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TIME-SHARED BASIC/2000
PROGRAM DOCUMENTATION

VOLUME III

(600) MANAGEMENT SCIENCES AND OPERATIONS RESEARCH
(700) BUSINESS AND MANUFACTURING APPLICATIONS



TIME-SHARED BASIC/2000 CONTRIBUTED LIBRARY HANDBOOK

VOLUME III

- (600) MANAGEMENT SCIENCES
AND OPERATIONS RESEARCH**
- (700) BUSINESS AND MANUFACTURING
APPLICATIONS**

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TITLE:

CRITICAL PATH EVALUATION

DESCRIPTION:

This program will compute CPATH and print a summary of earliest and latest event times and actual and maximum activity times, and indicate which are on the critical path.

INSTRUCTIONS:

Self-explanatory

The user has the option to enter data from the teletype as it becomes necessary, or to enter it internally with data-statements. If entered internally, use the following format:

9900 DATA # of events, list of ID numbers of events

9901 DATA # of activities, list of (for each activity) the ID # of the event preceding it, the ID # of the event succeeding it, and the time necessary to complete it.

**SPECIAL
CONSIDERATIONS:**

The program will handle up to 75 events and 150 activities.

To change bounds, alter dim-statement 9012 and delete input checks for 75 and 150.

At least one activity is necessary.

For each activity, the predecessor event must have a lower ID # than the successor event.

ACKNOWLEDGEMENTS:

RUN

CPATH

* CRITICAL PATH *

DO YOU WISH TO ENTER DATA FROM THE TELETYPE AS IT BECOMES NECESSARY,
OR TO ENTER IT INTERNALLY WITH 'DATA'-STATEMENTS? (ENTER 'T' FOR
TELETYPE, 'D' OTHERWISE)?T

HOW MANY EVENTS DO YOU HAVE?6
ENTER THE ID NUMBER OF THE FIRST EVENT?1
THE ID NUMBER OF THE NEXT EVENT?2
NEXT?3
NEXT?4
NEXT?5
NEXT?6

HOW MANY ACTIVITIES DO YOU HAVE?7
FOR THE FIRST ACTIVITY, ENTER THE NUMBER OF THE EVENT PRECEEDING IT,
THE NUMBER OF THE EVENT SUCCEEDING IT, AND THE TIME OF THE ACTIVITY.
?1,2,1
FOR THE NEXT ACTIVITY?2,5,1
NEXT?5,6,1
NEXT?1,6,5
NEXT?1,3,1
NEXT?3,4,1
NEXT?4,6,1

*** EVENT TIMES ***

EVENT	EARLIEST TIME	LATEST TIME	
1	0	0	CRITICAL PATH
2	1	3	
3	1	3	
4	2	4	
5	2	4	
6	5	5	CRITICAL PATH

*** ACTIVITY TIMES ***

PREDECESSOR	SUCCESSOR	ACTUAL TIME	MAXIMUM TIME	
1	2	1	3	
2	5	1	3	
5	6	1	3	
1	6	5	5	CRITICAL PATH
1	3	1	3	
3	4	1	3	
4	6	1	3	

DO YOU HAVE ANOTHER PROBLEM? ('Y' FOR YES, 'N' FOR NO)?N

DONE

DECSN
36065

TITLE: TOP MANAGEMENT DECISION GAME

DESCRIPTION: This program furnishes the simulated business conditions and the mechanics for operating a business game for any number from 10 to 60 participants. The participants form into teams representing fictitious companies and make decisions on price, promotion, production, capacity, research, incentives, and training in a one product market. The program provides a set of interrelated market and internal conditions that approximate real conditions, even including some random perturbation. The team decisions are converted into results fast enough so the results can be given back to the teams during the same class period, enabling the teams to make up to three sets of decisions during a two or three hour period. This quick feedback of results has been found to have excellent educational reinforcing characteristics. (See "ECONOMIC BACKGROUND" for further discussion.) An income statement for each team is printed out. The program recalculates sales units when the combination of production cost and beginning inventory are too low to meet sales units as generated by the first part of the program. Each income statement is completely formatted to 7 significant digits and each income statement is printed on an 11 inch sheet of paper.

INSTRUCTIONS: Data is put into lines 351 to 372. Line 370 is for beginning inventory for each team. This is to be entered in order as to team number. Line 371 is for training expense and it is to be entered the same as line 370. Line 372 is for units available for sale. This figure is from form IV line 3 and this also is to be entered the same as line 370 and line 371.

Line 370, at the start of the game, is 310000 for all teams. Line 372, at the start of the game, is 96000 for all teams. These lines are also printed in the new data printout block. Line 372, in the new data block, will only be ending inventory from the previous period and the beginning inventory for the next period less the new production for that period.

Because of line 371 there is no need to enter for training in the Data block. The (6) is automatically entered in the Data block.

The first time incentive is instituted it will be understated in the income statement and it should be corrected manually. Incentive coding is to be entered as:

- 10 = either skilled or unskilled labor
- 20 = both skilled and unskilled labor
- 30 = semiskilled labor only
- 40 = semiskilled and one other type of labor
- 50 = all three types of labor

SPECIAL
CONSIDERATIONS: None

ACKNOWLEDGEMENTS: Professor Joseph Nordstrom
Bowling Green University

ECONOMIC BACKGROUND

This game gives the participant practice in making top level management decisions under time pressure. The decisions to be made call for attention to the inter-dependencies among the various decision areas, in other words, to the need for integrated policy thinking. Through the use of a Hewlett-Packard table top computer (Model 2114A with an 8K word memory) which can be brought right into the classroom, the results of participant decisions can be made available to them in a very short time after the decisions are made. In fact, during a two hour class period, the participants can play two or three periods of the game, getting their results back each period only minutes after turning in their decisions. Finally, the simulated business situation programmed into the computer is considerably more complicated than would be possible for a paper and pencil game with the same turn-around speed. All the calculations described below are performed as automatic functions of the computer program.

As is the case in the market place, some carry-over exists in this game from period to period. For example, the promotion contracted for in one period will also affect sales in the following periods. The same is true of expenditures for Research and Training.

This game, departing from the practices present in most similar games, makes the participant teams compute their own accounting statements. The computer printout does not supply these figures. The participants are thus forced to consider accounting relationships more than otherwise. Experience has shown that this feature is a valuable part of this game.

The participant should develop a sense of the market as he plays. He should attempt to "psych-out" the demand relationships as functions of his decisions. It is to his interest, therefore, to adopt somewhat more extreme strategies in this game than would be safe under real business conditions. In this way, he can learn without cost, and in a short time, lessons that might cost much more, both in time and money in the real market. It is worth pointing out especially here the role of strategy in business as opposed to decision. The participant will learn little from a policy of changing decision rationale frequently. He will learn much more from the results of having made a series of decisions according to a certain rationale that he wishes to test, i.e., a strategy. This is true in real life and is true in this game.

Market Demand

In general, demand is a function of price and promotion; the higher the promotion or the lower the price, the higher will be the demand.* The participant must be concerned not only with demand relations, however, but also with production costs at various levels of capacity. Inventory costs also must be considered. These factors can be controlled to some degree by attention to investment in training, incentive and research activities, but the final results will be dependent on all these elements acting together. Finally, there are forces acting on demand that are outside the control of the participants, i.e., the general market trends. The game starts off with a growth trend for a few periods to invite attention to necessary increases in capacity. Then there is a market decline for a few periods, inviting attention to inventory costs and overextended production capability. Finally, there is another rise in demand. The result affords an excellent opportunity for the participant to practice forecasting talents.

*With price the demand relationship is continuous. With promotion, however, the demand rises with promotion expense up to a maximum of \$1,000,000 expense per period, whereupon the promotion effect saturates and no further increase in demand results from increased promotional outlay.

The market trend is given to the game by the following relationship:

$$F2 = 1 + .2P - .036P^2 + .0019P^3$$

where P is the number of the period being played.

The relation of demand to price and promotion is given by the following:

$$F1 = \frac{75}{P} \times \frac{300+S}{1500+S}$$

where P is the price and S is the promotion expense. In the case of total demand, mean price and promotion figures are used. In the case of team demand, the team's price and promotion figures are used.

For the total demand, the relation is:

$$D = N \times F1 \times F2 \times 60,000$$

where N is the number of teams. F1 gives the effects of price and promotion, and F2 gives the effect of the general market trend. The base demand is seen to be 60,000 units per team.

In addition to the factors mentioned above, there is a random perturbation of demand figures, so that a team's demand will not conform precisely to the functions noted above. This perturbation produces up to ten percent variation from the defined functions and can be thought of as the result of extraneous market conditions.

The Production Decision

The production cost is constant in any given period up to a production level which is 5000 units less than full capacity. Above this point, there is a per unit increase of 70 percent for production cost. For the participant this will result in gradually increasing average costs as he approaches and exceeds capacity. It might be noted that the participant may assume that he cannot produce above capacity. This is an erroneous assumption. Production in excess of capacity can be justified theoretically on the basis of creating a night shift, or farming some of the work out, etc.

The Capacity Decision

The capacity decision is made three periods in advance of the availability of the facilities contracted for. The facilities are not paid for until they are ready. The payment results in a reduction of the cash, but does not result in a commensurate reduction of profits in the period in which the facilities become available. The reduction in profits comes about through a steady state increase in administrative or overhead costs, so that, on a period by period basis, the cost is amortized. The amount of return on investment for money put into increased plant capacity will be favorable if this extra capacity is used, but it will just be extra expense if not used.

The Research Decision

Because it has been found advisable in this game for all teams to consider that they are selling the same product, research in product design is not appropriate. Therefore, it is assumed that research input is for the purpose of improving the process and that success in research will result in lower production costs. The research expenditures create a probability of breakthrough, the more expenditure the more

the probability. Only one breakthrough is possible in any one period and it lowers the production costs by 1.5 percent for every period from the point of breakthrough on. New breakthroughs increase the cost saving by the same factor. Obviously, the more production that is scheduled, the larger will be the resulting saving. The assignment of probabilities of breakthrough results from a random number simulation in the program. The characteristics of this probability function are such that a steady \$80,000 per period investment in inventory yields the best return on investment.

The Incentive Decision

It is assumed that trying to apply a wage incentive to either the skilled or unskilled classifications will result in no improvement at all, due to the practical difficulties involved. However, applying a wage incentive program for the semi-skilled workers will result in some substantial improvement. The improvement will take the form of increase in apparent capacity, so that, when a team is producing at or above stated capacity, the production costs will be less, enough so that a satisfactory return on investment (in the incentive plan) occurs. It is assumed that unit production costs will not be affected, because the form of the incentive is such that labor will get as much per unit of production under incentive as before. Therefore, savings will result from a reduction in the costs of above capacity production, in the manner stated.

The Training Decision

The training decision assumes that there will be a lower production cost associated with increased training expense. The effect of this training input, however, will attenuate over time so that the effect will be far less two or three periods hence than it is directly after instituting the program.

In Summary

The carry over of effects (Research, Training, etc.) occurs thru the continual updating of the last (data statement) matrix in the printout, as mentioned in the Instructions for the Referee. It is important either to carry out this updating thru entering the new data by hand from the last matrix or by entering it by tape in the manner described.

It should be noted that this game was developed for 12 periods of play. If the instructor plays many more periods, it would be advisable to move from [P = 12] back to [P = 5, P = 6, etc.]. If this is not done, the instructor will find the market tendency rising at a rate without bound.

In general, there is no existing equity relationship in the case, because there is no fixed asset item nor is long term indebtedness or equity mentioned. Some instructors using the game may wish to add these figures, making it possible to develop balance sheet relationships and financial ratios which are not possible under present conditions. This will be easy to accomplish.

INSTRUCTIONS FOR THE REFEREE

The referee should first make sure that the Basic compiler is in the computer (Hewlett-Packard Model 2114A, 8K memory) and operative. He should then read in the game tape. After initializing the game program according to INSTRUCTIONS FOR INITIALIZING, the game will be ready to play.

The participants in the game should be divided into teams, ideally no fewer than three, nor more than seven participants in each team. It is best when there are at least three teams and the computer program will not handle more than eight teams. Each team should be encouraged to select a chairman (or president), an accountant, and appoint members to represent the marketing, personnel, and production functions.

The referee should then make sure that each team has an official team booklet, with copies of Forms I through IV arranged in a set for three years (four periods each year). The official set should have initial data (as per copy attached to this set of instructions) entered on the forms. This should include data regarding production, capacity, inventory value, administrative cost, and cash balance. Each member of each team should have a set of PLAYERS' INSTRUCTIONS, a copy of Chart I showing the past twenty-four periods of sales experience for his team, and copies of Forms I through IV that he can use for calculations. It is advisable to make this material available for study sometime before initiating play of the game.

The referee should then explain the philosophy of the game, pointing out that it is up to the teams to find out how the market reacts to their decisions and explaining the decisions to be made in the play for the first period on Form I. It is wise at this point to discuss the basic nature of the game, the fact that the teams are interdependent, the fact that market response will be dependent on the team decisions, to some degree, but that the market response will also be determined by general economic trends and by some random variation. Also, it can be pointed out that one quarter's decisions will affect results not only for that quarter, but for future quarters as well.

Receiving the Decisions

Upon receiving the booklets (with decisions) from the teams, the referee should verify the calculations and the entries, making sure that enough lead time is given for decisions regarding new production and capability. He should check profit calculations and should assure himself that each team has entered the cost of negative cash balance, if the team incurred some.

Entering Data

The referee then types the decisions into the computer program as data. (See INSTRUCTIONS FOR ENTERING DATA.) Decisions as to price, promotion, production, capacity, research, and incentives are typed into memory locations from 351 to 358 (as needed), team one's decisions being typed into 351, team two's into 352, etc. In the event that some team other than team one is the first to turn in its decisions, that team's decisions can be entered as soon as the form arrives. For example, if team four is the first to turn in its decisions, the decisions can be entered into memory location 354. Decisions as to training are entered into memory locations 361 through 368 (as needed) in the same way that data was entered in the 351-358 block. The referee should check the means for entering training data carefully before proceeding. It should be noted that the data for incentive wages and for training must be coded before entry.

For incentive wages, the questions involve only whether the team has paid the full cost of the incentive plan and whether the plan is for the semi-skilled workers or not. A plan for another group of workers produces no effect at all. A plan, fully paid for, for semi-skilled workers, increases plant capacity, thereby causing less production expense when the plant is working near or above capacity. In coding the plan, the number entered should be 30 or more if the plan is for semi-skilled workers and less than 30 if the plan is for one of the other two classes of employees, or if there is no plan.

As for training, the number entered is a function of the number of periods since a training program was installed. In the first period, whether or not a training program was installed, this number will be (0). This is because the results of the training program are not apparent in the period for which it is installed. In the next period, if a training program was installed in the first period, the number should be (6). One period after the introduction of an additional new training program, six should be added to the number which appears as the last item of data in subject team's line in the last matrix printed out from the previous period (the matrix characterized as data statements). The data for the present period should be corrected by this increase. Note that, in entering such data, the whole data line must be entered, even though most of the data is as it was. For example, if team 4 had initiated a training program last period, and this period's data line had been "364 DATA 70,1,12,525,80,3.235", it should be re-entered as "364 DATA 70,1,12,525,80,9.235".

Running the Program

First, the "ON" button for the tape punch should be pressed and the "HERE IS" button should also be pressed. This will avoid any residual punching on the tape. Now, press the "OFF" button on the tape punch. At this point, after making sure that the program is initialized and all new data is fed in, type "RUN" and press the carriage return button. This should cause three matrices to be printed out along with two pieces of summary information. At the end of the second piece of summary information, "Total Promotion, \$XXX", there will be a pause of one second. During this second, press the "ON" button of the tape punch. All the new data for data block 36l through 36n will be typed out and punched onto the tape (n depending on the number of teams). At the end of this series of data statements there will be another pause of one second. At this point press the "OFF" button. This will insure that only the data statements are present on the tape. The computer will then type "READY". After this has happened, press the "ON" button again and press "HERE IS". This will give you some blank tape at the end of the data. Then press the "OFF" button. Immediately then put this piece of tape in the tape reader and read in the new data. The computer is now initialized for the next period of play. The first matrix printed out will simply show the team decisions for the referee's verification.

The referee should then insert the "sales" figures (in units), the "Prod Cost" figures (in dollars), and the "Admin Cost" figures (in dollars) from the second matrix in the appropriate places on the team forms. The last column, "unit cost", will be useful in the final game analysis. He can then hand the official booklets back to the teams. During the second play of the game, the teams will need assistance in completing the forms especially the Income Statement. It is probably appropriate to explain the forms to the participants as a group, going down through the necessary calculations.

Summarizing Results

After each period is decided, the referee should post on the blackboard: 1) the prices charged by each team last period; 2) a combined sales total for all teams; 3) the total amount charged by all teams for promotion. After each four periods post the year's profit for each team. Each period represents three months.

At the end of each four periods (i.e., each year) the referee will calculate a total profit for each team for the year. He will charge the team an income tax payable in the following period of play. This income tax will be 50% of the total profit calculated. This figure will be entered on Form II on line 15, labeled "Tax". The team must treat this as an expense in said period.

Upon completing the game for any one day's play, the referee should retain all official team booklets, allowing the participants to keep their calculation sheets. He should also read out the present stage of the game onto tape. This he does by first typing "PLIST" on the teletype, waiting a second and then pressing the "ON" button for the tape punch. The tape will be furnished with blank leader and follower in the process and can be used to initiate play of the game for the next period. Only the new decision data and the new period number will have to be furnished.

Game Analysis

Upon completion of all the plays of the game, the referee should post records of the performances of all teams. A suitable form for such a presentation is embodied in Chart II with a series of trend lines for each team depicting various criteria useful in analyzing the game experience. The teams should be encouraged to analyze their own experiences for the benefit of the other teams in the analysis session. The referee can comment as he feels appropriate. The data for the presentation can be found in the official team booklets and in the printouts from the computer.

Note: (1) It may be useful at times to experiment with the game in order to determine how the total demand function behaves. For such purpose, the experimenter may wish to print out only a selected portion of the total printout. He can eliminate printing Matrix A for example, simply by one instruction, "9 GO TO 17". Similarly he can eliminate printing the second matrix by typing "285 GO TO 330". The last (data statement) matrix can be omitted by typing "379 GO TO 400". When these matrices are again desired, simply type "9" then return, "285" then return, and "379" then return.

Note: (2) A copy of the referee's data sheet is included at the conclusion. It is useful to enter team decision data on this sheet before entering the data into the computer. In this way errors in entering data can be avoided. Further, information on this sheet will be useful in the final game analysis.

INSTRUCTIONS FOR INITIALIZING GAME

1. The letter "N" represents the number of teams in the game. In order to set up the program for a given play of the game, this number will have to be inserted in the following manner:

Type "4 LET N = (the number of teams)"

For example, if the number of teams is to be 5, the instruction is:

"4 LET N = 5"

2. Next, the period of play must be inserted. Assuming that this is the first period, this is done as follows:

Type "5 LET P = 1"

For the third period of play it would be:

"5 LET P = 3"

This instruction will give a market trend to the demand function throughout the game. As originally set up, this trend will call for rising total demand (all other things being equal) during the initial four periods. The demand will then level off and drop until the ninth period. The demand will then level off and rise again.*

3. The tape is set up initially for eight teams. For this reason, data will have to be omitted for any teams above the actual number playing. This will have to be done in two different data blocks, 351 to 358 and 361 to 368. The omissions should be from the higher numbers in each case to the lower numbers. For example, if the actual number of teams is 5, simply type the following numbers, pressing "return" after each number:

356, 357, 358, 366, 367, 368

4. The data representing cumulative effects of past decisions are already entered in the initial tape. These entries won't have to be changed for the first period's play.

The game is now ready for the first period.

*If the instructor contemplates playing many more than twelve periods, it would be wise to move from period 12 to period 5 and then to period 6, etc. Using period numbers much higher than 12 will introduce demands that will probably be too high for practical purposes.

PLAYER INSTRUCTIONS

(To be given to all players)

You are a member of a closely knit management team that is competing directly with several companies for a share of an industrial market. All of the companies are selling a product that is technically similar. Price and promotional effort are the key elements affecting volume. Profits result from a careful assessment of market demand, competitor's activities, and sound production and expense planning and control.

As in any business, a number of forms must be used to communicate your decisions and to report the company's position. Each period you must determine the: (1) product price, (2) promotion expenditure, (3) amount to be spent on plant expansion, (4) volume of raw material to be placed into production, (5) amount of research investment, (6) amount of expenditure for an incentive program, and (7) amount of investment in a training program. These decisions will be fed into a computer simulation representing a real market situation, and the results will be given back by the referee. Your team's results will be determined by (1) your decisions, (2) your competitors' decisions, and (3) the market conditions (affected by some trend indices). Additionally, there will be some random variation.

Selling Price (Line 1)

All other things being equal, the higher your promotion outlay, the more units of your product the market will absorb and the lower the price the more units of your product the market will absorb. However, the number of units sold by your firm will depend on the price and promotion outlays set by your firm in relationship to competitor's actions. There will be cyclical, seasonal and random influence in total market demand, as well as influence from the average price charged by all competitors and the total amount they spend on promotion. Orders must be filled from currently available merchandise; and inventory deficiency results in lost sales.

Selling prices can only be changed in one dollar increments with a maximum variation of two dollars per unit from one period to the next. Assume that the last price charged was \$30.00 per unit and your company sold 59,000 units.

Over the past several years each competitor has maintained an equal share of the market. Chart I portrays your company's sales volume over the last twenty-four periods. Your marketing research staff has reported that they expect the upward trend to continue.

Promotion Budget (Line 2)

This is the amount spent for advertising and personal sales effort. The budgeted amount cannot be altered more than \$100,000 from one period to the next, and changes made in \$50,000 steps. Your promotion budget last period was \$450,000. The effect of promotional effort is somewhat cumulative. That is, there will be some effect on sales in later periods due to this period's promotion.

Production (Line 3)

During any period you may begin the ordering and production cycle for any number of raw materials units. The complete cycle requires two periods: one period for the raw materials to arrive after they have been ordered and one period to change the inputs into finished goods. Therefore, if a stock of finished inventory is needed for sale during period five for example, the raw material order must be placed no later than the beginning of the third period. Therefore, the production decision must be made for the third period.

Two periods ago, 60,000 units of raw material were ordered. They can be sold during this first game period. Last period, 65,000 units were ordered and will be saleable during period II. If you wish to have additional inventory available for sale during the third period, enter the desired quantity now on line three, period III.

There is a 10% inventory carrying charge each period. This charge is based on cost value of the ending inventory. Your ending inventory last period was 41,000 units, valued at \$310,000. Thus the carrying charge would have been \$31,000 last period.

Your manufacturing cost is about \$10 per unit when production is near plant capacity. Above capacity production leads to overtime rates and other charges; if your plant operates much under its full potential, the \$700,000 fixed charges will raise the unit costs. However, this should not be construed as forbidding you to produce above capacity.

Plant Capacity Additions (Lines 4, 5, and 6)

Initially, your plant has a 75,000 unit per period capacity. Every \$60,000 spent for expansion will increase the plant's capacity 1,000 units. An expansion program initiated during one period is not completed until three periods have passed. Payments are not made for plant additions until the new space is available for use.

Your plant will have a 77,000 unit capacity during Period III. If you believe more capacity will be needed during the fourth period, this expansion program must be started now in the first period. Enter this decision on lines 7, 8, and 9 in the space provided under Period IV.

Research and Development (Line 7)

An investment may be made for research and development during any period. The more money that is put into research, the greater the probability of a breakthrough. For any investment made there is a period of delay due to the time needed for research before any results are realized. If a breakthrough does occur, the advantages will be realized through a reduction in total production cost for each period after the research investment repays itself. Repetitive breakthroughs are possible if research investments are repeated. The same total amount invested over time as a steady state input will give a greater possibility of breakthrough than if it is invested all in one period. That is, crash research programs, while effective, are more expensive than regular research investment. Investments in research must be made in multiples of \$20,000. There is an investment maximum of \$160,000 per period.

Incentive Wage Program (Line 8)

An incentive program may be installed for all levels of the production force: unskilled, semi-skilled, and skilled. Any one, all, or a combination of these segments may be put on incentive during any period. The costs of the program include an initial cost for determining each job's productivity measurement, for establishing evaluation methods, and for making accounting adjustments. This cost is \$50,000 for any or all groups of workers able to be put on incentive. There will also be a steady-state cost of \$10,000 per period for each skill level on incentive. This is needed to maintain the control, evaluation, and accounting procedures. The advantage of this program's establishment is that it may substitute for additions to the plant capacity. The increased production advantage of the program discontinues if the payments cease. As 60% of the work force is semi-skilled, the benefits of this group being put on incentive would be evidenced soonest -- during the period in which introduced. If this program is introduced, enter the amount of incentive expenditure on Line 4 of Form I. The total unit production, including increments added by incentives, will be taken into account when the computer calculates the production cost.

Training Program (Line 9)

It has been determined that the introduction and use of an extensive training program for production workers will result in lower total production costs whether production is at full capacity or not. If it is decided to begin this program, the expense will be one investment of \$30,000. This expense will include the cost of instructors and educational material. It will take a period before the details of the program's setup are complete and the instructors are trained. Then there will be a reduction in production costs. The amount of total production cost reduction will exist from time to first effect, in decreasing amount from period to period.

Negative Cash Balance

At the end of every period in which your cash balance is negative, you will be charged an extra 5% of the amount by which it is negative. Make your calculations on scratch paper first to see if you will have a negative cash balance. Then add this cost if so. This is the cost of borrowing money to cover debts.

Income Tax

At the end of each four periods (1 year) the referee will calculate an income tax to be paid in the following period. It will be entered in Form II, line 45 and also in the space provided.

Completing the Income Statement

- Step 1: The unit sales will be entered in Form II, line one, by the judge. Multiply the unit sales figure by the price charges by the company this period. Enter the dollar sales volume on line two.
- Step 2: Line three, Beginning Inventory, is the same as line six, Ending Inventory, from the previous period.
- Step 3: Line four, Production Cost, is entered on Form II by the judge.

- Step 4: Line five, Merchandise Available for Sale, is the sum of lines three and four.
- Step 5: Multiply the Unit Sales, line one, by the average unit cost (Form IV, line six) and enter the product on line seven as the Cost of Goods Sold. Form IV is provided as a worksheet to aid in calculating the number of units of ending inventory and also the average unit cost.
- Step 6: Subtract line 7, Cost of Goods Sold, from line 5, Merchandise Available for Sale, and enter on line 6, Ending Inventory.
- Step 7: Subtract line 7, Cost of Goods Sold, from line 2, Sales, and enter the difference on line 8, Gross Margin.
- Step 8: Enter the Promotion Expense on line 9, from Form I, line 2.
- Step 9: Enter the Research Expense on line 12 from Form I, line 7.
- Step 10: Enter the Incentive Cost on line 10, from Form I, line 8.
- Step 11: Enter the Training Expense on line 11 from Form I, line 9.
- Step 12: Inventory Carrying Charge, line 13, is 10% of line 6, Ending Inventory.
- Step 13: The Overhead is provided by the judge. It is a function of capacity.
- Step 14: Add lines 9 through 15 and subtract the total from line 8. Enter the difference on line 16.

Negative Cash Balance

- Step 1: Complete the Cash Available Statement - Form III. The "cash end this period" is the result of subtracting the sum of lines 4 and 5 from the sum of lines 1, 2, and 3.
- Step 2: If there is a negative cash balance at the end of the period, enter 5% of that figure as a penalty on the Income Statement, Form II, line 15. Reduce the Net Income (or increase the Net Loss) for the company for every period that there is a negative cash balance on Form III.

Average Unit Cost (Form IV, Line 6)

Calculate the average unit cost by dividing the value of total merchandise for sale (Form II, line 5) by the number of units available for sale (Form IV, line 30). This figure should be entered on line 6 of Form IV.

FORM I MANAGEMENT DECISIONS

Company _____ Year _____

	I	II	III	IV
1. Selling Price				
2. Promotion Budget				
3. Production, Units				
4. Plant Cap. Add'ns, Units				
5. Plant Cap. Add'ns, \$				
6. Cum. Cap. Add'ns, \$				
7. Research Inv't, \$				
8. Incentive Prog. Exp., \$				
9. Training Prog. Inv't, \$				

FORM II INCOME STATEMENT

1. Sales, Units				
2. Sales, \$				
3. Begin, Inv'y, \$				
4. Production Cost, \$				
5. Mdse. Av. for Sale, \$				
6. Ending Inv'y, \$				
7. Cost of Goods Sold, \$				
8. Gross Margin, \$				
9. Promotion Exp., \$				
10. Incentive Cost, \$				
11. Training Exp., \$				
12. Research Exp., \$				
13. Inv'y Carrying Charge, \$				
14. Overhead, \$				
15. Cash Shortage Charge, \$				
16. Net Income (loss), \$				

Year's Profit

Income Tax

Net After Tax

FORM I MANAGEMENT DECISIONS

Company X Year 197X

	I	II	III	IV
1. Selling Price				
2. Promotion Budget				
3. Production, Units	60,000	65,000		
4. Plant Cap. Add'ns, Units			2,000	
5. Plant Cap. Add'ns, \$			120,000	
6. Cum. Cap. Add'ns, \$	75,000	75,000	77,000	
7. Research Inv't, \$				
8. Incentive Prog. Exp., \$				
9. Training Prog. Inv't, \$				

FORM II INCOME STATEMENT

1. Sales, Units				
2. Sales, \$				
3. Begin. Inv'y, \$	310,000			
4. Production Cost, \$				
5. Mdse. Av. for Sale, \$				Year's Profit
6. Ending Inv'y, \$				
7. Cost of Goods Sold, \$				
8. Gross Margin, \$				Income Tax
9. Promotion Exp., \$				
10. Incentive Cost, \$				
11. Training Exp., \$				Net After Tax
12. Research Exp., \$				
13. Inv'y Carrying Charge, \$				
14. Overhead, \$	700,000			
15. Cash Shortage Charge, \$				
16. Net Income (loss), \$				

FORM III CASH AVAILABLE

	I	II	III	IV
1. Cash, End of Last Per.				
2. Inv'y End Last Period				
3. Net Income This Period				
4. Paid for Add'l Plant Cap.				
5. Inv'y End This Period				
6. Cash End This Period				

FORM IV INVENTORY WORKSHEET

1. Beginning Inv'y				
2. Units This Period				
3. Total Units for Sale				
4. Unit Sales, This Per.				
5. Ending Inv'y, Units				
6. Av. Unit Cost (II5/IV3)				

FORM III CASH AVAILABLE

	I	II	III	IV
1. Cash, End of Last Per.	660,000			
2. Inv'y End Last Period	310,000			
3. Net Income This Period				
4. Paid for Add'l Plant Cap.			120,000	
5. Inv'y End This Period				
6. Cash End This Period				

FORM IV INVENTORY WORKSHEET

1. Beginning Inv'y	31,000			
2. Units This Period	60,000			
3. Total Units for Sale	91,000			
4. Unit Sales, This Per.				
5. Ending Inv'y, Units				
6. Av. Unit Cost (II5/IV3)				

CHART I. Historical Unit Sales Record for Company

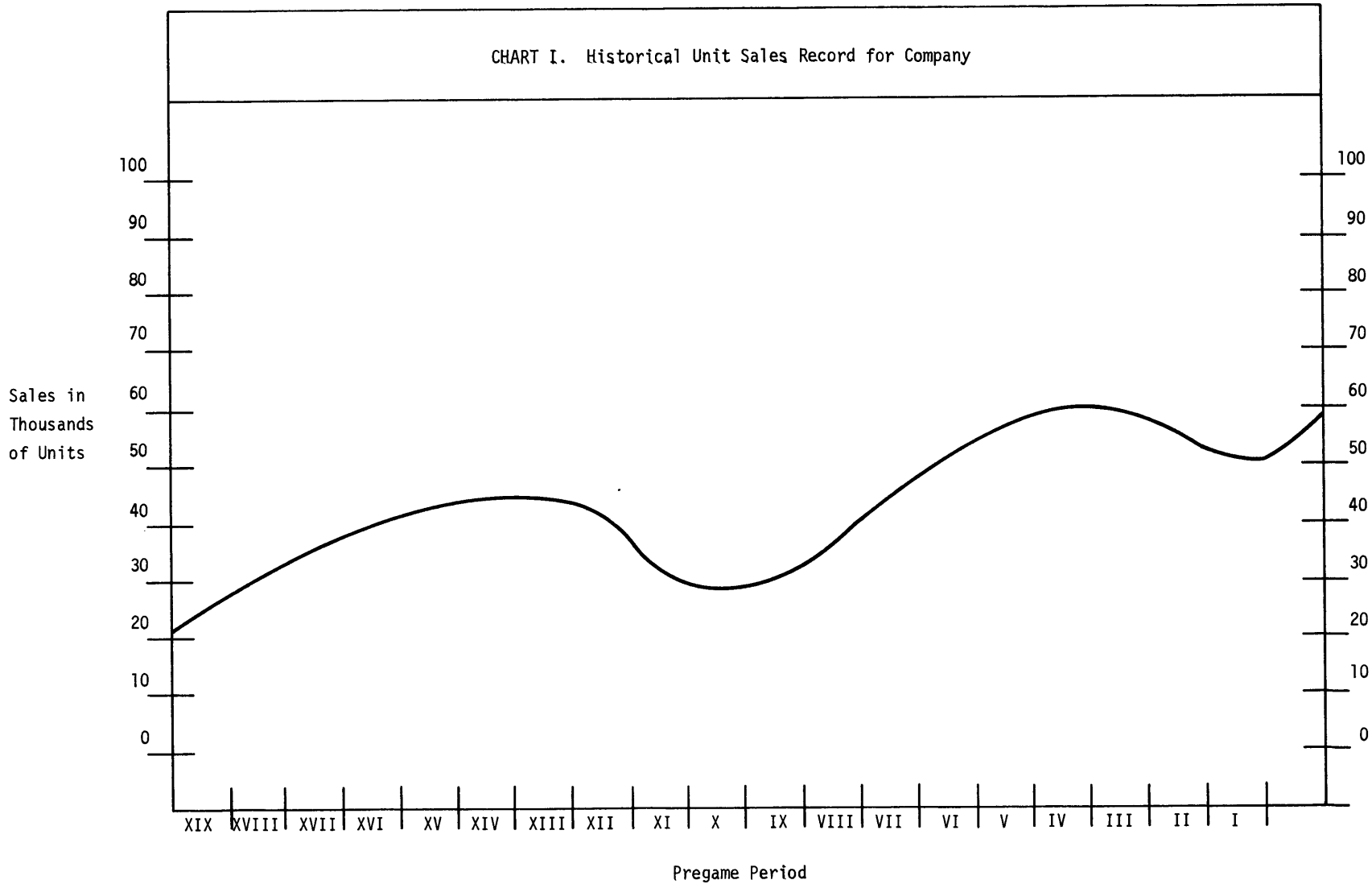
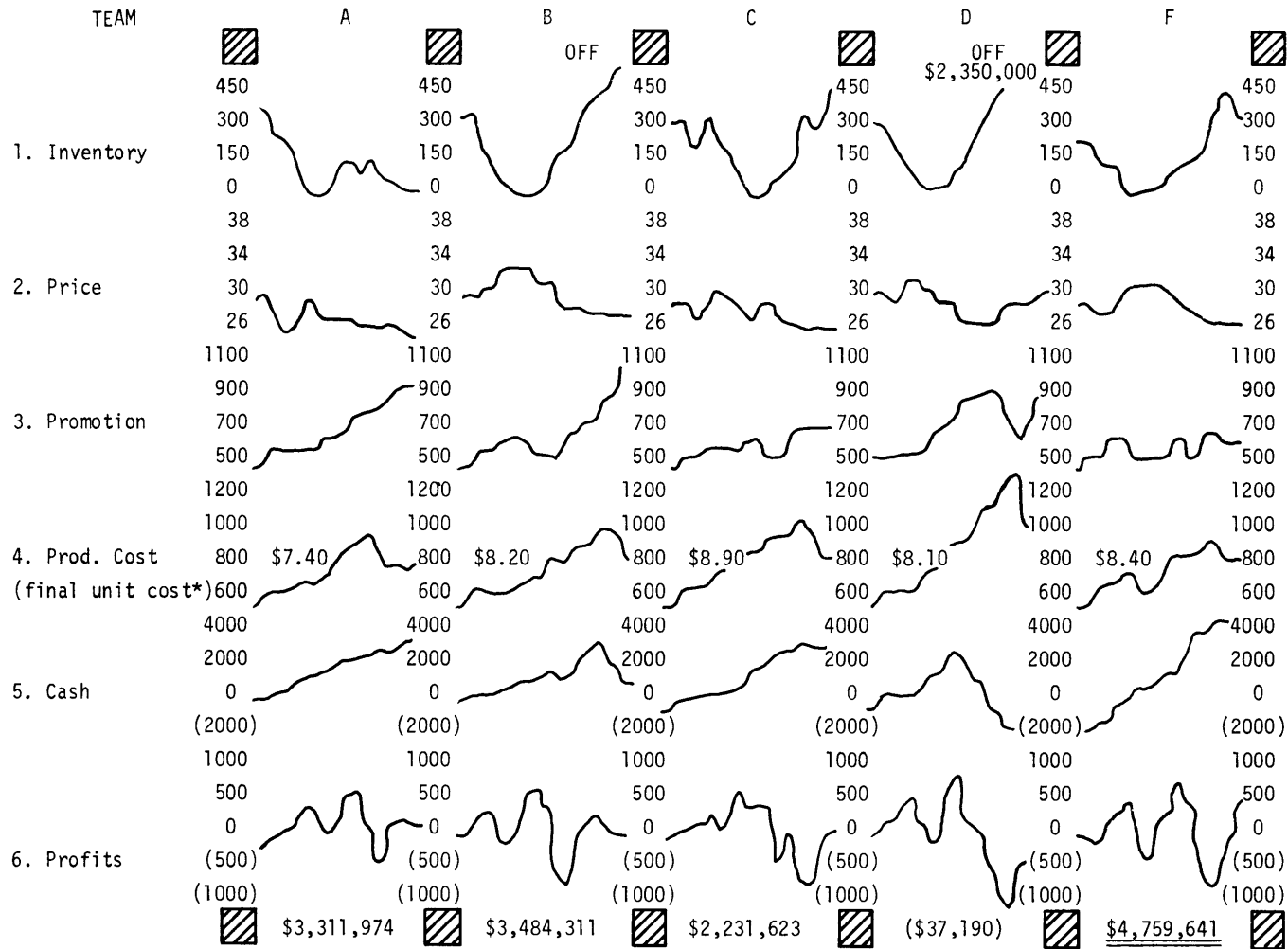


CHART II FINAL ANALYSIS SHEET



RUN

RUN
DECSN

NO.	PRICE	PROMOTION	PRODUCTION	CAPACITY	RESEARCH	INCENTIVE
1	30	500	65	75	100	30
2	30	850	100	80	130	20
3	31	500	55	75	30	10
4	29	650	90	80	10	0
5	30	500	65	75	80	30
6	30	550	90	80	100	30
7	28	450	70	80	50	20
8	27	700	90	86	60	10

TEAM NO.	SALES	PROD COST	ADMIN COST	UNIT COST
1	90011.1	640.25	700	9.85
2	105377.	1354.37	735	13.5438
3	81906.7	550	700	10
4	94503.2	1105	735	12.2778
5	82772.2	650	700	10
6	89066.8	954.465	735	10.6052
7	86677.1	700	735	10
8	107639.	987.955	777	10.9773

TOTAL POTENTIAL SALES, 737953. UNITS
TOTAL PROMOTION, \$ 4700

361	DATA 55	, .985	, 0	, 700	, 75	, 0
362	DATA 90	, .985	, 0	, 735	, 80	, 0
363	DATA 55	, 1	, 36	, 700	, 75	, 0
364	DATA 70	, 1	, 12	, 735	, 80	, 0
365	DATA 55	, 1	, 96	, 700	, 75	, 0
366	DATA 60	, .985	, 0	, 735	, 80	, 0
367	DATA 50	, 1	, 60	, 735	, 80	, 0
368	DATA 75	, .985	, 0	, 777	, 86	, 0

DONE

DYNPRO
36067

TITLE: DYNAMIC PROGRAMMING MODEL

DESCRIPTION: DYNPRO solves, by a standard algorithm, a somewhat general-purpose dynamic programming model. The solution is imbedded in the inlet state.

INSTRUCTIONS: Before running, be certain that the dimension in line 9398 are at least as large as one more than the number of values in the state variable, e.g., if there are 20 values in the state variable, 9398 must be at least as large as: DIM F(21,4), G(21,4).
The user must also supply his own functions for the routines that are unique to his application. These routines, and their locations are described within the DYNPRO listing between lines 9012 and 9068. Variable definitions are provided between lines 9070 and 9104, and between 9180 and 9218. Function definitions are provided between lines 9112 and 9176.
The user may also need to add or delete lines from the input data routine to meet his application. This routine is from line 9468 to 9496.

SPECIAL CONSIDERATIONS: DYNPRO is limited to one state variable.

ACKNOWLEDGEMENTS:

RUN

GET-\$DYNPRO

9398 DIM F(12,4),G(12,4)

RUN

DYNPRO

* DYNAMIC PROGRAMMING MODEL *

HOW MANY VALUES ARE THERE IN THE STATE VARIABLE?11

IF DIM-STATEMENT HAS NOT BEEN ADJUSTED TO F(LAST INPUT+1,4), ETC., THEN STOP PROGRAM AND DO SO NOW.

HOW MANY STAGES ARE THERE?4

WHAT IS THE SALES PRICE?35

AND WHAT IS THE COST?30

AND THE FLOW RATE OF FEED?1.5

INLET STATE -----	OPT ALLOCATION -----	MAX RETURN -----	OPT OUTLET -----
----------------------	-------------------------	---------------------	---------------------

STAGE NUMBER: 4

.8	.116812	16.6441	.416221
.79	.115858	16.2115	.415005
.78	.116309	15.7805	.412956
.77	.115732	15.351	.411469
.76	.113686	14.9231	.410787
.75	.111871	14.4966	.409947
.74	.112755	14.0723	.407525
.73	.109856	13.6493	.407239
.72	.109878	13.2286	.405239
.71	.108563	12.8095	.403973
.7	.107595	12.3925	.402469

STAGE NUMBER: 3

.6	9.65217E-02	8.35339	.385733
.59	9.59289E-02	7.96508	.383468
.58	9.25583E-02	7.58021	.382725
.57	.092752	7.19929	.37987
.56	8.98409E-02	6.82194	.378721
.55	8.88957E-02	6.44888	.376367
.54	8.62193E-02	6.07971	.374928
.53	8.55161E-02	5.71571	.372263
.52	8.32651E-02	5.35618	.370397
.51	8.27526E-02	5.00202	.367436
.5	7.93429E-02	4.65316	.36603

STAGE NUMBER: 2

.4	5.57667E-02	1.57986	.338041
.39	5.14664E-02	1.32999	.335257
.38	.046873	1.09452	.332367

.37	4.35539E-02	.87569	.328432
.36	4.00548E-02	.674725	.32426
.35	3.29919E-02	.493731	.321743
.34	2.91687E-02	.3366	.316921
.33	2.46202E-02	.204355	.312039
.32	1.66858E-02	.101871	.308525
.31	.011286	3.20753E-02	.30294
.3	1.97483E-03	1.22468E-03	.298848

STAGE NUMBER: 1

.2	9.87229E-03	-.226361	.19867
.19	3.33882E-03	-.077742	.189573
.18	9.75868E-03	-.229708	.178799
.17	3.17376E-03	-7.50557E-02	.169616
.16	8.93324E-03	-.211652	.158927
.15	2.83702E-03	-6.72003E-02	.149659
.14	7.82094E-03	-.185064	.139056
.13	1.15506E-02	-.273163	.128603
.12	3.61285E-03	-8.55038E-02	.119564
.11	9.97365E-03	-.236801	.108811
.1	3.13576E-03	-7.48497E-02	9.96338E-02

DONE

TITLE:

CRITICAL PATH ANALYSIS

DESCRIPTION:

Each project has several characteristics that are essential for analysis by the Critical Path Method:

- (1) The project consists of a well-defined collection of jobs (or activities) which, when completed, mark the end of the project.
- (2) The jobs may be started and stopped independently of each other, within a given sequence. (This requirement eliminates continuous-flow process activities, such as oil refining, where "jobs" or operations necessarily follow one after another with essentially no slack.)
- (3) The jobs are ordered - that is, they must be performed in technological sequence. (For example, the foundation of a house must be constructed before the walls are erected.)

First of all, each job necessary for the completion of a project is listed with a unique identifying symbol (such as a letter or number), the time required to complete the job, and its immediate prerequisite jobs. For convenience in graphing, and as a check on certain kinds of data errors, the jobs may be arranged in "technological order," which means that no job appears on the list until all of its predecessors have been listed. Technological ordering is impossible if a cycle error exists in the job data (e.g., job a precedes b, b precedes c, and c precedes a).

Then each job is drawn on the graph as a circle, with its identifying symbol and time appearing within the circle. Sequence relationships are indicated by arrows connecting each circle (job) with its immediate successors, with the arrows pointing to the latter. For convenience, all circles with no predecessors are connected to a circle marked "Start"; likewise, all circles with no successors are connected to a circle marked "Finish." (The "Start" and "Finish" circles may be considered pseudo jobs of zero time length.)

Typically, the graph then depicts a number of different "arrow paths" from Start to Finish. The time required to traverse each path is the sum of the times associated with all jobs on the path. The critical path (or paths) is the longest path (in time) from Start to Finish; it indicates the minimum time necessary to complete the entire project.

**SPECIAL
CONSIDERATIONS:**

This critical path analysis is described by Levy, Thompson and Wiest in "The ABC's of the Critical Path Method" (Harvard Business Review, September-October, 1963). This documentation contains excerpts from the article; permission to reprint has been granted by the publishers.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

INSTRUCTIONS:

The problem description is entered in a set of data statements beginning with line 1000. A problem consists of a number of jobs. Each job requires a specified amount of time to complete. Some jobs cannot be started until one or more of the other jobs have been completed. If job a must be completed before job b is begun, we say that a is a predecessor of b.

Each job must be assigned an identifying job number. There are no restrictions on these numbers except that no two jobs may be assigned the same number. Each job can be described in a data statement. The required information follows:

Job number

Completion time

Predecessor jobs (if any)

-1

For example:

1002 DATA 10, 30, 1, 15, -1

This describes job number 10, which requires 30 days to complete and cannot be started until jobs number 1 and 15 have both been completed.

Jobs may be described in any order.

After entering data statements, RUN the program. The job characteristics will be repeated, followed by the earliest completion time for the entire project. Then the program will print the earliest and latest starting and finishing times for each job, consistent with the earliest completion time for the entire project. Jobs on the "critical path" will also be indicated.

RUN

RUN
GCPATH

HAVE YOU ENTERED YOUR DATA ALREADY?NO
 ENTER THE PROJECT DESCRIPTION IN DATA STATEMENTS
 BEGINNING WITH LINE 1000
 FOR EACH JOB, GIVE THE FOLLOWING DATA --
 JOB NUMBER
 TIME REQUIRED TO COMPLETE
 PREDECESSOR JOBS (IF ANY)
 -1

JOBS MAY BE ENTERED IN ANY ORDER

AFTER ENTERING YOUR DATA STATEMENTS, RE-RUN THE PROGRAM

DONE

1000 DATA 1,10,-1
 1001 DATA 10,30,1,15,-1
 1002 DATA 8,20,10,30,-1
 1003 DT-ATA 30,40,25,-1
 1004 DATA 25,20,1,15,-1
 1005 DATA 15,20,-1

RUN
GCPATH

HAVE YOU ENTERED YOUR DATA ALREADY?YES

JOB	TIME	PREDECESSORS	
---	---	-----	-----
1	10		
10	30	1	15
8	20	10	30
30	40	25	
25	20	1	15
15	20		

EARLIEST COMPLETION TIME FOR THE ENTIRE PROJECT = 100

JOB	EARLIEST		LATEST		
	START	FINISH	START	FINISH	
---	---	---	---	---	
1	0	10	10	20	
10	20	50	50	80	
15	0	20	0	20	*** CRITICAL ***
8	80	100	80	100	*** CRITICAL ***
30	40	80	40	80	*** CRITICAL ***
25	20	40	20	40	*** CRITICAL ***

DONE

TITLE:

CRITICAL PATH ANALYSIS

DESCRIPTION:

The BASIC program GCPM1 can be used to perform a critical path analysis on any complex project which is capable of being represented as a network of individual tasks. As a practical matter, the number of jobs in the network should not exceed 45.

The program assumes the user can provide the following information:

1. The number of jobs in the project (including a dummy terminal job which takes no time to complete but which cannot be started until all other jobs are completed);
2. For each job, a list of jobs which are its immediate successors (following jobs) and the time required on the job until each succeeding job can be started.

INSTRUCTIONS:

See Page 2

SPECIAL
CONSIDERATIONS:Example Problem:

The critical path analysis of the network on Page 3 is provided as a sample run. A single critical path is found with a minimum time to completion of 33 units. Then the completion time for a branch (6,8) which is not on the critical path is reduced from 3 units to one unit. Since the reduction is by an amount less than the slack time for job 6, no change in the critical path occurs. Finally, jobs on the critical path are "crashed" or made to require less time. This has the effect of reducing the time to project completion.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

INSTRUCTIONS

It is important that the user understand the diagramming conventions which are assumed by this program. Figure 1 provides an example of a statement of tasks and the corresponding CPM network. The network is an activity-node diagram. That is, each node represents a different job. Job 11 is the dummy terminal node mentioned above. Note that the program permits a succeeding job to start before its predecessor is "finished." For example, job 3 has as successors both jobs 5 and 6. Job 5 cannot start until six time units of work have been completed on job 3; job 6, however, can begin once five units of work have been completed on job 3. If, for a particular problem, every job must "finish" before a successor starts, all branch times emanating from an individual node will be equal.

Problem information is input on DATA statements starting with line 8000. The network must be drawn and jobs numbered in such a way that for every job, any and all succeeding jobs have a higher job number. The first job in the network should be given the job number of one (1). An error message would be printed if, for example, job number 3 were listed as a successor of job number 4.

Once program execution is commenced by a RUN command, the program will output:

1. The earliest possible time each job can be started;
2. The latest possible time each job can be started and still complete the project (network) in the minimum amount of time;
3. The minimum time in which the project can be completed;
4. A list of all jobs which are on the project's critical path(s); and
5. One critical path through the network.

There is frequently more than a single critical path. When this occurs, all jobs with zero slack are printed but only a single path is traced. The user is left to trace the remaining paths.

Once this information is printed the user is given the opportunity to study the effect of changes in job times (although no jobs may be removed from or added to the original network). If the query

HOW MANY LINKS OF THE NETWORK DO YOU WISH TO CHANGE?

is answered with a zero, '0', execution will terminate. A response of any other number less than the total number of jobs in the network will produce the reply

FOR EACH LINK TYPE: FIRST JOB, SECOND JOB, TIME INVOLVED.

A response of 2,3,5 would mean that job 2 must now be worked on for five time units before job 3 can commence. This user input overrides information supplied in the original data statement.

Data Input

Input is through DATA statements starting with line 8000. The first line is

8000 DATA N

where N is the number of jobs, including the dummy terminal job, in the network. The second line of input is (numbering lines by 10)

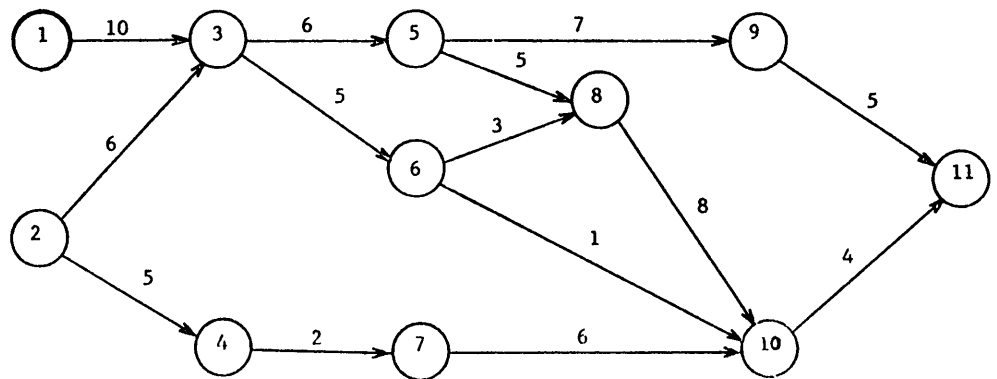
8010 DATA S1, 1S1, 1T1, 1S2, 1T2, ..., MS1, MT1

where

- S1 = the number of successor jobs to job 1;
- 1S1 = the number of the "first" successor to job 1;
- 1T1 = the time to be worked on job 1 before the "first" successor, 1S1, can be started;
-
- MS1 = the number of the "last" successor to job 1; and
- MT1 = the time required to be worked on job 1 before the "last" successor, MS1, can be started.

All following lines should list jobs 2, 3, ..., N and the appropriate successors and branch working times.

<u>Job</u>	<u>Immediate Successors</u>	<u>Time Required Before Beginning Successor Job</u>
1	3	10
2	3	6
	4	5
3	5	6
	6	5
4	7	2
5	8	5
	9	7
6	8	3
	10	1
7	10	6
8	10	8
9	11	5
10	11	4
11		



RUN

8000 DATA 11
 8010 DATA 1,3,10
 8020 DATA 2,3,6,4,5
 8030 DATA 2,5,6,6,5
 8040 DATA 1,7,2
 8050 DATA 2,8,5,9,7
 8060 DATA 2,8,3,10,1
 8070 DATA 1,10,6
 8080 DATA 1,10,8
 8090 DATA 1,11,5
 8100 DATA 1,11,4

RUN
 GCPM1

EVENT NUMBER	EARLIEST START	LATEST START	SLACK TIME
1	0	0	0
2	0	4	4
3	10	10	0
4	5	21	16
5	16	16	0
6	15	18	3
7	7	23	16
8	21	21	0
9	23	28	5
10	29	29	0
11	33	33	0

THE TIME TO PROJECT COMPLETION IS: 33
 THE JOBS ON THE CRITICAL PATH ARE:
 1 > 3 > 5 > 8 > 10 > 11
 ONE CRITICAL PATH THROUGH THE NETWORK IS:
 1 > 3 > 5 > 8 > 10 > 11

HOW MANY LINKS OF THE NETWORK DO YOU WISH TO CHANGE?
 ?1
 FOR EACH LINK TYPE:FIRST JOB,SECOND JOB,TIME INVOLVED.
 ?6,8,1

EVENT NUMBER	EARLIEST START	LATEST START	SLACK TIME
1	0	0	0
2	0	4	4
3	10	10	0
4	5	21	16
5	16	16	0
6	15	20	5
7	7	23	16
8	21	21	0
9	23	28	5
10	29	29	0
11	33	33	0

THE TIME TO PROJECT COMPLETION IS: 33
 THE JOBS ON THE CRITICAL PATH ARE:
 1 > 3 > 5 > 8 > 10 > 11
 ONE CRITICAL PATH THROUGH THE NETWORK IS:
 1 > 3 > 5 > 8 > 10 > 11

HOW MANY LINKS OF THE NETWORK DO YOU WISH TO CHANGE?

?2

FOR EACH LINK TYPE:FIRST JOB,SECOND JOB,TIME INVOLVED.

?1,3,7

?5,8,3

EVENT NUMBER	EARLIEST START	LATEST START	SLACK TIME
1	0	0	0
2	0	1	1
3	7	7	0
4	5	16	11
5	13	13	0
6	12	15	3
7	7	18	11
8	16	16	0
9	20	23	3
10	24	24	0
11	28	28	0

THE TIME TO PROJECT COMPLETION IS: 28

THE JOBS ON THE CRITICAL PATH ARE:

1 > 3 > 5 > 8 > 10 > 11

ONE CRITICAL PATH THROUGH THE NETWORK IS:

1 > 3 > 5 > 8 > 10 > 11

HOW MANY LINKS OF THE NETWORK DO YOU WISH TO CHANGE?

?0

DONE

TITLE:

LINEAR PROGRAMMING - VARIABLES RESTRICTED TO VALUES OF ONE
OR ZERO

DESCRIPTION:

This program will solve linear programming problems in which all variables are restricted to values of either zero or one. An objective function of the form:

$$c_1x_1 + c_2x_2 + \dots + c_Nx_N$$

will be minimized subject to a series of M constraints, each of the form:

$$a_{i1}x_1 + a_{i2}x_2 + \dots + a_{iN}x_N \geq B_i \quad (\text{for } i = 1, \dots, M)$$

And, of course:

$$x_j = 0,1 \quad (\text{for } j = 1, 2, \dots, N)$$

INSTRUCTIONS:

Input can be via DATA statements or the terminal. If data statements are used, they should be entered beginning at line 9000, in the following order:

number of constraints (M) < = 20

number of variables (N) < = 40

for each constraint:

coefficient for variable 1 (a_{i1})

coefficient for variable 2 (a_{i2})

. . .

coefficient for last variable (a_{iN})

right-hand side (B_i)

coefficients for objective function (c_1, c_2, \dots, c_N)

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

RUN
GINTLP

PLEASE INDICATE INPUT SOURCE --
'T' FOR TERMINAL
'D' FOR DATA STATEMENTS
SOURCE --?T

NUMBER OF CONSTRAINTS --?3
NUMBER OF VARIABLES --?5

COEFFICIENTS FOR CONSTRAINT 1
VARIABLE 1 : ?1
VARIABLE 2 : ?-3
VARIABLE 3 : ?5
VARIABLE 4 : ?1
VARIABLE 5 : ?-4
RIGHT-HAND SIDE : ?2

COEFFICIENTS FOR CONSTRAINT 2
VARIABLE 1 : ?-2
VARIABLE 2 : ?6
VARIABLE 3 : ?-3
VARIABLE 4 : ?-2
VARIABLE 5 : ?2
RIGHT-HAND SIDE : ?0

COEFFICIENTS FOR CONSTRAINT 3
VARIABLE 1 : ?0
VARIABLE 2 : ?-1
VARIABLE 3 : ?2
VARIABLE 4 : ?-1
VARIABLE 5 : ?-1
RIGHT-HAND SIDE : ?1

COEFFICIENTS FOR OBJECTIVE FUNCTION --
VARIABLE 1 : ?5
VARIABLE 2 : ?7
VARIABLE 3 : ?10
VARIABLE 4 : ?3
VARIABLE 5 : ?1

ANSWERS:

VARIABLE	VALUE
1	0
2	1
3	1
4	0
5	0

MINIMUM VALUE OF THE OBJECTIVE FUNCTION = 17

DONE

TITLE:

LINEAR PROGRAMMING

DESCRIPTION:

This program will solve a standard linear programming problem of modest size. Up to 28 constraints may be used, and up to 45 variables. Cases in which the number of variables plus the number of constraints exceeds 40 may, however, prove too large.

INSTRUCTIONS:

The problem description must be entered in data statements beginning with line 2000. For each non-zero coefficient in a constraint, the following information is required:

Constraint number, variable number, coefficient

For each coefficient in the objective function, the following information is required:

"OBJ," variable number, coefficient

For each constraint, the following information is entered:

- a) If the value must be less than or equal to the right-hand-side value:

constraint number, "<=", right-hand-side value

- b) If the value must be equal to the right-hand-side value:

constraint number, "=", right-hand-side value

- c) If the value must be greater than or equal to the right-hand-side value:

constraint number, ">=", right-hand-side value

Each group of three items must be entered in order (as described), but groups may be entered in any order.

After entering the data statements, RUN the program. It will ask you if you want to MAXIMIZE or MINIMIZE the value of the objective function. Then it will request the number of variables and the number of constraints.

The output includes information on the optimal value of the objective function, the values of the variables in the solution, the constraints that were binding (and their shadow-prices), and the constraints that were slack (and the amounts by which they were slack). Most of the information is self-explanatory. The major exception is the set of shadow-prices. Roughly, a shadow-price indicates the amount by which the objective function would change if the constraint in question were changed by one unit. This provides some information concerning the desirability of changing constraints and shows how sensitive the results are to the particular assumptions employed.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

2000 DATA 1,1,2
2001 DATA 1,2,3
2002 DATA 2,1,5
2003 DATA 2,2,4
2004 DATA "OBJ",1,300
2005 DATA "OBJ",2,360
2006 DATA 1,"<=",1000
2007 DATA 2,"<=",2000

RUN
GLP

DO YOU WANT TO MAXIMIZE OR MINIMIZE?MAXIMIZE
NUMBER OF VARIABLES?2
NUMBER OF CONSTRAINTS?2

--

SOLUTION

VALUE OF THE OBJECTIVE = 137143.

VARIABLES

=====

VARIABLE	VALUE
2	142.857
1	285.714

BINDING CONSTRAINTS

=====

CONSTRAINT	SHADOW-PRICE
1	85.7143
2	25.7143

SLACK CONSTRAINTS

=====

CONSTRAINT	SLACK
------------	-------

DONE

TITLE:

LINEAR PROGRAMMING TWO-PHASE SIMPLEX METHOD

DESCRIPTION:

This program solves a linear programming problem via the two-phase simplex method and permits the user to perform sensitivity and parametric analyses on the right-hand side and cost coefficients. The program does not provide the opportunity for post-optimality analysis of the technological coefficients. The data for the problem matrix is provided in a series of DATA statements while user prompts after the program start determine the nature of the problem (maximization or minimization, number of variables and constraints, and the direction of constraint inequalities). The program will solve a problem having 28 or fewer constraints and for which the sum of variables, all constraints and surplus variables (\geq inequalities) is less than or equal to 69.

INSTRUCTIONS:

See Page 2

ACKNOWLEDGEMENTS:Graduate School of Business
Stanford University

INSTRUCTIONS:

Input of the Problem Matrix

The program will solve problems organized in either of the following two forms:

$$\begin{aligned}
 &\text{minimize} && \sum_{j=1}^N c_j X_j \\
 &\text{subject to} && \sum_{j=1}^N a_{ij} X_j \leq b_i \quad , \quad i = 1, 2, \dots, L \\
 (1) &&& \sum_{j=1}^N a_{ij} X_j = b_i \quad , \quad i = L + 1, \dots, L + E \\
 &&& \sum_{j=1}^N a_{ij} X_j \geq b_i \quad , \quad i = L+E+1, \dots, L+E+G \\
 &&& X_j \geq 0 \quad \quad \quad j = 1, 2, \dots, N
 \end{aligned}$$

or

$$\begin{aligned}
 &\text{maximize} && \sum_{j=1}^N c_{ij} X_j \\
 &\text{subject to} && \sum_{j=1}^N a_{ij} X_j \leq b_i \quad , \quad i = 1, 2, \dots, L \\
 (2) &&& \sum_{j=1}^N a_{ij} X_j = b_i \quad , \quad i = L + 1, \dots, L+E \\
 &&& \sum_{j=1}^N a_{ij} X_j \geq b_i \quad , \quad i = L+E+1, \dots, L+E+G \\
 &&& X_j \geq 0 \quad \quad \quad j = 1, 2, \dots, N
 \end{aligned}$$

where

- N = the number of primal variables in the original problem,
- L = the number of constraints with a \leq inequality,
- E = the number of constraints which hold with equality, and
- G = the number of constraints with a \geq inequality.

Note that regardless of whether the problem requires maximization or minimization, the problem constraint matrix is organized with the Type I (\leq) inequalities first, equalities second, and Type II (\geq) inequalities last. This problem organization also requires that all b_i be greater than or equal to zero. In the event a given b_i is negative, the corresponding constraint can be multiplied by -1 and the inequality reversed to conform with the program requirements.

INSTRUCTIONS: (continued)Input of the Problem Matrix (continued)

The DATA statements used to input the problem matrix should be numbered consecutively, starting with statement number 5000. The largest allowable statement number is 9998. The a_{ij} elements should be entered first, constraint row by constraint row. Then the c_j coefficients should be entered, followed by the right-hand side or b_j elements. The resulting list of data statements should appear as follows:

```

5000 DATA a11, a12, ... , a1N
5010 DATA a21, a22, ... , a2N
... ..
... DATA aM1, aM2, ... , aMN
... DATA c1, c2, ... , cn
... DATA b1, b2, ... , bm

```

Running the Program

After all DATA statements are entered, type the statement

```
RUN
```

to commence execution. The program will then respond with

```
TYPE: '1' FOR MAXIMIZATION OR '-1' FOR MINIMIZATION.
```

Enter the appropriate answer and then press the carriage return so that execution can continue.

The next prompt will be

```
TYPE: THE NUMBER OF CONSTRAINTS, NUMBER OF VARIABLES.
```

To answer this query enter the total number of constraints ($M = L + E + G$) and the number of problem variables (N); these two numbers should be separated by a comma. Once the carriage has been returned after this entry, a final query will be printed.

```
TYPE: NUMBER OF LESS THAN, EQUAL, GREATER THAN CONSTRAINTS.
```

To answer this prompt enter the values of L , E , and G , all separated by commas, and return the carriage.

The program will then respond with a list of original problem variable numbers (YOUR VARIABLES = 1, 2, ..., N), the numbers of all slack or surplus variables added to the inequality constraints, and the numbers of all artificial variables added so that an initial feasible solution can be found. The program then proceeds to solve the problem. If no feasible solution can be found for the original problem, the following message will be printed.

```
THE PROBLEM HAS NO FEASIBLE SOLUTION;
```

execution is then terminated. If a feasible solution exists but an optimal solution cannot be found due to the absence of a convex feasible region, the message

```
THE SOLUTION IS UNBOUNDED
```

will be printed and execution terminated.

If an optimal solution is located, the optimal values of the primal variables, dual variables, and the objective function are printed. The zero values of all non-basic primal and dual variables are not printed.

INSTRUCTIONS: (continued)Right-Hand Side Ranging

Once the optimal solution is printed, the opportunity to do sensitivity analysis on this solution is announced by the message:

NOW YOU CAN DO SENSITIVITY ANALYSIS ON THE RIGHT HAND SIDE.

For any set, I, of right side b_i elements, the associated constraints

$$\sum_{j=1}^N a_{ij} X_j \leq b_i \quad (\text{for } i \text{ in } I)$$

can be changed to

$$\sum_{j=1}^N a_{ij} X_j \leq b_i + \theta$$

(The \leq constraint is used for illustration) The program then finds the upper and lower bounds on θ . These bounds indicate the amount by which each of the b_i (i in the set I) can be increased or decreased so that the current optimal basis remains feasible. This basis is no longer feasible when one of the basic variables becomes negative. The basic variables which goes to zero when θ reaches its upper and lower bounds are also identified by the program.

To perform the analysis the program asks

HOW MANY CAPACITIES DO YOU WISH TO CHANGE?

A response of 0 sends the program to another section where sensitivity analysis of the cost coefficients is performed. Right-hand side ranging can be performed on from one to M constraints. The next query,

WHICH CAPACITIES DO YOU WISH TO CHANGE?

requires a specification of the index numbers ($i = 1, 2, \dots, M$) of the b_i to be included in a ranging analysis. If the number of a constraint is entered more than once, the θ added to b_i will be multiplied by the number of times the constraint is entered. For example, if the first constraint is entered twice, the result will be

$$\sum_{j=1}^N a_{ij} X_j \leq b_i + 2\theta$$

Thus, in determining a bound on θ , b_i will increase twice as fast as the b_i of a constraint which is entered only once.

The program repeatedly offers the opportunity to perform righthand side analyses until a zero response is given to the original query.

Cost Coefficient Ranging

The opportunity to perform a ranging analysis on the c_j coefficients is announced by

YOU MAY NOW DO SENSITIVITY ANALYSIS ON THE COST FACTORS.

For a selected set of variables, J, in the original objective function

$$\sum_{j=1}^N c_j X_j$$

is changed to

$$\sum_{j=1}^N c_j X_j + \theta \sum_{j \in J} X_j.$$

That is, each selected coefficient c_j becomes $c_j + \theta$. The program then determines the upper and lower bounds on θ such that the original optimal solution remains optimal. This determines the amount by which each c_j in the set J can be increased or decreased without changing anything but the objective function value of the optimal solution.

INSTRUCTIONS: (continued)

The program queries used to perform this analysis are

HOW MANY COSTS DO YOU WISH TO CHANGE?

and

WHICH COSTS DO YOU WISH TO CHANGE?

Entries are provided in the same manner as for right-side ranging. Entry of a variable index number more than a single time has the same effect on the rate of that variable's increase and decrease as is the case in the right side analysis.

A zero response to the initial cost change query sends program control to sections to perform parametric analysis of right-hand side and cost coefficients.

Parametric Analysis -- Right-Hand Side

The opportunity to perform a complete parametric analysis of one or more right-hand side elements, b_i , is announced by

YOU MAY NOW DO PARAMETRIC ANALYSIS ON THE RIGHT HAND SIDE.

Recall that after slack and surplus variables were added, the original problem had constraints of the form

$$\sum_{j=1}^N a_{ij} X_j = b_i \quad i = 1, \dots, M.$$

Parametric analysis allows us to select a set, I , of b_i elements and change them to $b_i + \theta$. Then θ is increased, or decreased (an option not explicitly available or needed in right side ranging), up to the point where a basis change occurs. The new optimal solution is printed at this point, and θ is allowed to continue in its change in value over several optimal bases until the solution is no longer bounded or until the problem becomes infeasible.

The program will ask

HOW MANY CAPACITIES DO YOU WISH TO CHANGE?

A zero response stops execution. As with previous queries, if analysis is to be done, enter the number of constraints to be used. The inquiry

WHICH CAPACITIES DO YOU WISH TO CHANGE?

is answered with the numbers of the constraints being analyzed. If the direction of change desired is a decrease in b_i , i.e., $b_i - \theta$, precede the constraint number with a minus sign. Entering a constraint's number more than once causes the rate of change for θ to be increased by a multiple of the times a number is entered.

Once the response to the above question is entered, the analysis will be performed and printed. There are then four possible options open to the program user:

1. A parametric analysis can be performed on the same constraints as were considered in the previous analysis but the direction of change in the b_i will be reversed. The starting point for this analysis will be the final optimal solution reached in the preceding parametric analysis, not the original optimal basis and original right hand side.
2. A parametric analysis may be performed on a new set of capacities using as a starting point the basis and right hand side reached at the conclusion of the previous parametric analysis.
3. A parametric analysis can be performed on a new set of capacities using the original right side and optimal basis. (This requires a resolving of the problem.)
4. Execution can be terminated.

INSTRUCTIONS: (continued)

To select an option, the following prompt should be answered.

TYPE: A '1' TO REVERSE THE PREVIOUS PARAMETRIC ANALYSIS, A '2' TO START ANOTHER PARAMETRIC ANALYSIS FROM THIS POINT, OR A '3' TO DO ANOTHER PARAMETRIC ANALYSIS ON THE ORIGINAL CAPACITIES. TYPE A '0' TO QUIT.

A response of zero stops execution. A 1 answer performs the reversed analysis and returns with the above prompt; a 2 or a 3 response will produce the prompts

YOU MAY NOW DO PARAMETRIC ANALYSIS ON THE RIGHT HAND SIDE HOW MANY CAPACITIES DO YOU WISH TO CHANGE?

Respond in the same form as the previous such query and the analysis will be performed. Return will be to the four-option point in the program.

RUN

5000 DATA 4,9,7,10
 5010 DT-ATA 1,1,3,40
 5020 DATA 4000,6000
 5030 DATA 12,20,18,40
 RUN
 GLPSA1

TYPE: '1' FOR MAXIMIZATION, OR '-1' FOR MINIMIZATION. ?1
 TYPE: THE NUMBER OF CONSTRAINTS, NUMBER OF VARIABLES. ?2,4
 TYPE: NUMBER OF LESS THAN,EQUAL,GREATER THAN CONSTRAINTS. ?2,-,0,0

YOUR VARIABLES 1 THROUGH 4
 SLACK VARIABLES 5 THROUGH 6

ANSWERS:

PRIMAL VARIABLES:

VARIABLE	VALUE
1	666.667
4	133.333

DUAL VARIABLES:

VARIABLE	VALUE
1	2.93333
2	.266667

VALUE OF OBJECTIVE FUNCTION 13333.3

YOU CAN NOW DO SENSITIVITY ANALYSIS ON THE RIGHT HAND SIDE.

HOW MANY CAPACITIES DO YOU WISH TO CHANGE?1
 WHICH CAPACITIES DO YOU WISH TO CHANGE?1
 THE BOUND ON THE DECREASE IS 2500. AT WHICH POINT VARIABLE 1
 GOES TO ZERO.
 THE BOUND ON THE INCREASE IS 20000 AT WHICH POINT VARIABLE 4
 GOES TO ZERO.

HOW MANY CAPACITIES DO YOU WISH TO CHANGE?0

YOU MAY NOW DO SENSITIVITY ANALYSIS ON THE COST FACTORS.

HOW MANY COSTS DO YOU WISH TO CHANGE?2
 WHICH COSTS DO YOU WISH TO CHANGE?2,3
 THE BOUND ON THE INCREASE IS 3.33333
 AT THIS POINT VARIABLE 3 CAN ENTER THE BASIS.VARIABLE 1
 WILL LEAVE THE BASIS.
 THE DECREASE IS NOT BOUNDED.

HOW MANY COSTS DO YOU WISH TO CHANGE?0

YOU CAN NOW DO PARAMETRIC ANALYSIS ON THE RIGHT HAND SIDE.

HOW MANY CAPACITIES DO YOU WISH TO CHANGE?1
 WHICH CAPACITIES DO YOU WISH TO CHANGE?1
 THE NEXT BOUND ON THE CHANGE IS 20000 . VARIABLE 4
 WILL GO TO ZERO.VARIABLE 2 WILL ENTER THE BASIS.
 THE NEW OPTIMAL SOLUTION IS:

ANSWERS:
 PRIMAL VARIABLES:

VARIABLE	VALUE
1	6000
2	0

 DUAL VARIABLES:

VARIABLE	VALUE
1	1.6
2	5.6

 VALUE OF OBJECTIVE FUNCTION 72000.

THE NEXT BOUND ON THE CHANGE IS 30000. . VARIABLE 1
 WILL GO TO ZERO.VARIABLE 5 WILL ENTER THE BASIS.
 THE NEW OPTIMAL SOLUTION IS:

ANSWERS:
 PRIMAL VARIABLES:

VARIABLE	VALUE
2	6000.
5	0

 DUAL VARIABLES:

VARIABLE	VALUE
1	0
2	20.

 VALUE OF OBJECTIVE FUNCTION 120000.

THERE IS NO FURTHER BOUND ON THE CHANGE.

TYPE: A '1' TO REVERSE THE PREVIOUS PARAMETRIC ANALYSIS,
 A'2' TO START ANOTHER PARAMETRIC ANALYSIS AT THIS POINT,
 OR A '3' TO DO ANOTHER PARAMETRIC ANALYSIS ON THE
 ORIGINAL CAPACITIES. TYPE A '0' TO QUIT.
 ?0

DONE

TITLE:

NETWORK FLOW DETERMINATION (MAX/MIN)

DESCRIPTION:

This program finds the minimum-cost feasible flow through a network. The network is made up of nodes and arcs. Each arc runs from one node to another, and can handle flows within a specified range. Each unit of flow along a given arc has an associated cost. Finally, the total flow into a node must equal the total flow out of the node. Given the description of such a network, the program will find a set of flows that meets all the requirements at either minimum or maximum total cost.

INSTRUCTIONS:

Each node is assigned an arbitrary number between 1 and 99. The network is described by giving the following information for each arc:

From node number

To node number

Cost per unit of flow

Upper bound (maximum flow)

Lower bound (minimum flow)

For example:

1000 DATA 20,30,3,10,40

This describes an arc from node 20 to node 30; each unit of flow along the arc adds 3 units to total cost; and the flow must be between 10 and 40 units inclusive.

All numbers must be integers (whole numbers).

Data should be entered in data statements, beginning with line 1000.

The program has been modified to allow maximization. If this option is specified, all cost figures are multiplied by -1 before processing begins, and the total cost figure is multiplied by -1 prior to output. Node prices (the values of the dual variables) are not altered prior to output.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

1000 DATA 20,30,0,20,20
 1001 DATA 21,30,0,25,25
 1002 DATA 22,30,0,30,30
 1003 DATA 23,30,0,15,15
 1004 DATA 30,1,0,100,0
 1005 DATA 1,10,0,15,0
 1006 DATA 1,11,0,30,0
 1007 DATA 1,12,0,15,0
 1008 DATA 1,13,0,40,0
 1009 DATA 10,20,4,100,0
 1010 DATA 10,21,5,100,0
 1011 DATA 10,22,8,100,0
 1012 DT-ATA 10,23,20,100,0
 1013 DATA 11,20,22,100,0
 1014 DATA 11,21,20,100,0
 1015 DATA 11,22,14,100,0
 1016 DATA 11,23,4,100,0
 1017 DATA 12,20,,-3,100,0
 1018 DATA 12,21,12,100,0
 1019 DATA 12,22,5,100,0
 1020 DATA 12,23,17,100,0
 1021 DATA 13,20,8,100,0
 1022 DATA 13,21,14,100,0
 1023 DATA 13,22,6,100,0
 1024 DATA 13,23,29,100,0

RUN
GNETFL

ARCS

FROM	TO	COST	UPPER	LOWER
20	30	0	20	20
21	30	0	25	25
22	30	0	30	30
23	30	0	15	15
30	1	0	100	0
1	10	0	15	0
1	11	0	30	0
1	12	0	15	0
1	13	0	40	0
10	20	4	100	0
10	21	5	100	0
10	22	8	100	0
10	23	20	100	0
11	20	22	100	0
11	21	20	100	0
11	22	14	100	0
11	23	4	100	0
12	20	3	100	0
12	21	12	100	0
12	22	5	100	0
12	23	17	100	0
13	20	8	100	0
13	21	14	100	0
13	22	6	100	0
13	23	29	100	0

DO YOU WANT TO MAXIMIZE OR MINIMIZE?MINIMIZE

SOLUTION

FROM	TO	FLOW
20	30	20
21	30	25
22	30	30
23	30	15
30	1	90
1	10	15
1	11	20
1	12	15
1	13	40
10	20	0
10	21	15
10	22	0
10	23	0
11	20	0
11	21	5
11	22	0
11	23	15
12	20	15
12	21	0
12	22	0
12	23	0
13	20	5
13	21	5
13	22	30
13	23	0

NON-ZERO NODE PRICES

NODE	PRICE
10	15
12	11
13	6
20	14
21	20
22	12
23	4

MINIMUM TOTAL COST = 570

DONE

GSSS
36552**TITLE:**

SMALL SYSTEMS SIMULATOR

DESCRIPTION:

GSSS (Small Systems Simulator) allows the user to simulate the behavior of certain types of systems. Almost anything can move through a simulated system. The term item is used in GSSS to denote such an entity. Each item is created, moved through the system, then destroyed.

INSTRUCTIONS:

See Page 2

ACKNOWLEDGEMENTS:Graduate School of Business
Stanford University

INSTRUCTIONS:

The system to be simulated is described by a set of blocks. Each must be given a number between 1 and 49. There are six different kinds of blocks.

The CREATE block creates items at various intervals. Associated with a create block is a mean time and a spread. If the spread is positive, the time between creations is drawn randomly from a rectangular distribution of values between (mean - spread) and (mean + spread). If the spread is negative, the time between creations is drawn randomly from a normal distribution with the specified mean and a standard deviation equal to the absolute value of the spread. In either case, values below zero are considered to equal zero when drawn. After creation, an item is moved to the next block associated with the CREATE block.

The BRANCH block routes an item to one of two next-blocks, depending on the value of a random number drawn from a rectangular distribution between zero and one. Associated with the BRANCH is a probability. If the random number is smaller than this value, the item is routed to next-block-A. Otherwise, it is routed to next-block-B.

The ADVANCE block simulates any activity that requires time. The actual time is drawn randomly, based on the mean and spread associated with the block. If the spread is positive, a rectangular distribution is used, otherwise a normal distribution is used. Procedures are the same as those used for a CREATE block.

Most simulations involve facilities of limited capacity. GSSS allows the use of up to 49 facilities, numbered 1 to 49. Each facility has a capacity (if none is given, the capacity is assumed to equal 1).

The number of items in a facility at any time must be less than or equal to its capacity. If a facility is full, no item will be allowed to enter it until another leaves.

The ENTER block represents the act of entering a facility if it is available (not full), waiting up to some maximum time limit if it is not available, and going elsewhere if the maximum waiting time is exceeded. A facility number is associated with the ENTER block. If it is available, the item will enter it and go to next-block-A. If the facility is not available, the item will remain in the ENTER block. When the facility becomes available, the item will then enter it and go on to next-block-A. However, if the delay exceeds the maximum waiting time associated with the ENTER block, the item will not enter the facility, and will instead go on to next-block-B.

Once in a facility, an item remains until it passes through a LEAVE block.

When an item has passed through the simulated system it has served its purpose. Since only 100 items can be in the entire system at any one time, it is essential to route them to a DESTROY block when they are no longer needed.

A diagrammatic representation of a simple system is shown on the following page. The number of each block is shown immediately above it.

The description of the system to be simulated should be entered in DATA statements beginning with line 9000. For example:

```
9000 DATA 1, "CREATE", 5, 2, 2
```

This describes block number 1 -- a CREATE block with a mean time of 5 and a spread of 2. The final "2" indicates the number of the next block.

The formats are:

block number, "CREATE", mean, spread, next block

block number, "DESTROY"

block number, "BRANCH", probability, Next-block-A, Next-block-B

block number, "ENTER", facility, wait time, Next-block-A, Next-block-B

block number, "LEAVE", facility, next block

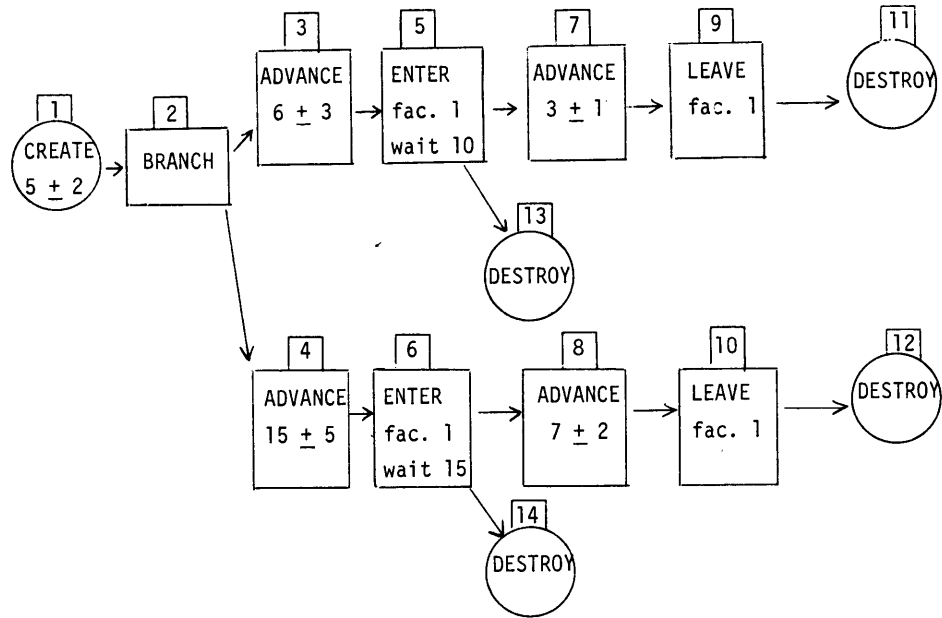
block number, "ADVANCE", mean, spread, next block

The capacity of a facility is given in one line. For example:

```
9014 DATA 1, "FACILITY", 2
```

This indicates that facility 1 has a capacity of 2 items.

INSTRUCTIONS: (continued)



Only one more piece of information is required: the number of items to be moved through the system during the simulation. This is also given in one line. For example:

9015 DATA 50, "ITEMS"

This indicates that 50 items are to be moved through the system during the simulation.

RUN

```

9000 DATA 1,"CREATE",5,2,2
9001 DATA 2,"BRANCH",.3,3,4
9002 DATA 3,"ADVANCE",6,3,5
9003 DATA 4,"ADVANCE",15,5,6
9004 DATA 5,"ENTER",1,10,7,13
9005 DATA 6,"ENTER",1,15,8,14
9006 DATA 7,"ADVANCE",3,1,9
9007 DATA 8,"ADVANCE",7,2,10
9008 DATA 9,"LEAVE",1,11
9009 DATA 10,"LEAVE",1,12
9010 DATA 11,"DESTROY"
9011 DATA 12,"DESTROY"
9012 DATA 13,"DESTROY"
9013 DATA 14,"DESTROY"
9014 DATA 1,"FACILITY",2
9015 DATA 50,"ITEMS"
RUN
GSSS
    
```

SYSTEM DESCRIPTION

```

-----
1  CREATE      5      2      2
2  BRANCH     .3      3      4
3  ADVANCE     6      3      5
4  ADVANCE    15      5      6
5  ENTER       1     10      7     13
6  ENTER       1     15      8     14
7  ADVANCE     3      1      9
8  ADVANCE     7      2     10
9  LEAVE       1     11
10 LEAVE       1     12
11 DESTROY
12 DESTROY
13 DESTROY
14 DESTROY
1  FACILITY    2
50 ITEMS
    
```

SIMULATION RESULTS

```

-----
BLOCK #          # ENTERED          # LEFT          # REMAINING
-----
1
2              54              54              0
3              14              14              0
4              40              36              4
5              14              14              0
6              36              36              0
7              14              14              0
8              36              36              0
9              14              14              0
10             36              36              0
11             14
12             36
13              0
14              0

FACILITY #      CAPACITY      CURRENT # OF    AVERAGE # OF
-----      -----      -----      -----
1              2              0              1.12186
    
```

SIMULATED TIME = 271.843

DONE

TITLE:

COMMITTEE CHOICE ANALYSIS

DESCRIPTION:

This program uses simulation to estimate the probability that a committee of M members will have transitive preferences among N mutually exclusive alternatives when using majority votes in pairwise comparisons. Each member is assumed to have transitive preferences. This is accomplished by drawing random numbers to represent the "score" assigned to each alternative, then assuming that each member always votes for the member of a pair with the largest "score." Each pair is subjected to vote using the set of scores drawn for the trial, then the votes are analyzed to determine whether or not they are transitive.

INSTRUCTIONS:

The procedure used to check transitivity of committee choices is as follows. First, matrix V is filled in with the results of the vote. V (row, column) = the excess of the votes in favor of the row over the column. Values along the diagonal are set to zero; those below the diagonal simply equal -1 times the corresponding element above (i.e., $V_{ji} = -V_{ij}$). Next, the numbers are changed to: (-1) if negative, (+1) if positive and the row sums calculated. The sum for a row is the value of (number of inferior alternatives - number of superior alternatives). Let C_i represent the sum for row (alternative) i. Then the alternatives rank (R_i) is simply:

$$R_i = \frac{N + 1}{2} - \frac{C_i}{2}$$

Since the committee is assumed to have an odd number of members, no one of whom is indifferent between any two alternatives, if the committee's preferences are transitive, no two alternatives will have the same rank. Thus no two will have the same value of C_i . To check for transitivity then, one merely checks to see if any two values of C_i are the same.

The program allows the user to specify the committee size, the number of alternatives to be considered, and the number of trials to be run.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

RUN
GVOTE

DO YOU WANT INSTRUCTIONS?YES
THIS PROGRAM SIMULATES THE VOTING OF A COMMITTEE
EACH MEMBER IS ASSUMED TO HAVE TRANSITIVE PREFERENCES
AMONG A NUMBER OF ALTERNATIVES, ONE OF WHICH
IS TO BE CHOSEN BY MAJORITY VOTE
THE NUMBER OF COMMITTEE MEMBERS SHOULD BE ODD, SO
THERE ARE NO TIES. THUS , GIVEN TWO ALTERNATIVES,
THE COMMITTEE WILL ALWAYS 'PREFER' ONE OVER THE OTHER
YOU MAY CHOOSE THE NUMBER OF ALTERNATIVES AND THE
NUMBER OF MEMBERS
YOU MAY ALSO CHOOSE THE NUMBER OF 'TRIALS'
YOU MAY THINK OF EACH TRIAL AS A DIFFERENT COMMITTEE
VOTING ON THE SAME SET OF ALTERNATIVES.
ALTERNATIVELY, YOU MAY THINK OF EACH TRIAL AS THE
SAME COMMITTEE VOTING ON A DIFFERENT SET OF
ALTERNATIVES.
FOR EACH TRIAL, THE PROGRAM WILL DETERMINE IF THE
COMMITTEE'S 'PREFERENCES' ARE TRANSITIVE.
IF SO -- A 'T' WILL BE PRINTED
IF NOT -- A '*' WILL BE PRINTED
AT THE END, THE PERCENT OF THE TRIALS IN WHICH THE
COMMITTEE'S PREFERENCES WERE TRANSITIVE WILL BE PRINTED

HOW MANY ALTERNATIVES (<=20)?5
HOW MANY MEMBERS (<=100)?3
HOW MANY TRIALS?100
*TTT*T**T**TTT*TT*T*TTTT*TTTTTTTT*TT*TT*T*T*TT*TTTTTTTT**TTTT**TTTT
TTT**TT*T*T*TTTTTT*TT*TTTT*

PERCENT TRANSITIVE = 70

DONE

LINPRO
36068**TITLE:**

LINEAR PROGRAMMING MODEL

DESCRIPTION:

Given $A=(A(I,J))$, $B=(B(1),\dots,B(M))$, and $C=(N)$, the standard linear programming problem is to find any or all non-negative $X=(X(1),\dots,X(N))$ which maximize, (or minimize), the matrix product $C*X$, subject to the condition $A*X \leq B$. $C*X+C(N+1)$ is called the objective function, and the inequalities contained in $A*X \leq B$, (or $A*X > B$), are called the linear constraints.

LINPRO will generate its own slack and artificial variables, print a matrix tableau of the initial problem, the basis after each iteration, the answers for the variables and dual variables, the value of the objective function and the final tableau.

INSTRUCTIONS:

First, arrange your constraints so that the 'less than' inequalities precede the strict equalities which, in turn, precede the 'greater than' inequalities.

Do not include coefficients for slack, surplus, or artificial variables.

The program will ask you to:

Input whether you wish to see the pivot steps and simplex tableaux. Input whether you are maximizing the objective function (as you put it in data), or minimizing it. Input the number of constraints and variables in your program. Input the number of 'less than inequalities, strict equalities and 'greater than' inequalities. Input the constraints and objective function. Remember to always type zeros when applicable.

**SPECIAL
CONSIDERATIONS:**

The $A = (A_{ij})$ matrix is restricted to 30 X 50 (line 60). This program uses the extended tableau method. For a large program the user should use a program which uses the condensed tableau method.

ACKNOWLEDGEMENTS:

Donald E. Ramirez
University of Virginia

RUN

RUN
LINPRO

A PROGRAM TO SOLVE LINEAR PROGRAMS WITH CONSTRAINTS OF THE FORM
 $A \cdot X \leq B$, $A \cdot X = B$, AND $A \cdot X \geq B$ WHERE B IS A NONNEGATIVE VECTOR.
 DO YOU WISH TO SEE THE PIVOT STEPS (Y OR N)?Y
 DO YOU WISH TO SEE THE SIMPLEX TABLEAUX (Y OR N)?N

IF MAX, TYPE '1'; IF MIN, TYPE '-1'?1

TYPE: NUMBER OF CONSTRAINTS, NUMBER OF VARIABLES?2,2
 TYPE: NO. OF LESS THANS, NO. OF EQUALITIES, NO. OF GREATER THANS?1,0,1
 ENTER THE SIMPLEX TABLEAU IN THE ORDER: <= INEQUALITIES,
 EQUALITIES, >= INEQUALITIES, OBJECTIVE FUNCTION.
 ?1,2,3
 ??2,3,4
 ???3,4,5

YOUR VARIABLES 1 THROUGH 2
 SURPLUS VARIABLES 3 THROUGH 3
 SLACK VARIABLES 4 THROUGH 4
 ARTIFICIAL VARIABLES 5 THROUGH 5

BASIS BEFORE ITERATION 1
 VARIABLE VALUE
 4 3
 5 4
 PIVOT COORDINATE IS (2 , 2)

BASIS BEFORE ITERATION 2
 VARIABLE VALUE
 4 .333333
 2 1.33333
 PIVOT COORDINATE IS (1 , 3)

BASIS BEFORE ITERATION 3
 VARIABLE VALUE
 3 .5
 2 1.5
 PIVOT COORDINATE IS (2 , 1)

ANSWERS:
 VARIABLE VALUE
 3 2
 1 3

DUAL VARIABLES:
 COLUMN VALUE
 3 0
 4 3

OBJECTIVE FUNCTION VALUE = 14.
 IN 3 ITERATIONS

DONE

RUN
LINPRO

A PROGRAM TO SOLVE LINEAR PROGRAMS WITH CONSTRAINTS OF THE FORM
 $A \cdot X \leq B$, $A \cdot X = B$, AND $A \cdot X \geq B$ WHERE B IS A NONNEGATIVE VECTOR.
 DO YOU WISH TO SEE THE PIVOT STEPS (Y OR N)?N
 DO YOU WISH TO SEE THE SIMPLEX TABLEAUX (Y OR N)?N

IF MAX, TYPE '1'; IF MIN, TYPE '-1'?1

TYPE: NUMBER OF CONSTRAINTS, NUMBER OF VARIABLES?4,4
 TYPE: NO. OF LESS THANS, NO. OF EQUALITIES, NO. OF GREATER THANS?1,1,2
 ENTER THE SIMPLEX TABLEAU IN THE ORDER: <= INEQUALITIES,
 EQUALITIES, >= INEQUALITIES, OBJECTIVE FUNCTION.
 ?1,2,3,4,5
 ??2,3,4,5,6
 ???3,4,5,6,7
 ??4,5,6,7,8
 ??1,1,1,1,0

YOUR VARIABLES 1 THROUGH 4
 SURPLUS VARIABLES 5 THROUGH 6
 SLACK VARIABLES 7 THROUGH 7
 ARTIFICIAL VARIABLES 8 THROUGH 10

ANSWERS:

VARIABLE	VALUE
7	2.
5	2.
6	4.
1	3.

DUAL VARIABLES:

COLUMN	VALUE
5	0
6	0
7	0
8	.5

OBJECTIVE FUNCTION VALUE = 3.

IN 4 ITERATIONS

DONE

RUN
 LINPRO

A PROGRAM TO SOLVE LINEAR PROGRAMS WITH CONSTRAINTS OF THE FORM
 $A \cdot X \leq B$, $A \cdot X = B$, AND $A \cdot X \geq B$ WHERE B IS A NONNEGATIVE VECTOR.
 DO YOU WISH TO SEE THE PIVOT STEPS (Y OR N)?N
 DO YOU WISH TO SEE THE SIMPLEX TABLEAUX (Y OR N)?Y

IF MAX, TYPE '1'; IF MIN, TYPE '-1'?1

TYPE: NUMBER OF CONSTRAINTS, NUMBER OF VARIABLES?4,4
 TYPE: NO. OF LESS THANS, NO. OF EQUALITIES, NO. OF GREATER THANS?1,1,2
 ENTER THE SIMPLEX TABLEAU IN THE ORDER: <= INEQUALITIES,
 EQUALITIES, >= INEQUALITIES, OBJECTIVE FUNCTION.
 ?1,2,3,4,5
 ??2,3,4,5,6
 ??3,4,5,6,7
 ??4,5,6,7,8
 ??1,1,1,1,0

YOUR VARIABLES 1 THROUGH 4
 SURPLUS VARIABLES 5 THROUGH 6
 SLACK VARIABLES 7 THROUGH 7
 ARTIFICIAL VARIABLES 8 THROUGH 10

TABLEAU AFTER 0				ITERATIONS						
1	2	3	4	0	0	1	0	0	0	5
2	3	4	5	0	0	0	1	0	0	6
3	4	5	6	-1	0	0	0	1	0	7
4	5	6	7	0	-1	0	0	0	1	8
-1	-1	-1	-1	0	0	0	0	0	0	0
-9	-12	-15	-18	1	1	0	0	0	0	-21

TABLEAU AFTER 4			ITERATIONS							
0	.5		1.		1.5		0	0	1	- .5
0	0	2.								
0	.5		1.		1.5		1	0	0	1.5
-1	0	2.								
0	1.		2.		3.		0	1	0	2.
0	-1	4.								
1	1.5		2	2.5		0	0	0	.5	0
0	3.									
0	.5		1	1.5		0	0	0	.5	0
0	3.									
0	0	0	0	0	0	0	1	1	1	0

ANSWERS:
 VARIABLE VALUE
 7 2.
 5 2.
 6 4.
 1 3.

DUAL VARIABLES:
 COLUMN VALUE
 5 0
 6 0
 7 0
 8 .5

OBJECTIVE FUNCTION VALUE = 3.
 IN 4 ITERATIONS

DONE

RUN
 LINPRO

A PROGRAM TO SOLVE LINEAR PROGRAMS WITH CONSTRAINTS OF THE FORM
 $A \cdot X \leq B$, $A \cdot X = B$, AND $A \cdot X \geq B$ WHERE B IS A NONNEGATIVE VECTOR.
 DO YOU WISH TO SEE THE PIVOT STEPS (Y OR N)? Y
 DO YOU WISH TO SEE THE SIMPLEX TABLEAUX (Y OR N)?
 ???

IF MAX, TYPE '1'; IF MIN, TYPE '-1'? 1

TYPE: NUMBER OF CONSTRAINTS, NUMBER OF VARIABLES? 2, 2
 TYPE: NO. OF LESS THANS, NO. OF EQUALITIES, NO. OF GREATER THANS? 1, 0, 1
 ENTER THE SIMPLEX TABLEAU IN THE ORDER: <= INEQUALITIES,
 EQUALITIES, >= INEQUALITIES, OBJECTIVE FUNCTION.
 ? 1, 2, 3
 ?? 2, 3, 4
 ?? 3, 4, 5

YOUR VARIABLES 1 THROUGH 2
 SURPLUS VARIABLES 3 THROUGH 3
 SLACK VARIABLES 4 THROUGH 4
 ARTIFICIAL VARIABLES 5 THROUGH 5

TABLEAU AFTER 0			ITERATIONS			
1	2	0	1	0	3	
2	3	-1	0	1	4	
-3	-4	0	0	0	5	
-2	-3	1	0	0	-4	

BASIS BEFORE ITERATION 1
 VARIABLE VALUE
 4 3
 5 4
 PIVOT COORDINATE IS (2 , 2)
 TABLEAU AFTER 1 ITERATIONS
 -.333333 0 .666667 1 -.666667 .333333
 .666667 1 -.333333 0 .333333 1.33333
 -.333333 0 -1.33333 0 1.33333 10.3333
 0 0 0 0 1 0

BASIS BEFORE ITERATION 2
 VARIABLE VALUE
 4 .333333
 2 1.33333
 PIVOT COORDINATE IS (1 , 3)
 TABLEAU AFTER 2 ITERATIONS
 -.5 0 1 1.5 -1 .5
 .5 1 0 .5 0 1.5
 -1 0 0 2 0 11.
 0 0 0 0 1 0

BASIS BEFORE ITERATION 3
 VARIABLE VALUE
 3 .5
 2 1.5
 PIVOT COORDINATE IS (2 , 1)
 TABLEAU AFTER 3 ITERATIONS
 0 1. 1 2 -1 2
 1 2 0 1 0 3
 0 2 0 3 0 14.
 0 0 0 0 1 0

ANSWERS:
 VARIABLE VALUE
 3 2
 1 3

DUAL VARIABLES:
 COLUMN VALUE
 3 0
 4 3

OBJECTIVE FUNCTION VALUE = 14.
 IN 3 ITERATIONS

DONE

TITLE:

SOLVES EITHER A LINEAR OR QUADRATIC PROGRAMMING PROBLEM

DESCRIPTION:

This program solves either a linear or quadratic programming problem.

INSTRUCTIONS:

Enter the following data beginning in line number 9900.

1. Problem type: "MAX" or "MIN".
2. Number of terms in the objective function (i.e., the expression $X_1X_2 - X_1 - 3X_2$ consists of three terms).
3. Number of allocation variables (i.e., the expression $X_1X_2 - X_1 - 3X_2$ has two allocation variables: X_1 and X_2).
4. Number of constraint equations in the problem.
5. The terms of the objective function expressed in the following format:
"entry 1", "entry 2", "coefficient"
where "entry 1" is the number of an allocation variable and "entry 2" is the number of an allocation variable; (i.e., the term X_1X_2 would be expressed as 1,2,1 and the term $-2X_1$ would be expressed as 1,0,-2 or 0,1,-2 where zero signifies that the term is linear).
6. The coefficients of the constraint equations written in the following manner for both maximization and minimization:
$$H(X_1, X_2, \dots, X_n) \geq 0$$

(for example, $-4X_1 - 2X_2 + 7 \geq 0$ would be entered as -4,-2,7).

The input given in the sample RUN is for the quadratic programming problem:

$$\text{Max } 6X_1 + 3X_2 - X_1^2 + 4X_1X_2 - 4X_2^2$$

$$\text{subject to: } X_1 + X_2 \leq 3$$

$$4X_1 + X_2 \leq 9$$

**SPECIAL
CONSIDERATIONS:**

The program begins at line number 9000.

The following variables are used in the program:

A, F, I, I8, I9, J, K, L, P, Q, R, S, U, W, X, Z5, Z6, Z7, Z8, Z9

A, B, M, R\$, S\$, T\$, V\$, Y are array names

ACKNOWLEDGEMENTS:Babson College
Babson Park, Massachusetts

RUN

```

9900 DATA "MAX"
9901 DATA 5,2,2
9902 DATA 1,1,-1
9903 DATA 2,2,-4
9904 DATA 1,2,4
9905 DATA 1,0,6
9906 DATA 2,0,3
9907 DATA -1,-1,3
9908 DATA -4,-1,9
    
```

RUN
LINQUP

OBJECTIVE IS TO MAXIMIZE THE SUM OF THE FOLLOWING TERMS:

```

-1 * X( 1 ) * X( 1 )
-4 * X( 2 ) * X( 2 )
 4 * X( 1 ) * X( 2 )
 6 * X( 1 )
 3 * X( 2 )
    
```

THE CONSTRAINTS ARE:

```

H 1   =:
-1 * X( 1 )
-1 * X( 2 )
 3
>= 0

H 2   =:
-4 * X( 1 )
-1 * X( 2 )
 9
>= 0
    
```

DO YOU WISH TO SELECT THE PIVOT ELEMENTS MANUALLY,YES OR NO
?NO
DO YOU WISH PRINTOUT OF INTERMEDIATE TABLEAUS,YES OR NO
?NO

ALLOCATION VARIABLES AND ASSOCIATED LAGRANGE MULTIPLIERS

```

X 1   = 2.           MU 1   = 0
X 2   = 1           MU 2   = 0
    
```

CONSTRAINT RELATIONS AND ASSOCIATED LAGRANGE MULTIPLIERS

```

H 1   = 0           MU 3   = 2
H 2   = 0           MU 4   = 1
    
```

OBJECTIVE FUNCTION = 15

DONE

LNTRND
36069**TITLE:**

LINEAR TREND FORECASTING

DESCRIPTION:

LNTRND computes a simple linear trend forecast with seasonal adjustments for monthly data. (A good fit will result only if the trend is linear.)

INSTRUCTIONS:

Data should be entered in the following order, beginning in line 9900:

1. N = no. of years for which data will be entered.

2. A_{1_1} $A_{1_{12}}$ values for year #1 A_{2_1} $A_{2_{12}}$ values for year #2:
:
: A_{N_1} $A_{N_{12}}$ values for year #N

Output will be of the following form:

first the A&B values of the linear forecasting equation: $Y = A + B * X$,
and then the forecasts and seasonal values for the next 12 month period.**SPECIAL****CONSIDERATIONS:**N must be <9, otherwise alter dim-statements in line 9230 to
 $A[N,12]$, $B[N,12]$, $D[N,12]$, $E[12]$, $F[12]$.**ACKNOWLEDGEMENTS:**

RUN

GET-SLNTRND
LIST-9900
LNTRND

9900 DATA 4,2,2,2,2,4,2,6,2,8,3,3,2,3,4,4,4,5,4,8,5
9901 DATA 5,5,2,5,4,5,6,5,3,5,4,5,6,5,7,5,8,6,6,6,1
9902 DATA 6,6,1,6,3,6,5,6,7,6,8,6,9,6,7,6,7,6,9,7,7
9903 DATA 7,7,7,1,7,7,2,7,3,6,9,7,7,7,4,7,5,7,5
9999 END

RUN
LNTRND

* LINEAR TREND FORECASTING *

LINEAR FORECASTING EQUATION IS: $Y = 3.08732 + .105705 * X$.

DATA FOR PERIODS 1 THRU 48 WERE SUPPLIED AS INPUT.
THE NEXT 12 MONTHS ARE FORECAST HERE:

PERIOD	FORECAST	SEASONAL FACTOR
49	7.97485	.964679
50	8.11943	.969768
51	8.40676	.991567
52	8.5377	.994611
53	8.61503	.991411
54	8.78659	.999002
55	8.6036	.96658
56	8.57601	.952173
57	8.939	.980962
58	9.76507	1.05933
59	9.97208	1.06952
60	9.99914	1.0604

DONE

TITLE:

QUEUEING SYSTEM

DESCRIPTION:

This program calculates all the necessary information for a Queueing system with single server, Poisson input and Exponential service times.

INSTRUCTIONS:

The program asks for λ (the input rate) and μ (the service rate). In the Queueing Theory, $\rho = \frac{\lambda}{\mu}$ is defined as the traffic intensity. For the existence of the steady state probability distribution, ρ must be less than one.

**SPECIAL
CONSIDERATIONS:**

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Introduction to Operations Research
Introduction to Queueing Theory

ACKNOWLEDGEMENTS:

David Y. W. Cheng
Fu Shing Mfg. & Lumber Co., Ltd.

RUN

RUN
M7M21

WHAT ARE THE VALUES OF ARRIVAL RATE, AND SERVICE RATE
?.3,.56

THE TRAFFIC INTENSITY = .535714

THE STEADY STATE QUEUE LENGTH DISTRIBUTION AS FOLLOWS:

U(0) = .464286
U(1) = .248724
U(2) = .133245
U(3) = 7.13814E-02
U(4) = 3.82401E-02
U(5) = 2.04857E-02
U(6) = 1.09745E-02
U(7) = 5.87920E-03
U(8) = 3.14957E-03
U(9) = 1.68727E-03
U(10) = 9.03896E-04
U(11) = 4.84230E-04
U(12) = 2.59409E-04
U(13) = 1.38969E-04
U(14) = 7.44478E-05
U(15) = 3.98827E-05
U(16) = 2.13658E-05
U(17) = 1.14459E-05
U(18) = 6.13176E-06
U(19) = 3.28487E-06
U(20) = 1.75975E-06
U(21) = 0.

THE PROBABILITY OF FINDING MORE THAN N IN THE QUEUE IS P(N):

P(0) = .535714
P(1) = .28699
P(2) = .153745
P(3) = 8.23632E-02
P(4) = 4.41232E-02
P(5) = 2.36374E-02
P(6) = 1.26629E-02
P(7) = 6.78370E-03
P(8) = 3.63413E-03
P(9) = 1.94685E-03
P(10) = 1.04296E-03
P(11) = 5.58727E-04
P(12) = 2.99318E-04
P(13) = 1.60349E-04
P(14) = 8.59013E-05
P(15) = 4.60186E-05
P(16) = 2.46528E-05
P(17) = 1.32069E-05
P(18) = 7.07511E-06
P(19) = 3.79024E-06
P(20) = 2.03049E-06
P(21) = 1.08776E-06
P(22) = 0.

THE EXPECTED QUEUE LENGTH = 1.15385

THE VARIANCE OF QUEUE LENGTH = 2.48521

THE EXPECTED WAITING TIME = 2.06044

THE VARIANCE OF WAITING TIME = 11.6041

THE EXPECTED LENGTH OF BUSY PERIOD = 3.84615

NOTE---

THIS PROGRAM FORCES ALL PROBABILITIES LESS THAN
0.000001 TO ZERO.

IF HIGHER ACCURACY IS DESIRED, LINE #250, AND #330
MUST BE PEARRANGED.

DONE

RUN
M2M21

WHAT ARE THE VALUES OF ARRIVAL RATE, AND SERVICE RATE
.5,.3

THE TRAFFIC INTENSITY = 1.66667

THE STEADY STATE DISTRIBUTION DOES NOT EXIST

DONE

MZMS
36656

TITLE: M/M/S QUEUEING SYSTEM

DESCRIPTION: This program calculates all the necessary information for a Queueing system with S servers, Poisson input and Exponential service times. The service rate between different servers is assumed homogeneous.

INSTRUCTIONS: The program will ask for λ (the input rate), μ (the service rate) and S (the number of server). In the Queueing Theory, $\rho = \frac{\lambda}{S\mu}$ is defined as the traffic intensity. For the existence of the steady state probability distribution, ρ must be less than one.

SPECIAL CONSIDERATIONS: FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Introduction to Operations Research
Introduction to Queueing Theory

ACKNOWLEDGEMENTS: David Y. W. Cheng
Fu Shing Mfg. & Lumber Co., Ltd.

RUN

RUN
MZMZS

WHAT ARE THE VALUES OF ARRIVAL RATE, AND SERVICE RATE
 ?4,2.5
 WHAT IS THE NUMBER OF SERVERS
 ?2

THE TRAFFIC INTENSITY = .8

THE STEADY STATE QUEUE LENGTH DISTRIBUTION FOR N CUSTOMER
 IN THE SYSTEM IS $U(N)$, AND THE PROBABILITY OF FINDING MORE
 THAN N IN THE QUEUE IS $P(N)$:

$U(0) = .111111$	$P(0) = .888889$
$U(1) = .177778$	$P(1) = .711111$
$U(2) = .142222$	$P(2) = .568889$
$U(3) = .113778$	$P(3) = .455111$
$U(4) = 9.10222E-02$	$P(4) = .364089$
$U(5) = 7.28178E-02$	$P(5) = .291271$
$U(6) = 5.82542E-02$	$P(6) = .233017$
$U(7) = 4.66034E-02$	$P(7) = .186413$
$U(8) = 3.72827E-02$	$P(8) = .149131$
$U(9) = 2.98262E-02$	$P(9) = .119304$
$U(10) = 2.38609E-02$	$P(10) = 9.54435E-02$
$U(11) = 1.90887E-02$	$P(11) = 7.63547E-02$
$U(12) = .015271$	$P(12) = 6.10838E-02$
$U(13) = 1.22168E-02$	$P(13) = .048867$
$U(14) = 9.77343E-03$	$P(14) = 3.90936E-02$
$U(15) = 7.81874E-03$	$P(15) = 3.12749E-02$
$U(16) = 6.25499E-03$	$P(16) = 2.50199E-02$
$U(17) = 5.00399E-03$	$P(17) = 2.00158E-02$
$U(18) = 4.00319E-03$	$P(18) = 1.60127E-02$
$U(19) = 3.20255E-03$	$P(19) = 1.28101E-02$
$U(20) = 2.56204E-03$	$P(20) = 1.02481E-02$
$U(21) = 2.04964E-03$	$P(21) = 8.19838E-03$
$U(22) = 1.63971E-03$	$P(22) = 6.55866E-03$
$U(23) = 1.31177E-03$	$P(23) = 5.24688E-03$
$U(24) = 1.04941E-03$	$P(24) = 4.19748E-03$
$U(25) = 8.39530E-04$	$P(25) = 3.35801E-03$
$U(26) = 6.71624E-04$	$P(26) = 2.68638E-03$
$U(27) = 5.37299E-04$	$P(27) = 2.14911E-03$
$U(28) = 4.29839E-04$	$P(28) = 1.71924E-03$
$U(29) = 3.43871E-04$	$P(29) = 1.37532E-03$

U(30) = 2.75097E-04	P(30) = 1.10018E-03
U(31) = 2.20078E-04	P(31) = 8.80122E-04
U(32) = 1.76062E-04	P(32) = 7.04050E-04
U(33) = 1.40850E-04	P(33) = 5.63145E-04
U(34) = 1.12680E-04	P(34) = 4.50492E-04
U(35) = 9.01438E-05	P(35) = 3.60370E-04
U(36) = 7.21150E-05	P(36) = 2.88248E-04
U(37) = 5.76920E-05	P(37) = 2.30551E-04
U(38) = 4.61536E-05	P(38) = 1.84417E-04
U(39) = 3.69229E-05	P(39) = 1.47462E-04
U(40) = 2.95383E-05	P(40) = 1.17898E-04
U(41) = 2.36306E-05	P(41) = 9.42945E-05
U(42) = 1.89045E-05	P(42) = 7.53403E-05
U(43) = 1.51236E-05	P(43) = 6.02007E-05
U(44) = 1.20989E-05	P(44) = 4.81606E-05
U(45) = 9.67910E-06	P(45) = 3.85046E-05
U(46) = 7.74328E-06	P(46) = 3.07560E-05
U(47) = 6.19463E-06	P(47) = 2.45571E-05
U(48) = 4.95570E-06	P(48) = 1.95503E-05
U(49) = 3.96456E-06	P(49) = 1.56164E-05
U(50) = 3.17165E-06	P(50) = 1.23978E-05
U(51) = 2.53732E-06	P(51) = 9.89437E-06
U(52) = 2.02985E-06	P(52) = 7.86781E-06
U(53) = 1.62388E-06	P(53) = 6.19888E-06
U(54) = 1.29911E-06	P(54) = 4.88758E-06
U(55) = 1.03929E-06	P(55) = 3.81470E-06
U(56) = 0.	P(56) = 0.

THE PROBABILITY THAT ALL SERVERS WILL BE BUSY = .711111

THE PROBABILITY THAT AT LEAST ONE CUSTOMER WILL BE WAITING
= .568889

THE EXPECTED QUEUE LENGTH = 4.44444

THE EXPECTED NUMBER OF CUSTOMERS ACTUALLY WAITING
= 2.84444

THE EXPECTED WAITING TIME = .711111

THE EXPECTED NUMBER OF BUSY SERVERS = 1.6

NOTE---

THIS PROGRAM FORCES ALL PROBABILITIES LESS THAN
0.000001 TO ZERO.
IF HIGHER ACCURACY IS DESIRED, LINE #460, #530, AND
#580 MUST BE REARRANGED.

DONE

RUN
M/M/S

WHAT ARE THE VALUES OF ARRIVAL RATE, AND SERVICE RATE
?3.5,1
WHAT IS THE NUMBER OF SERVERS
?3

THE TRAFFIC INTENSITY = 1.16667

THE STEADY STATE DISTRIBUTION DOES NOT EXIST

DONE

TITLE: MAXIMUM FLOW IN A CAPACITATED NETWORK USING THE LABELING TECHNIQUE OF FORD & FULKERSON

DESCRIPTION: Consider a connected network consisting of a single source, a single sink, and some intermediate nodes. We assume that there is a capacity restriction $c_{ij} \geq 0$ (usually $c_{ij} \neq c_{ji}$) on each arc connecting node i and node j . The problem is to assign flow for the various arcs in such a way that the sum of flow from source to sink is maximized, yet none of the capacity constraint has been violated.

INSTRUCTIONS: Label the nodes in such a way that node 1 is the source and node N is the sink in a N -node network.

Input data starting on line 2000 as follows:

2000	DATA	N	The number of nodes
2001	DATA	$I, J, C(I, J)$	The capacity from i to j
.
.
....	DATA	$N, N, 0$	Last line must be $N, N, 0$

continued on following page

SPECIAL CONSIDERATIONS:

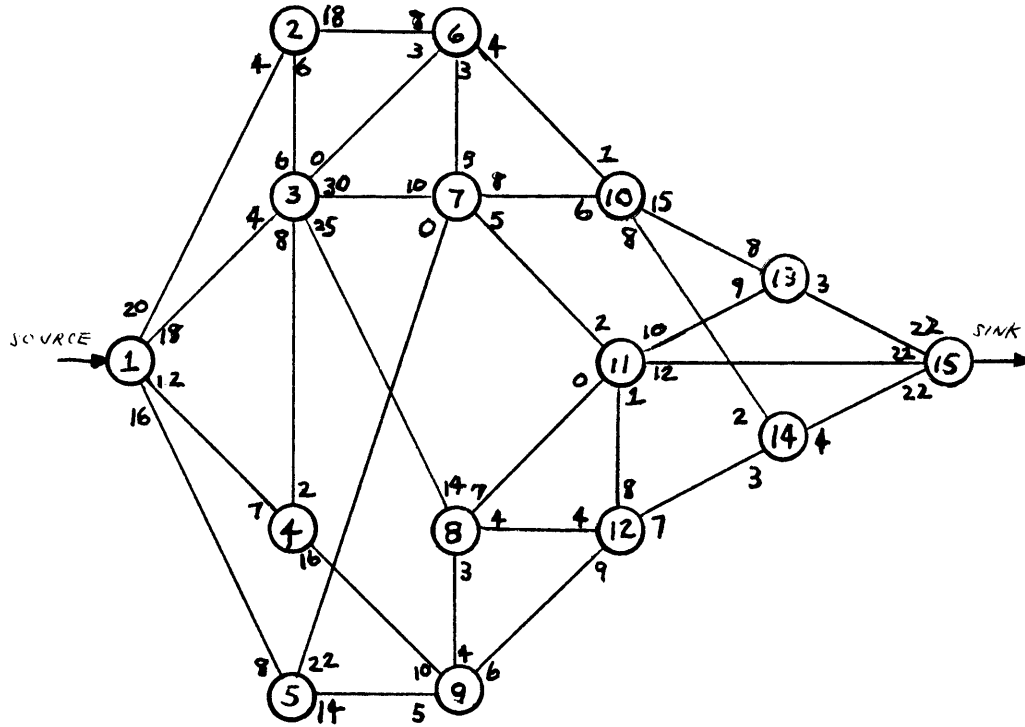
FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Introduction to Operations Research
Introduction to Graph Theory

ACKNOWLEDGEMENTS:

David Y. W. Cheng
Fu Shing Mfg. & Lumber Co., Ltd.

INSTRUCTIONS - continued

"MAXFLO SAMPLE PROBLEM"



RUN

```

2000 DATA 15
2001 DATA 1,2,20
2002 DATA 1,3,18
2003 DATA 1,4,12
2004 DATA 1,5,16
2005 DATA 2,1,4
2006 DATA 2,3,6
2007 DATA 2,6,18
2008 DATA 3,1,5
2009 DATA 3,2,6
2010 DATA 3,4,8
2011 DATA 3,7,30
2012 DATA 3,8,25
2013 DATA 4,1,7
2014 DATA 4,3,2
2015 DATA 4,9,16
2016 DATA 5,1,8
2017 DATA 5,7,22
2018 DATA 5,9,14
2019 DATA 6,2,8
2020 DATA 6,3,3
2021 DATA 6,7,3
2022 DATA 6,10,4
2023 DATA 7,3=0
2024 DATA 7,6,5
2025 DATA 7,10,8
2026 DATA 7,11,5
2027 DATA 8,3,14
2028 DATA 8,9,3
    
```

2029 DATA 8,11,7
 2030 DATA 8,12,4
 2031 DATA 9,4,10
 2032 DATA 9,5,5
 2033 DATA 9,8,4
 2034 DATA 9,12,6
 2035 DATA 10,6,1
 2036 DATA 10,7,6
 2037 DATA 10,13,15
 2038 DATA 10,14,8
 2039 DATA 11,7>
 2040 DATA 11,12,1
 2041 DATA 11,13,10
 2042 DATA 11,15,12
 2043 DATA 12,8,4
 2044 DATA 12,9,9
 2045 DATA 12,11,8
 2046 DATA 12,14,7
 2047 DATA 13,10,8
 2048 DATA 13,11,9
 2049 DATA 13,15,3
 2050 DATA 14,10,2
 2051 DATA 14,12,3
 2052 DATA 14,15,4
 2053 DATA 15,11,22
 2054 DATA 15,13,22
 2055 DATA 15,14,22
 2056 DATA 15,15,0
 2023 DATA 7,3,10
 2039 DATA 11,7,2

RUN
MAXFLO

THE CHAIN CONNECT NODE 1 (SOURCE) AND NODE 15 (SINK):
 1 3 7 11 15
 FLOW = 5

THE CHAIN CONNECT NODE 1 (SOURCE) AND NODE 15 (SINK):
 1 3 8 11 15
 FLOW = 7

THE CHAIN CONNECT NODE 1 (SOURCE) AND NODE 15 (SINK):
 1 2 6 10 13 15
 FLOW = 3

THE CHAIN CONNECT NODE 1 (SOURCE) AND NODE 15 (SINK):
 1 2 6 10 14 15
 FLOW = 1

THE CHAIN CONNECT NODE 1 (SOURCE) AND NODE 15 (SINK):
 1 3 7 10 14 15
 FLOW = 3

THE OPTIMAL SOLUTION AS FOLLOWS:

F(1, 2)= 4.00
 F(1, 3)= 15.00
 F(2, 6)= 4.00
 F(3, 7)= 8.00
 F(3, 8)= 7.00
 F(6, 10)= 4.00
 F(7, 10)= 3.00
 F(7, 11)= 5.00
 F(8, 11)= 7.00
 F(10, 13)= 3.00
 F(10, 14)= 4.00
 F(11, 15)= 12.00
 F(13, 15)= 3.00
 F(14, 15)= 4.00

THE MAXIMUM FLOW = 19

DONE

RUN

```

2000 DATA 10
2001 DATA 1,2,7
2002 DATA 1,3,8
2003 DATA 2,3,7
2004 DATA 2,4,8
2005 DATA 2,5,6
2006 DATA 3,5,6
2007 DATA 3,6,4
2008 DATA 4,5,2
2009 DATA 4,7,3
2010 DATA 4,8,3
2011 DATA 5,6,7
2012 DATA 5,7,2
2013 DATA 5,8,6
2014 DATA 6,8,9
2015 DATA 7,8,5
2016 DATA 7,10,9
2017 DATA 6,9,6
2018 DATA 8,9,8
2019 DATA 8,10,8
2020 DATA 9,10,8
2021 DATA 10,10,0

```

```

RUN
SHORTR

```

```

TYPE 1-FOR ONE WAY TRAFFIC (C(I,J)#C(J,I))
      2-FOR TWO WAY TRAFFIC (C(I,J)=C(J,I))

```

```

?1
AFTER 5 ITERATIONS, WE FOUND THE OPTIMAL SOLUTION AS FOLLOWS:

```

FROM	TO	DISTANCE
1	2	7.00
2	5	6.00
5	7	2.00
7	10	9.00

TOTAL DISTANCE = 24

```

DONE

```

```

RUN
SHORTR

```

```

TYPE 1-FOR ONE WAY TRAFFIC (C(I,J)#C(J,I))
      2-FOR TWO WAY TRAFFIC (C(I,J)=C(J,I))

```

```

?2
AFTER 9 ITERATIONS, WE FOUND THE OPTIMAL SOLUTION AS FOLLOWS:

```

FROM	TO	DISTANCE
1	2	7.00
2	5	6.00
5	7	2.00
7	10	9.00

TOTAL DISTANCE = 24

```

DONE

```

CONTRIBUTED PROGRAM **BASIC**

TITLE:	FIRST DIFFERENCES, PERCENT CHANGES, PERCENT DIFFERENCE	TIMDIF 36801
DESCRIPTION:	This program calculates first differences, percent changes, or percent differences for up to 1000 time periods. The average change, variance, standard deviation, and Durbin-Watson statistic are also calculated. Data may be entered through DATA statements or a data file.	
INSTRUCTIONS:	Enter data in DATA statements beginning at line 5000, or store data on a sequential file. When running, the program will ask the user to select various options.	
SPECIAL CONSIDERATIONS:	If file input is used, the data must be stored on a sequential file.	
ACKNOWLEDGEMENTS:	Larry Lazzarini De Paul University	

RUN

RUN
TIMDIF

DO YOU WANT INSTRUCTIONS(1=YES,0=NO)?1
 THIS PROGRAM READS IN A VECTOR OF VALUES (1000 ELEMENTS
 MAXIMUM) AND CALCULATES EITHER (1)FIRST DIFFERENCES,
 (2) PERCENTAGE CHANGES, OR (3) PERCENT DIFFERENCES,
 DEPENDING ON THE USER'S OPTION.
 ENTER DATA IN DATA STATEMENTS STARTING ON LINE 5000
 AS FOLLOWS:

5000 DATA N1,N2,N3,N4, ETC.

N1,N2,N3,N4, ETC. ARE THE VALUES. THIS PROGRAM WILL
 OPTIONALLY USE DATA FILE INPUT INSTEAD OF DATA STATEMENTS.

DONE

5000 DATA 59.22,54.74,17.57,20.45,65.64,71.22,19.06,60.27,38.12,75.26
 5010 DATA 38.2,63.35,10.21,13.18,78.57,93.89,97.26,95.13,66.81,26.84
 5020 DATA 22.18,99.84,67.22,92.37,92.38,88.35,31.96,26.08,71.6,95.51
 5030 DATA 30.48,43.91,90.45,67.93,2.1,60.39,39.33,17.2,75.23,68.93
 5040 DATA 87.59,57.04,97.33,3.09,72.51,93.25,18.97,97.37,2.07,35.07
 5050 DATA 76.11,66.37,15.03,96.86,14.04,21.08,42.28,58.71,46.96,41.06
 5060 DATA 13.02,54.76,46.82,21.13,49.69,58.08,55.2,11.55,95.28,30.73
 5070 DATA 11.99,70.18,16.81,7.81,94.65,45.6,28.78,84.26,61.72,9.79
 5080 DATA 80.18,73.12,94.39,59.18,49.1,4.08,29.88,2.81,88.32,30.93
 5090 DATA 80.4,56.34,65.96,16.82,31.3,60.68,44.71,65.95,12.37,44
 6000 END

RUN
TIMDIF

DO YOU WANT INSTRUCTIONS(1=YES,0=NO)?NO
 ??0
 1= DATA ON FILE, 0= DATA IN DATA STATEMENTS. WHICH ?0
 DO YOU WANT YOUR RAW DATA PRINTED(1=YES,0=NO) ?1
 # OF VALUES?100

ENTER THE NUMBER OF YOUR OPTION
 1 FOR 1ST DIFF., 2 FOR % CHANGES, 3 FOR % DIFF.
 ?1

RAW DATA:

59.22	54.74	17.57	20.45	65.64	71.22	19.06	60.27
38.12	75.26	38.20	63.35	10.21	13.18	78.57	93.89
97.26	95.13	66.81	26.84	22.18	99.84	67.22	92.37
92.38	88.35	81.96	26.08	71.60	95.51	30.48	43.91
90.45	67.93	2.10	60.39	39.33	17.20	75.23	68.93
87.59	57.04	97.33	3.09	72.51	93.25	18.97	97.37
2.07	35.07	76.11	66.37	15.03	96.86	14.04	21.08
42.28	58.71	46.96	41.06	13.02	54.76	46.82	21.13
49.69	58.08	55.20	11.55	95.28	30.73	11.99	70.18
16.81	7.81	94.65	45.60	28.78	84.26	61.72	9.79
80.18	73.12	94.39	59.18	49.10	4.08	29.88	2.81
88.32	30.93	80.40	56.34	65.96	16.82	31.30	60.68
44.71	65.95	12.37	44.00				

MEAN = 51.9959
 VARIANCE = 875.174
 STANDARD DEVIATION = 29.5833
 DURBIN-WATSON STATISTIC = 2.12907

TRANSFORMED DATA:

-4.48	-37.17	2.88	45.19	5.58	-52.16	41.21	-22.15
37.14	-37.06	25.15	-53.14	2.97	65.39	15.32	3.37
-2.13	-28.32	-39.97	-4.66	77.66	-32.62	25.15	0.01
-4.03	-6.39	-55.88	45.52	23.91	-65.03	13.43	46.54
-22.52	-65.83	58.29	-21.06	-22.13	58.03	-6.30	18.66
-30.55	40.29	-94.24	69.42	20.74	-74.28	78.40	-95.30
33.00	41.04	-9.74	-51.34	81.83	-82.82	7.04	21.20
16.43	-11.75	-5.90	-28.04	41.74	-7.94	-25.69	28.56
8.39	-2.88	-43.65	83.73	-64.55	-18.74	58.19	-53.37
-9.00	86.84	-49.05	-16.82	55.48	-22.54	-51.93	70.39
-7.06	21.27	-35.21	-10.08	-45.02	25.80	-27.07	85.51
-57.39	49.47	-24.06	9.62	-49.14	14.48	29.38	-15.97
21.24	-53.58	31.63					

MEAN = -.153737

VARIANCE = 1882.29

STANDARD DEVIATION = 43.3854

DURBIN-WATSON STATISTIC = 3.03707

ANOTHER OPTION (1=YES,0=NO) ? 1

ENTER THE NUMBER OF YOUR OPTION

1 FOR 1ST DIFF., 2 FOR % CHANGES, 3 FOR % DIFF.

? 2

RAW DATA:

59.22	54.74	17.57	20.45	65.64	71.22	19.06	60.27
38.12	75.26	38.20	63.35	10.21	13.18	78.57	93.89
97.26	95.13	66.81	26.84	22.18	99.84	67.22	92.37
92.38	88.35	81.96	26.08	71.60	95.51	30.48	43.91
90.45	67.93	2.10	60.39	39.33	17.20	75.23	68.93
87.59	57.04	97.33	3.09	72.51	93.25	18.97	97.37
2.07	35.07	76.11	66.37	15.03	96.86	14.04	21.08
42.28	58.71	46.96	41.06	13.02	54.76	46.82	21.13
49.69	58.08	55.20	11.55	95.28	30.73	11.99	70.18
16.81	7.81	94.65	45.60	28.78	84.26	61.72	9.79
80.18	73.12	94.39	59.18	49.10	4.08	29.88	2.81
88.32	30.93	80.40	56.34	65.96	16.82	31.30	60.68
44.71	65.95	12.37	44.00				

MEAN = 51.9959

VARIANCE = 875.174

STANDARD DEVIATION = 29.5833

DURBIN-WATSON STATISTIC = 2.12907

TRANSFORMED DATA:

92.43	32.10	116.39	320.98	108.50	26.76	316.21	63.25
197.43	50.76	165.84	16.12	129.09	596.13	119.50	103.59
97.81	70.23	40.17	82.64	450.14	67.33	137.41	100.01
95.64	92.77	31.82	274.54	133.39	31.91	144.06	205.99
75.10	3.09	2875.71	65.13	43.73	437.38	91.63	127.07
65.12	170.63	3.17	2346.60	128.60	20.34	513.28	2.13
1694.20	217.02	87.20	22.65	644.44	14.50	150.14	200.57
138.86	79.99	87.44	31.71	420.58	85.50	45.13	235.16
116.88	95.04	20.92	824.94	32.25	39.02	585.32	23.95
46.46	1211.91	48.18	63.11	292.77	73.25	15.86	819.00
91.19	129.09	62.70	82.97	8.31	732.35	9.40	3143.06
35.02	259.94	70.07	117.07	25.50	186.09	193.87	73.68
147.51	18.76	355.70					

MEAN = 259.454

VARIANCE = 270728.

STANDARD DEVIATION = 520.315

DURBIN-WATSON STATISTIC = 2.31805

ANOTHER OPTION (1=YES,0=NO) ? 1

ENTER THE NUMBER OF YOUR OPTION
 1 FOR 1ST DIFF., 2 FOR % CHANGES, 3 FOR % DIFF.
 ?3

RAW DATA:

59.22	54.74	17.57	20.45	65.64	71.22	19.06	60.27
38.12	75.26	38.20	63.35	10.21	13.18	78.57	93.89
97.26	95.13	66.81	26.84	22.18	99.84	67.22	92.37
92.38	88.35	81.96	26.08	71.60	95.51	30.48	43.91
90.45	67.93	2.10	60.39	39.33	17.20	75.23	63.93
87.59	57.04	97.33	3.09	72.51	93.25	18.97	97.37
2.07	35.07	76.11	66.37	15.03	96.86	14.04	21.08
42.28	58.71	46.96	41.06	13.02	54.76	46.82	21.13
49.69	58.08	55.20	11.55	95.28	30.73	11.99	70.18
16.81	7.81	94.65	45.60	28.78	84.26	61.72	9.79
80.18	73.12	94.39	59.18	49.10	4.08	29.88	2.81
88.32	30.93	80.40	56.34	65.96	16.82	31.30	60.68
44.71	65.95	12.37	44.00				

MEAN = 51.9959

VARIANCE = 875.174

STANDARD DEVIATION = 29.5833

DURBIN-WATSON STATISTIC = 2.12907

TRANSFORMED DATA:

-8.18	-211.55	14.08	68.85	7.83	-273.66	68.38	-58.11
49.35	-97.02	39.70	-520.47	22.53	83.23	16.32	3.46
-2.24	-42.39	-148.92	-21.01	77.78	-48.53	27.23	0.01
-4.56	-7.80	-214.26	63.58	25.03	-213.35	30.59	51.45
-33.15	-3134.76	96.52	-53.55	-128.66	77.14	-9.14	21.30
-53.56	41.40	-3049.84	95.74	22.24	-391.57	80.52	-4603.86
94.10	53.92	-14.68	-341.58	84.48	-589.89	33.40	50.14
27.99	-25.02	-14.37	-215.36	76.22	-16.96	-121.58	57.48
14.45	-5.22	-377.92	87.88	-210.06	-156.30	82.92	-317.49
-115.24	91.75	-107.57	-58.44	65.84	-36.52	-530.44	87.79
-9.66	22.53	-59.50	-20.53	-1103.43	86.35	-963.35	96.82
-185.55	61.53	-42.71	14.58	-292.15	46.26	48.42	-35.72
32.21	-433.14	71.89					

MEAN = -174.316

VARIANCE = 426472.

STANDARD DEVIATION = 653.048

DURBIN-WATSON STATISTIC = 2.24311

ANOTHER OPTION (1=YES,0=NO) ?0

DONE

TITLE:

TRANSPORTATION PROBLEM

DESCRIPTION:

This program provides optimal solutions to the transportation class of linear programs, and determines the cost of implementing the solution.

INSTRUCTIONS:

Enter data beginning in line 9000 as follows:

1. i, j i = number of rows; j = number of columns
2. a_1, a_2, \dots, a_i a_i = rim value for row i
3. b_1, b_2, \dots, b_j b_j = rim value for column j
4. $c_{11}, c_{12}, \dots, c_{1j}$
 $c_{21}, c_{22}, \dots, c_{2j}$ c_{ij} = elements of the cost/profit matrix,
 \vdots row by row
 \vdots
 $c_{i1}, c_{i2}, \dots, c_{ij}$

SPECIAL
CONSIDERATIONS:

The program is capable of handling either cost or profit matrices up to a maximum size of 20 x 20.

The rim requirements (sources and destinations) must be represented as integers.

This program is based on a restricted primal-dual algorithm described by Ford and Fulkerson in Management Science, 3, No. 1 (1956), pp. 24-32.

ACKNOWLEDGEMENTS:

Lynn W. Marples
University of Western Ontario, Canada

RUN

9000 DATA 3,3
9001 DATA 1,2,3
9002 DATA 3,2,1
9003 DATA 1,2,3, 6,4,2, 1,4,7

RUN
TRANSP

THE TRANSPORTATION PROBLEM

TYPE: +1 FOR COST MINIMIZATION
OR -1 FOR PROFIT MAXIMIZATION. WHICH?+1

OPTIMAL SOLUTION

0	1	0
0	1	1
3	0	0

OBJECTIVE FUNCTION = 11

DONE
RUN
TRANSP

THE TRANSPORTATION PROBLEM

TYPE: +1 FOR COST MINIMIZATION
OR -1 FOR PROFIT MAXIMIZATION. WHICH?-1

OPTIMAL SOLUTION

1	0	0
2	0	0
0	2	1

OBJECTIVE FUNCTION = 28

DONE

TITLE:	ANNUITY ANALYSIS
DESCRIPTION:	This program performs the calculations necessary for determining both payment and withdrawal annuities.
	See any standard textbook on annuities for the computational method.
INSTRUCTIONS:	To use this program, supply values for the variables as required by the problem.
	Variables are denoted as follows:
	N = Number of periods
	P = Original principal amount
	A = Total amount at end of n periods
	I = Interest rate per period, in percent
	R = Amount of payment/withdrawal each period
	For a payment annuity, you may give any three of N,A,I,R and find the fourth.
	For a withdrawal annuity, you give any three of N,P,I,R and find the fourth.
	For loan or mortgage, use the withdrawal annuity option.
	After each case, you may choose one of the following alternatives:
	1 = Another case, same unknown variable
	2 = Another case, different unknown
	3 = Another case, other type of annuity
	4 = Total interest paid over n periods
	5 = Table of withdrawals, principal, and interest
	6 = Stop the program
SPECIAL CONSIDERATIONS:	The answer does not account for any simple interest that might have been paid on deposits prior to the first compounding period.
ACKNOWLEDGEMENTS:	

RUN

GET-SANNUIT
 RUN
 ANNUIT

* ANNUITY *

THIS PROGRAM COMPUTES PAYMENT AND WITHDRAWAL ANNUITIES.

DEFINITION OF VARIABLES:

- N = NUMBER OF PERIODS
- A = AMOUNT LEFT AT END OF N PERIODS
- I = INTEREST IN PERCENT PER PERIOD
- R = AMOUNT OF PAYMENT PER PERIOD
- P = ORIGINAL PRINCIPAL AMOUNT

 WHICH ANNUITY TYPE (1=PAYMENT, 2=WITHDRAWAL)?2

WHICH VARIABLE IS UNKNOWN (1=N,2=P,3=I,4=R)?4

WHAT ARE N(INTEGER),P(\$),I(PCT)?10,1000,10

WITHDRAWAL EACH PERIOD = R = 162.746

 ANOTHER CASE? ENTER ONE OF THE FOLLOWING: 1)'1' FOR ANOTHER CASE, SAME TYPE; 2)'2' FOR ANOTHER CASE, DIFFERENT UNKNOWN; 3)'3' FOR ANOTHER CASE, OTHER TYPE OF ANNUITY; 4)'4' TO GET TOTAL INTEREST PAID OVER THE N PERIODS; 5)'5' FOR A TABLE OF WITHDRAWALS, PRINCIPAL, AND INTEREST; OR 6)'6' TO TERMINATE?5

PERIOD	PRINCIPAL	INTEREST	PRINC BAL	INT TO DATE
0			1000	
1	62.75	100	937.255	100
2	69.02	93.73	868.234	193.73
3	75.92	86.82	792.312	280.55
4	83.51	79.23	708.798	359.78
5	91.87	70.88	616.932	430.66
6	101.05	61.69	515.88	492.35
7	111.16	51.59	404.723	543.94
8	122.27	40.47	282.45	584.41
9	134.5	28.25	147.949	612.66
10.	147.95	14.79	0	627.455

 ANOTHER CASE? ENTER ONE OF THE FOLLOWING: 1)'1' FOR ANOTHER CASE, SAME TYPE; 2)'2' FOR ANOTHER CASE, DIFFERENT UNKNOWN; 3)'3' FOR ANOTHER CASE, OTHER TYPE OF ANNUITY; 4)'4' TO GET TOTAL INTEREST PAID OVER THE N PERIODS; 5)'5' FOR A TABLE OF WITHDRAWALS, PRINCIPAL, AND INTEREST; OR 6)'6' TO TERMINATE?6

DONE

CONTRIBUTED PROGRAM **BASIC**BALSHT
36075

TITLE: PROFORMA INCOME STATEMENT AND BALANCE SHEET

DESCRIPTION: BALSHT provides a listing of a simple proforma income statement and balance sheet.

INSTRUCTIONS: Data can be entered either from the teletype as it becomes necessary, or internally with Data-Statements. Your choice on the above option will be asked as the first question. Then enter, (either as data beginning in line 9900, or with INPUT Statements) the following values:

B1 = Base period sales total
 B2 = Base period net fixed assets
 B4 = Base period long-term debt remaining
 B5 = Base period total owners' equity
 B6 = Base period accumulated retained earnings
 S2 = Federal corporate tax rate on profit
 S3 = Promised period dividends
 R1 = Amount of cash the user wishes to hold after the base period
 R2 = Accounts/Receivable turnover
 R3 = Inventory turnover
 R6 = Accounts/Payable turnover (i.e., A/P as fraction of sales)

Then enter the next 24 values, in 6 groups of 4 (for the next 4 periods):

L(1,1 thru 4) = Estimated percentage growth in sales for next 4 periods
 L(2,1 thru 4) = Cost of goods sold as an estimated % of sales
 L(3,1 thru 4) = General selling & administrative expense as an estimated % of sales
 L(4,1 thru 4) = Estimated amount of fixed asset purchases
 L(5,1 thru 4) = Estimated amount of fixed assets retired
 L(6,1 thru 4) = Planned payments per quarter on debt

Enter all percentages as decimals less than 1.

ACKNOWLEDGEMENTS:

RUN

RUN
BALSHT

*** PROFORMA INCOME STATEMENT & BALANCE SHEET ***

THIS PROGRAM WILL PROVIDE A LISTING OF A SIMPLE PROFORMA INCOME STATEMENT AND BALANCE SHEET.

DO YOU WISH TO ENTER YOUR DATA FROM THE TELETYPE AS IT BECOMES NECESSARY, OR INTERNALLY WITH DATA-STATEMENTS? (ENTER 'T' OR 'D')?T

PLEASE ENTER THE FOLLOWING VALUES:

WHAT IS THE BASE PERIOD'S TOTAL SALES?50000

WHAT IS THE NET FIXED ASSETS FOR THE BASE PERIOD?450000

WHAT IS THE REMAINING LONG-TERM DEBT FOR THE BASE PERIOD?35000

WHAT IS THE TOTAL OWNER'S EQUITY FOR THE BASE PERIOD?800000

WHAT ARE THE RETAINED EARNINGS FOR THE BASE PERIOD?31000

WHAT IS THE FEDERAL CORPORATE TAX RATE?.48

WHAT IS THE QUARTERLY PROJECTED AMOUNT OF DIVIDENDS?8000

WHAT AMOUNT OF CASH WOULD YOU LIKE TO RETAIN FOR EACH QUARTER?30000

WHAT IS THE NORMAL ACCOUNTS/RECEIVABLE TURNOVER?2.25

WHAT IS THE NORMAL INVENTORY TURNOVER?1.50

WHAT PERCENTAGE OF SALES ARE THE ACCOUNTS/PAYABLE (I.E., A/P TRNOVR)?.20

NOW ENTER FOUR VALUES FOR EACH QUESTION. EACH VALUE APPLIES TO THE RESPECTIVE QUARTER:

ENTER THE ESTIMATED PERCENTAGE GROWTH IN SALES

? .10
?.10, .15, .20

ENTER THE COST OF GOODS SOLD AS AN ESTIMATED PERCENTAGE OF SALES

? .48, .49, .50, .51

ENTER THE GENERAL SELLING & ADMINISTRATIVE EXPENSE AS A PERCENT OF SALES

? .10, .12, .12, .12

ENTER THE ESTIMATED AMOUNT OF FIXED ASSET PURCHASES PER QUARTER

?2000, 5000, 5000, 1000

ENTER THE ESTIMATED AMOUNT OF FIXED ASSET RETIREMENTS PER QUARTER

?1000, 1000, 1000, 1000

ENTER THE PLANNED DEBT PAYMENTS PER QUARTER

?25000, 25000, 25000, 25000\
2500, 2500, 2500, 2500

DO YOU WISH A BALANCE SHEET ONLY (TYPE '1'); AN INCOME STATEMENT ONLY (TYPE '2'); OR BOTH (TYPE '3')?3

***** INCOME STATEMENT *****

	QTR #1	QTR #2	QTR #3	QTR #4
SALES	55000.	60500.	69575.	83490.
COST OF GOODS SOLD	26400	29645	34787.5	42579.9
GS AND A EXPENSES	5500	7260	8349	10018.8
PROFIT BEFORE TAX	23100	23595	26438.5	30891.3
FED. INCOME TAX	11088	11325.6	12690.5	14827.8
PROFIT AFTER TAX	12012	12269.4	13748.	16063.5
ANNUAL DIVIDENDS	8000	8000	8000	8000

*** BALANCE SHEET ***

	QTR #1	QTR #2	QTR #3	QTR #4
CASH	377489.	370485.	362829.	357852.
ACCOUNTS RECEIVABLE	24444.4	26888.9	30922.2	37106.7
INVENTORY	36666.7	40333.3	46383.3	55660.
TOTAL CURRENT ASSETS	438600.	437707.	440135.	450619.
NET FIXED ASSETS	451000.	455000.	459000.	459000.
TOTAL ASSETS	889600.	892707.	899135.	909619.
ACCOUNTS PAYABLE	11000	12100	13915	16698
ACCRUED TAXES	11088	11325.6	12690.5	14827.8
TOTAL CURRENT LIAB.	22088	23425.6	26605.5	31525.8
DEBT FINANCING	32500	30000	27500	25000
EQUITY	800000.	800000.	800000.	800000.
RETAINED EARNINGS .	35012.	39281.4	45029.4	53092.9
TOTAL LIABILITIES	889600.	892707.	899135.	909619.

DONE

TITLE:

BOND PRICE ANALYSIS

DESCRIPTION:

BNDPRC computes the price and accrued interest for a bond, given its coupon, redemption price, yield, and maturity life.

INSTRUCTIONS:

Self-explanatory

ACKNOWLEDGEMENTS:

RUN

RUN
BNDPRC

BOND PRICE

SETTLEMENT DATE (MO, DAY, YR)?1, 1, 1970
MATURITY DATE (MO, DAY, YR)?4, 1, 1987
ANNUAL COUPON(%)?3.7
DESIRED YIELD(%)?5.5
TOTAL NUMBER OF BONDS?95

THE PRICE OF THE BOND IS : \$ 801.027

THE ACCRUED INTEREST IS : \$ 9.25

THE TOTAL BOND PRICE IS : \$ 76976.3

DONE

CONTRIBUTED PROGRAM **BASIC**BNDSWH
36077**TITLE:**

BOND SWITCH ANALYSIS

DESCRIPTION:

BNDSWH calculates the effect of a bond switch, and provides a sensitivity analysis on various input.

INSTRUCTIONS:

In all output provided, there are three columns of data. This is for the purpose of comparison. The left-most column is for the results if the old bond is kept until the terminal date, and then sold. The middle column is for the results if the old bond is sold now, and the net revenue on its sale is immediately reinvested in the same bond. The last column is for the results if the old bond is sold now, and the net revenue on its sale is immediately reinvested on the new bond, which is held to the terminal date and then sold.

The following input information is necessary: (This can be entered as data-statements beginning in line 9900, or directly with input-statements. The first question will ask you to indicate your choice of method.)

B1 = book value of old bond

P1 = price of old bond

C1 = coupon on old bond

M1,M3 = maturity on old bond in years, months

R1 = proceeds on redemption of old bond

T1 = tax rate on old bond interest payments

P2 = price of new bond

C2 = coupon on new bond

M2,M4 = maturity on new bond in years, months

R2 = proceeds on redemption of new bond

T2 = tax rate on new bond interest payments

S1,S2 = years, months to terminal date

Y3 = predicted yield on old bond to terminal date

Y4 = predicted yield on new bond to terminal date

T3,T4 = capital loss rate now, capital gains rate now

T5,T6 = capital loss rate at terminal date, capital gains rate then

D3 = capital gains rate at maturity of old bond

D4 = capital gains rate at maturity of new bond

Y9 = after-tax reinvestment rate on coupons

**SPECIAL
CONSIDERATIONS:**

There is a storage problem with BNDSWH. If using input-statements, delete lines 9900-9998 and run. If using data-statements, delete lines 9024-9108 and run.

Terminal data must be ≤ 5 years hence. Otherwise change line 9074, and dimension of A in line 9114 to $2 * S1 + S2/6 + 2$.

Increment on yield spread and yields must be such that no more than 10 partitions are used. To increase, change line 9279 or line 9302 and make dimension of A in line 9114 $(Z5-Z4)/Z6$.

ACKNOWLEDGEMENTS:

RUN
 GET-\$BND SH-WH
 RUN
 BND SWH

* BOND SWITCH *

THIS PROGRAM CALCULATES THE EFFECT OF A BOND SWITCH.

DO YOU WISH TO ENTER YOUR DATA FROM THE TELETYPE AS IT BECOMES NECESSARY, OR INTERNALLY WITH DATA-STATEMENTS? (ENTER 'T' OR 'D')?T

WHAT IS THE BOOK VALUE OF THE OLD BOND?90
 WHAT IS THE PRICE OF THE OLD BOND?100
 COUPON ON OLD BOND?5
 MATURITY ON OLD BOND IN YEARS, MONTHS?3,6
 PROCEEDS ON REDEMPTION OF OLD BOND?120
 TAX RATE ON OLD BOND INTEREST PAYMENTS?.45

WHAT IS THE PRICE OF THE NEW BOND?80
 COUPON ON NEW BOND?7.50
 MATURITY ON NEW BOND IN YEARS, MONTHS?5,0
 PROCEEDS ON REDEMPTION OF NEW BOND?115
 TAX RATE ON NEW BOND INTEREST PAYMENTS?.45

 HOW MANY YEARS, MONTHS TO TERMINAL DATE?4.0
 PREDICTED YIELD ON OLD BOND TO TERMINAL DATE?.25
 PREDICTED YIELD ON NEW BOND TO TERMINAL DATE?.30
 CAPITAL LOSS RATE NOW, CAPITAL GAINS RATE NOW?.15,.33
 CAPITAL LOSS RATE AT TERMINATION DATE, CAPITAL GAINS RATE THEN?.15,.33
 CAPITAL GAIN RATE AT MATURITY OF OLD BOND?.33
 CAPITAL GAIN RATE AT MATURITY OF NEW BOND?.33
 AFTER TAX REINVESTMENT RATE ON COUPONS?.055

ENTER THE NUMBER OF THE SENSITIVITY TABLE YOU PREFER:
 '0' TO TERMINATE PROGRAM
 '1' FOR TERMINAL DATE SENSITIVITY
 '2' FOR YIELD SPREAD SENSITIVITY
 '3' FOR YIELDS SENSITIVITY
 '4' FOR NO TABLES, FINAL VALUES

?1

SENSITIVITY OF YIELD AND TERMINAL VALUE TO TERM. DATE IN YEARS HENCE.

TERM. DATE (IN YEARS)	YIELD TO TERMINAL DATE	OLD BOND	TAX SW.	NEW BOND
.5		-52.39	-54.36	-76.03
1		-20.81	-22.16	-34.65
1.5		-8.7	-9.76	-17.82
2		-2.26	-3.14	-8.65
2.5		1.18	1.03	-2.84
3		3.6	3.44	1.22
3.5		5.41	5.21	4.15
4		6.84	6.61	6.05
4.5		8.02	7.76	7.61
5		9.01	8.74	8.92

TERM. DATE (IN YEARS)	TERMINAL VALUE IN DOLLARS.	OLD BOND	TAX SW.	NEW BOND
.5		75.22	74.22	63.84
1		81.91	80.69	70.71
1.5		89.3	87.84	78.28
2		97.42	95.74	86.66
2.5		104.88	104.48	95.96
3		113.11	112.62	106.31
3.5		122.22	121.43	117.57
4		132.3	131.19	128.4
4.5		143.48	142	140.48
5		155.88	154	153.98

ENTER THE NUMBER OF THE SENSITIVITY TABLE YOU PREFER:

- '0' TO TERMINATE PROGRAM
- '1' FOR TERMINAL DATE SENSITIVITY
- '2' FOR YIELD SPREAD SENSITIVITY
- '3' FOR YIELDS SENSITIVITY
- '4' FOR NO TABLES, FINAL VALUES

?2

ENTER THE RANGE OF SPREADS YOU WISH TO CONSIDER. (NEW BOND YIELD TO OLD BOND YIELD AT TERMINAL DATE).
 ENTER THE HIGH SPREAD IN BASIS PTS., THE LOW SPREAD, & THE SENSITIVITY INCREMENT?-200,200,50

SENSITIVITY OF YIELD AND TERMINAL VALUE TO SPREAD AT TERMINAL DATE. (OLD BOND YIELD HELD CONSTANT).

SPREAD YIELD TO TERMINAL DATE
 (IN BASIS PTS.)

	OLD BOND	TAX SW.	NEW BOND
-200	6.84	6.61	7.06
-150	6.84	6.61	6.98
-100	6.84	6.61	6.91
-50	6.84	6.61	6.84
0	6.84	6.61	6.77
50	6.84	6.61	6.69
100	6.84	6.61	6.62
150	6.84	6.61	6.55
200	6.84	6.61	6.48

SPREAD TERMINAL VALUE IN DOLLARS.
 (IN BASIS PTS.)

	OLD BOND	TAX SW.	NEW BOND
-200	132.3	131.19	132.99
-150	132.3	131.19	132.65
-100	132.3	131.19	132.31
-50	132.3	131.19	131.97
0	132.3	131.19	131.64
50	132.3	131.19	131.3
100	132.3	131.19	130.97
150	132.3	131.19	130.64
200	132.3	131.19	130.32

ENTER THE NUMBER OF THE SENSITIVITY TABLE YOU PREFER:

- '0' TO TERMINATE PROGRAM
- '1' FOR TERMINAL DATE SENSITIVITY
- '2' FOR YIELD SPREAD SENSITIVITY
- '3' FOR YIELDS SENSITIVITY
- '4' FOR NO TABLES, FINAL VALUES

?3

ENTER THE RANGE OF OLD BOND YIELDS AT TERMINAL DATE
 INPUT HIGH YIELD, LOW YIELD, AND INCREMENT DESIRED?.35
 ?? .20, .025

SENSITIVITY OF YIELD AND TERMINAL VALUES TO YIELD AT TERMINAL DATE. (SPREAD HELD CONSTANT).

YIELD YIELD TO TERMINAL DATE
 (OLD BOND)

	OLD BOND	TAX SW.	NEW BOND
.2	6.43	6.2	6.77
.225	6.64	6.41	6.41
.25	6.84	6.61	6.05
.275	7.05	6.81	5.71
.3	7.26	7.01	5.37
.325	7.46	7.21	5.04
.35	7.66	7.41	4.71

YIELD (OLD BOND)	TERMINAL VALUE IN DOLLARS.		
	OLD BOND	TAX SW.	NEW BOND
.2	130.29	129.24	131.64
.225	131.3	130.22	129.99
.25	132.3	131.19	128.4
.275	133.31	132.16	126.86
.3	134.31	133.13	125.37
.325	135.32	134.1	123.92
.35	136.32	135.08	122.52

ENTER THE NUMBER OF THE SENSITIVITY TABLE YOU PREFER:

- '0' TO TERMINATE PROGRAM
- '1' FOR TERMINAL DATE SENSITIVITY
- '2' FOR YIELD SPREAD SENSITIVITY
- '3' FOR YIELDS SENSITIVITY
- '4' FOR NO TABLES, FINAL VALUES

?4

YIELD TO SALE DATE A/T IF OLD BOND KEPT: 6.843
YIELD TO SALE DATE A/T ON TAX SWITCH: 6.61
YIELD TO SALE DATE A/T ON SWITCH TO NEW BOND: 6.052

TERMINAL VALUE IF OLD BOND KEPT: \$ 263.28
TERMINAL VALUE OF TAX SWITCH : \$ 131.19
TERMINAL VALUE OF SWITCH TO NEW BOND: \$ 128.4

ENTER THE NUMBER OF THE SENSITIVITY TABLE YOU PREFER:

- '0' TO TERMINATE PROGRAM
- '1' FOR TERMINAL DATE SENSITIVITY
- '2' FOR YIELD SPREAD SENSITIVITY
- '3' FOR YIELDS SENSITIVITY
- '4' FOR NO TABLES, FINAL VALUES

?0

DONE

TITLE:

BOND YIELD ANALYSIS

DESCRIPTION:

BNDYLD computes after-tax yield to maturity of a bond, given its coupon, redemption price, maturity life, price, and the tax rates applied to interest and capital gains.

INSTRUCTIONS:

The user has the option to enter the input either with the teletype, or with data-statements.

If the user chooses to use the data-statement option, he should enter the following data beginning at line 9900:

C = amount in dollars of the annual coupon
R = redemption price
M1, M2 = maturity life (M1 = years, M2 = months)
P = price
T1 = tax rate applied to interest
T2 = tax rate applied to capital gains

**SPECIAL
CONSIDERATIONS:**

This program uses the Fisher Algorithm for determining the exact rate of return.

ACKNOWLEDGEMENTS:

RUN

RUN
BNDYLD

BOND YIELD

SETTLEMENT DATE (MO, DAY, YR)?1, 1, 1970
MATURITY DATE (MO, DAY, YR)?8, 1, 1993
ANNUAL COUPON(%)?4.1
BOND PRICE ?81.621946

THE BOND YIELD IS : 5.50025 %

DONE

BNKRSV
36079**TITLE:**

BANK RESERVE CALCULATIONS

DESCRIPTION:

BNKRSV calculates the required bank reserve, and the reserve position at the close of a given bank's business day.

INSTRUCTIONS:

Enter all values in dollars.

BNKRSV will require a number of input values. There is no data to enter as data-statements.

For a user familiar with the program, the following changes could be made to expedite the input routine:

```
9047 READ C,D,E,F,G,H,H1
9048 GOTO 9130
9201 READ J,J1,J2,K8,K1,K,L,M,N,O,P,P9
9203 GOTO 9340
```

and at 9900 enter the data for the above values.

The names of the above variables can easily be seen from the listing of BNKRSV from line 9060 to 9125 and 9215 to 9335.

ACKNOWLEDGEMENTS:

RUN
RUN

BNKRSV

* BANK RESERVE CALCULATIONS *

THIS PROGRAM CALCULATES THE REQUIRED BANK RESERVE, AND THE RESERVE POSITION AT THE CLOSE OF A GIVEN BANK'S BUSINESS DAY.
PLEASE ENTER THE FOLLOWING BALANCES AT THE CLOSE OF BUSINESS YESTERDAY:

DEMAND DEPOSITS OF BANKS? 15000
U.S. GOVERNMENT DEMAND DEPOSITS?102000
OTHER DEMAND DEPOSITS?412000
CASH ITEMS IN PROCESS?11500
DEMAND DEPOSITS DUE FROM BANKS?18500
TIME DEPOSITS?10500
CURRENCY AND COIN?9500

THE REQUIRED RESERVE IS EQUAL TO \$ 50695.

WOULD YOU LIKE TO CALCULATE THE STATEMENT OF RESERVE POSITION?YES

PLEASE ENTER THE FOLLOWING AMOUNTS:

FEDERAL RESERVE BANK BALANCE YESTERDAY?65000
NUMBER OF DAYS REMAINING IN THE PERIOD?21
CUMULATIVE EXCESS OR DEFICIENCY(-) AS OF YESTERDAY?32000
FEDERAL FUNDS RATE (IN DECIMALS)?.115
COLLECTED FLOAT TO BE CREDITED TODAY?11000
CASH LETTER?2150
SECURITIES COLLECTED OR PURCHASED (-) BY THE FED?95000
CASH SHIPPED OR ORDERED (-)?30000
TRANSFERS IN OR OUT (-)?-12000
TREASURY TAX & LOAN CHARGE?150000-
OTHER CREDITS OR DEBITS(-)?9000
FUTURE TRANSACTIONS -CREDITS OR DEBITS(-)?-6500

*** STATEMENT OF RESERVE POSITION ***
21 DAYS REMAINING IN RESERVE PERIOD

RESERVE BALANCE AT THE CLOSE YESTERDAY		65000.
ADD COLLECTED FLOAT TO BE CREDITED TODAY		11000

	SUBTOTAL	76000.
LESS CASH LETTER		2150

	SUBTOTAL	73850.
SECURITIES COLLECTED OR PURCHASED(-)	95000.	
CASH SHIPPED OR ORDERED(-)	30000	
TRANSFERS IN OR OUT(-)	-12000	
TREASURY TAX & LOAN CHARGE	-15000	
OTHER CREDITS OR DEBITS(-)	9000	107000.

ESTIMATED RESERVE BALANCE AT CLOSE TODAY		180850.
LESS REQUIRED RESERVE		50695.

INDICATED RESERVE EXCESS OR DEFICIENCY		130155.
PRIOR CUMULATIVE EXCESS OR DEFICIENCY		32000

CUMMULATIVE EXCESS OR DEFICIENCY TO DATE		162155.
CUM EXCESS OR DEF AFTER FUTURE TRANSACTIONS		155655.
AVRG FOR DAYS REMAINING		7412.14

LEVEL OF DEMAND DEP	REQUIRED RESERVE	EXCESS OR DEFICIENCY	CUMULATIVE POSITION	FED FUNDS VALUE
-----	-----	-----	-----	-----
476100.	44347.	136503.	298658.	95405.
480900.	44923.	135927.	298082.	95221.
485700.	45499.	135351.	297506.	95037.

490500.	46075.	134775.	296930.	94853.
495300.	46651.	134199.	296354.	94669.
500100.	47227.	133623.	295778.	94485.
504900.	47803.	133047.	295202.	94301.
509700.	48379.	132471.	294626.	94117.
514500.	48955.	131895.	294050.	93933.
519300.	49531.	131319.	293474.	93749.
524100.	50107.	130743.	292898.	93565.
528900.	50683.	130167.	292322.	93381.
533700.	51259.	129591.	291746.	93197.
538500.	51835.	129015.	291170.	93013.
543300.	52411.	128439.	290594.	92829.
548100.	52987.	127863.	290018.	92645.
552900.	53563.	127287.	289442.	92461.
557700.	54139.	126711.	288866.	92277.
562500.	54715.	126135.	288290.	92093.
567300.	55291.	125559.	287714.	91909.
572100.	55867.	124983.	287138.	91725.
576900.	56443.	124407.	286562.	91541.
581700.	57019.	123831.	285986.	91357.

DONE

TITLE:

DEPARTMENTAL MANAGER'S BUDGETING PROGRAM

DESCRIPTION:

This program asks for projected controllable expenses for a six month period and produces an itemized budget summary table of all expenses for that period. Uncontrollable costs such as overhead, taxes and depreciation are calculated by the program and automatically included in this summary so that the user need only be concerned with controllable costs. The itemized budget summary is stored in a file as well as being printed so the data is easily available for additional processing as needed.

The projected controllable expenses that BUDGET requests are listed below:

- . Salaries
- . Printing and Reproduction
- . Operating Supplies
- . Equipment Costs
- . Demo and Loan Expense
- . Travel Expense
- . Means and Lodging
- . Other Expense
- . Advertising and Promotion

When all controllable expenses have been typed-in, BUDGET immediately begins printing the itemized budget summary. When this has been done, the program halts. BUDGET simplifies the budgeting task faced at least bi-annually by every department manager. It has two primary benefits:

- . It permits the manager to concentrate on controllable costs only; the program takes care of all uncontrollable expenses.
- . The manager can use the program to explore an entire series of alternate budgets when faced with cutting the total expense. Since the more laborious calculations are performed by the program, the manager is free to explore alternatives.

INSTRUCTIONS:

Load the Program.

Establish a File.

The BUDGET program uses one file which must be established before the program is run. Set up the file by typing the command below:

OPE-BFILE,6

Opening this file, simply allocates storage. The BUDGET program itself places data on file.

RUN

Information Needed by Budget (General)

- . Date
- . Location Code
- . Personnel Count
- . Salaries
- . Transfers in and out
- . % Salary increase in July
- . Printing & Reproduction
- . Operating Supplies
- . Equipment Costs
- . Demo & Loan Expense
- . Travel Expense
- . Meals & Lodging
- . Other Expense
- . Advertising and Promotion

Information Calculated by Budget

- . Total for each controllable expense item
- . Total operating Expense
- . Total controllable Expense
- . Payroll Taxes
- . Depreciation
- . Occupancy Costs
- . Freight Out
- . Overhead charges
- . Training Sold
- . Total Location (overall) Expense
- . Total Personnel Count

Information Saved by Budget

Budget places all the information found in the summary printout in a file. Each time the program is run, the old data is erased and replaced with the newly calculated data.

TITLE: DEPARTMENTAL MANAGER'S BUDGETING PROGRAM (cont.)

SPECIAL
CONSIDERATIONS:

<u>Message</u>	<u>Response/Explanation</u>
NON-EXISTENT FILE REQUESTED	OPEN FILE
MISSING OR PROTECTED FILE	OPEN FILE
READ ONLY FILE	Another system user has already gotten BUDGET and has priority access to the file. He must SCRATCH-BUDGET before you can write on the file.
END OF FILE/ END OF RECORD	FILE NOT LARGE ENOUGH. Type the commands below; then restart BUDGET from beginning. KIL-BFILE OPE-BFILE,6
BAD INPUT, RETYPE FROM ITEM 1	Data is of wrong type (letters instead of numbers). Retype correctly.
EXTRA INPUT, WARNING ONLY	Non-numeric characters (e.g. '\$', ',') were typed when only numbers were expected. Program does the best it can. Check budget summary to see particular value. May be necessary to re-run entire program.

ACKNOWLEDGEMENTS:

RUN

GET-BUDGET
 RUN
 BUDGET

HEWLETT-PACKARD
 DEPARTMENTAL BUDGET PROGRAM

TODAY'S DATE?NOVEMBER 12, 1970

LOCATION CODE?6733-89

TYPE PERSONNEL COUNT BY MONTH

?4

?4

?5

?5

?7

?8

TYPE 4 SALARIES FOR MAY

?490

?610

?900

?950

TYPE 1 SALARIES FOR MONTH 3 'S HIRES (MINUS FOR LOSSES)

?1000

TYPE 2 SALARIES FOR MONTH 5 'S HIRES (MINUS FOR LOSSES)

?800

?750

TYPE 1 SALARIES FOR MONTH 6 'S HIRES (MINUS FOR LOSSES)

?550

WHAT % SALARY INCREASE IN JULY (NORMAL IS 5.0)?5

WHAT % SALARY INCREASE IN OCTOBER (NORMAL IS 2.0)?2

TRANSFERS IN

?0

?0

?0

?0

?0

?0

?0

TRANSFERS OUT

?0

?0

?0

?0

?0

?0

PRINTING & REPRODUCTION

?1000

?800

?2300

?0

?910

?1190

OPERATING SUPPLIES

?250

?104

?125

?200

?245

?180

EQUIPMENT COSTS

?1500

?1400

?4500

?950

?3300

?2400

DEMO & LOAN EXPENSE

?450

?300

?225

?580

?125

?350

TRAVEL EXPENSE

?560

?400

?350

?605

?160
 ?350
 MEALS & LODGING
 ?360
 ?400
 ?250
 ?300
 ?150
 ?280
 OTHER EXPENSE
 ?105
 ?200
 ?50
 ?390
 ?0
 ?125
 ADVERTISING & PROMOTION
 ?0
 ?1300
 ?1090
 ?1100
 ?500
 ?0

 NOVEMBER 12, 1970

6733-89

LOCATION	TARGET	MAY	JUN	JUL	AUG	SEP	OCT	TOTAL
SALARIES		2950	2950	4097	4097	5647	6256	25997
PLUS TRANSFERS IN		0	0	0	0	0	0	0
LESS TRANSFERS OUT		0	0	0	0	0	0	0
NET SALARIES		2950	2950	4097	4097	5647	6256	25997
PRINTING & REPRO		1000	800	2300	0	910	1190	6200
OPERATING SUPPLIES		250	104	125	200	245	180	1104
EQUIPMENT COSTS		1500	1400	4500	950	3300	2400	14050
DEMO & LOAN COSTS		450	300	225	580	125	350	2030
TRAVEL EXPENSE		560	400	350	605	160	350	2425
MEALS & LODGING		360	400	250	300	150	280	1740
OTHER EXPENSE		105	200	50	390	0	125	870
TOTAL OPERATING EXPENSE		7175	6554	11897	7122	10537	11131	54416
ADVERTISING & PROMOTION		0	1300	1090	1100	500	0	3990
TOTAL CONTROLLABLE EXP		7175	7854	12987	8222	11037	11131	58406
PAYROLL TAXES		333	248	307	254	313	327	1782
DEPRECIATION		0	0	0	0	0	0	0
OCCUPANCY COSTS		320	320	400	400	560	640	2640
FREIGHT OUT		0	0	0	0	0	0	0
OVERHEAD CHARGES		0	0	0	0	0	0	0
TRAINING SOLD		0	0	0	0	0	0	0
TOTAL LOCATION EXPENSE		7828	8422	13694	8876	11910	12098	62828
PERSONNEL COUNT		4	4	5	5	7	8	33

 DONE

CONTRIBUTED PROGRAM **BASIC**CAPDCF
36825**TITLE:**

CAPITAL INVESTMENT ANALYSIS (DISCOUNTED CASH FLOW METHOD)

DESCRIPTION:

CAPDCF is a general purpose program intended to aid the financial manager in the evaluation of capital investment alternatives. Cash flows are determined and the rate of return is calculated using discounted cash flow analysis. An iterative technique is used to determine the rate of return rather than the trial and error technique.

INSTRUCTIONS:

The program can be run either interactively or from a set of data entered before running the program. The user inputs basic data concerning the investment and the associated cash flows. This includes such information as investment amount, tax rate, etc. Also the user enters information regarding the cash flows (referred to as earnings and expenses in the program). The user can enter normal and/or extraordinary cash flows. He can enter the specific cash flows or he can characterize them such as "rapid decline in early years", "straight line decline", etc. Depreciation information is also entered by the user.

Program Input

Input to the program whether it is from data statements or conversationally is the same information. An asterisk (*) indicates required information.

Basic Data

* Investment Amount	I1
* Investment Tax Credit	C1
* Salvage Value	S1
* Length of Life of Investment	L1
* Income Tax Rate	T1

Normal Earnings Data

Where

- 1 - Each is entered
- 2 - Uniform earnings
- 3 - Straight line decline
- 4 - Rapid decline in early years
- 5 - Rapid decline in later years

If earnings option = 1, earnings are entered for each period. If earnings option = 2 thru 5, enter the following:

Earnings Life in Periods	E2
Initial Earnings	E3
% of Initial Earning to be Final	E4

Extra Earnings Data

* Extra Earnings Option	E5
-------------------------	----

Where

- 1 - Extra earnings exist
- 0 - No extra earnings

If option = 1, the following

Number of Extra Earnings	E6
--------------------------	----

For 1 to E6

Period, Earnings	E7, A(E7)
------------------	-----------

(continued on next page)

ACKNOWLEDGEMENTS:

Ray McCarthy
HP/Automatic Measurements Division

Instructions: (Cont'd.)

Normal Expense Data

- * Expense Option X1
- Where
- 1 - Each is entered
- 2 - Uniform expenses
- 3 - Straight line decline
- 4 - Rapid decline in early years
- 5 - Rapid decline in later years
- 0 - No normal expenses

If expense option = 1, expenses for each period are entered. If expense option = 2 thru 5 enter the following:

- Expense Life in Periods X2
- Initial Expense X3
- % of Initial Expense to be Final X4

Extra Expense Data

- * Extra Expense Option X5
- Where
- 1 - Extra expenses exist
- 2 - No extra expenses

If option = 1, the following:

- Number of Extra Expenses X6
- For 1 to X6
- Period, Expense in Period X7, Y(X7)

Depreciation Data

- * Depreciation Option D1
- Where
- 1 - Each is entered
- 2 - Straight line
- 3 - Declining balance
- 4 - Sum of years digits

If depreciation option = 1, depreciation amounts for each period are entered. If depreciation option = 2 thru 4, enter the following:

- Percent of Investment Not to be Depreciated D2
- Number of Years to be Depreciate D3

SAMPLE INVESTMENT TO BE ANALYZED

A \$350,000 numerically controlled machine tool purchase is to be evaluated. The following is assumed:

- 7% investment tax credit
- 50% income tax rate
- 12 year depreciation period using the sum of the years digits' method
- \$100 per hour gross income when working
- 40% machine utilization
- Two shift operation, 6 days a week, 48 weeks a year
- \$6 per hour operator cost including fringe benefits
- \$250 per day for overhead (space maintenance, programming support, and tooling expense)
- \$25,000 major overhaul required every five years
- \$35,000 salvage value

Preliminary Calculations:

Estimated annual machine tool utilization:

$$\begin{array}{r}
 16 \text{ hrs/day} \\
 \times .4 \text{ utilization} \\
 \hline
 6.4 \text{ hrs/day} \\
 \times 6 \text{ days/week} \\
 \hline
 38.4 \text{ hrs/week} \\
 \times 48 \text{ weeks/yr} \\
 \hline
 1843 \text{ hrs/year}
 \end{array}$$

Instructions: (Cont.)

Estimated annual gross income:

1843 hrs/yr
x \$100 per hour
\$184,320

Estimated annual operating expenses:

16 operator hrs/day
x 6 days/week
96 hrs/week
x \$6 operator cost/hour
\$576 per week
x 48 weeks/yr
\$27,648 per year
+72,000 overhead/yr (\$250/day x 6 days x 48 weeks)
\$99,648 normal annual operating expense

Investment tax credit
\$350,000 purchase price
x .07 investment credit %
\$24,500

Extraordinary Expenses

YR 5 & 10 - \$25,000 (overhaul)

Extraordinary Earnings

YR 12 - \$35,000 (salvage value)

Depreciation

Sum of the years digit method

Included in this documentation are sample RUNs illustrating use of the program both by (1) entering DATA statements, and (2) entering data conversationally.

Change Option: Upon completion of a run, the user may optionally change some of the data from the previous run. This facility simplifies re-runs. A sample RUN illustrating this feature is also included.

Data Statement Format

nnn DATA I1, C1, S1, L1, T1
nnn DATA E1, E2, E3, E4

or

nnn DATA 1, E(1), E(2)E(L1)
nnn DATA 1, E6, E7(1), A(E7)(2), A(E7)E7(E6), A(E7)

or

nnn DATA 0
nnn DATA X1, X2, X3, X4

or

nnn DATA 1, X(1), X(2), X(L1)
nnn DATA 1, X6, X7(1), Y(X7), X7(2), Y(X7) X7(x6), Y(X7)

or

nnn DATA 0
nnn DATA D1, D2, D3

or

nnn DATA 1, D(1), D(2), D(L1)

Instructions: (Cont'd)Calculations FormulasEarnings

$$F = \text{Final Earnings} = (.01 E4) E3$$

Uniform

$$e_n = E3, N = 1, \dots, L1$$

Straight Line

$$e_n = E3 - \frac{(n-1)(E3-F)}{(E2-1)}, n = 1, \dots, E2$$

Rapid Decline in Early Years

$$e_1 = E3$$

$$e_n = e_{n-1} - \frac{2(E2-n+1)(E3-F)}{E2(E2-1)}, n=2, \dots, E2$$

Rapid Decline in Later Years

$$e_1 = E3$$

$$e_n = e_n - 1 - \frac{2(N-1)(E3-F)}{E2(E2-1)}, n=2, \dots, E2$$

Expenses

$$F = \text{Final Expenses} = (.01 \times 4) \times 3$$

Uniform

$$X_n = X3, N = 1, \dots, L1$$

Straight Line

$$X_n = X3 - \frac{(N-1)(X3-F)}{(X2-1)}, n = 1, \dots, X2$$

Rapid Decline in Early Years

$$X_1 = X3$$

$$X_n = X_{2-1} - \frac{2(X2-n+1)(X3-F)}{X2(X2-1)}, n=2, \dots, X2$$

Rapid Decline in Later Years

$$X_1 = X3$$

$$X_n = X_{n-1} - \frac{2(n-1)(X3-F)}{X2(X2-1)}, n=2, \dots, X2$$

Depreciation

$$D = \text{Depreciable Investment} = (I1-C1) (1- .01D2)$$

Straight Line

$$d_n = \frac{D}{D3}, n = 1, \dots, D3$$

Double Declining Balance

$$\left. \begin{aligned} d_n &= \frac{2D}{D3} \\ D &= D - d_n \end{aligned} \right\} n = 1, \dots, D3$$

Sum of the Years Digits

$$d_n = \frac{2D(D3-n+1)}{D3(D3+1)}, n=1, \dots, D3$$

NOTES: DATA statements numbers may be any number between 1 and 999. The time period used in the program must be consistent throughout. The product life length and cash flow inputs must be the same. The program converts to annual for return calculations.

RUN

10 DATA 350000.,24500,35000.,12,50
 20 DATA 2,0,184320.,0
 30 DATA 1,1,12,35000.
 40 DATA 2,0,99648.,0
 50 DATA 1,2,5,25000,10,25000
 60 DATA 4,0,12

RUN
 CAPDCF

CAPITAL INVESTMENT ANALYSIS

ENTER TIME PERIOD TO BE USED FOR CASH FLOWS AND LIFE:
 (1)ANNUAL, (2)SEMI-ANNUAL, (3)QUARTERLY, (4)MONTHLY?1

IS INPUT FROM (1)DATA STATEMENTS OR (2)CONVERSATIONALLY?1

RETURN ON INVESTMENT IS 13.9504 PERCENT (ANNUAL)

DO YOU WISH A COMPLETE REPORT?Y

CAPITAL INVESTMENT ANALYSIS

INVESTMENT COST	350000	SALVAGE VALUE	35000
INVESTMENT TAX CREDIT	24500	LIFE OF INVESTMENT	12 YEARS
NET INVESTMENT COST	325500	INCOME TAX RATE	50.00 PERCENT

PERIOD	NORMAL EARNINGS	EXTRA EARNINGS	NORMAL EXPENSES	EXTRA EXPENSES	BEFORE TAX CASH FLOW
1	184320	0	99648	0	84672
2	184320	0	99648	0	84672
3	184320	0	99648	0	84672
4	184320	0	99648	0	84672
5	184320	0	99648	25000	59672
6	184320	0	99648	0	84672
7	184320	0	99648	0	84672
8	184320	0	99648	0	84672
9	184320	0	99648	0	84672
10	184320	0	99648	25000	59672
11	184320	0	99648	0	84672
12	184320	35000	99648	0	119672

PERIOD	DEPRECIATION	TAXABLE INCOME	INCOME TAX	AFTER TAX CASH FLOW	DISCOUNTED CASH FLOW
1	48462	36210	18105	66567	58417
2	44423	40249	20124	64548	49710
3	40385	44287	22144	62528	42260
4	36346	48326	24163	60509	35889
5	32308	27364	13682	45990	23938
6	28269	56403	28201	56471	25795
7	24231	60441	30221	54451	21827
8	20192	64480	32240	52432	18445
9	16154	68518	34259	50413	15563
10	12115	47557	23778	35894	9724
11	8077	76595	38298	46374	11026
12	4038	115634	57817	61855	12906

TOTAL DISCOUNTED CASH FLOW 325500
 INITIAL INVESTMENT 325500
 NET PRESENT VALUE OF INVESTMENT 0

DO YOU WISH TO (1)QUIT, (2)ENTER NEW SET OF DATA, OR (3)CHANGE CURRENT ?1

DONE

RIJN
 CAPDCF

CAPITAL INVESTMENT ANALYSIS

ENTER TIME PERIOD TO BE USED FOR CASH FLOWS AND LIFE:
 (1)ANNUAL, (2)SEMI-ANNUAL, (3)QUARTERLY, (4)MONTHLY?1

IS INPUT FROM (1)DATA STATEMENTS OR (2)CONVERSATIONALLY?2

INVESTMENT AMOUNT?350000
 INVESTMENT TAX CREDIT AMOUNT?24500
 SALVAGE VALUE?35000
 LIFE OF INVESTMENT?12
 INCOME TAX RATE?50

EARNINGS OPTIONS:
 1-EARNINGS FOR EACH PERIOD ARE ENTERED
 2-UNIFORM EARNINGS
 3-STRAIGHT LINE DECLINE
 4-RAPID DECLINE IN EARLY YEARS
 5-RAPID DECLINE IN LATER YEARS
 6-EXIT

WHICH OPTION?2
 ENTER SINGLE EARNING AMOUNT?184320

ANY EXTRAORDINARY EARNINGS?YES
 ENTER THE NUMBER OF EXTRAORDINARY EARNINGS?1
 FOR EACH EARNING, ENTER PERIOD # AND AMOUNT
 EARNING # 1 ?12,35000

ANY NORMAL EXPENSES?YES
 EXPENSE OPTIONS:
 1-EXPENSES FOR EACH PERIOD ARE ENTERED
 2-UNIFORM EXPENSES
 3-STRAIGHT LINE DECLINE
 4-RAPID DECLINE IN EARLY YEARS
 5-RAPID DECLINE IN LATER YEARS
 6-EXIT

WHICH OPTION?2
 ENTER UNIFORM EXPENSE AMOUNT?99648

ANY EXTRAORDINARY EXPENSES?YES
 ENTER THE NUMBER OF EXTRAORDINARY EXPENSES?2
 FOR EACH EXPENSE, ENTER PERIOD # AND AMOUNT
 EXPENSE # 1 ?5,25000
 EXPENSE # 2 ?10,25000

DEPRECIATION OPTIONS;
 1-EACH IS ENTERED
 2-STRAIGHT LINE
 3-DECLINING BALANCE
 4-SUM OF YEARS DIGITS
 5-EXIT

WHICH OPTION?4
 ENTER % OF INVESTMENT NOT TO BE DEPRECIATED?0
 ENTER NUMBER OF YEARS TO DEPRECIATE?12

RETURN ON INVESTMENT IS 13.9504 PERCENT (ANNUAL)

DO YOU WISH A COMPLETE REPORT?NO

DO YOU WISH TO (1)QUIT, (2)ENTER NEW SET OF DATA, OR (3) CHANGE CURRENT
 ?1

DONE

10 DATA 350000.,24500,35000.,12,50
 20 DATA 2,0,184320.,0
 30 DATA 1,1,12,35000.
 40 DATA 4,12,200000.,10
 50 DATA 1,2,5,25000,10,25000
 60 DATA 4,0,12

RUN
 CAPDCF

CAPITAL INVESTMENT ANALYSIS

ENTER TIME PERIOD TO BE USED FOR CASH FLOWS AND LIFE:
 (1)ANNUAL, (2)SEMI-ANNUAL, (3)QUARTERLY, (4)MONTHLY?1

IS INPUT FROM (1)DATA STATEMENTS OR (2)CONVERSATIONALLY?1

RETURN ON INVESTMENT IS 12.2004 PERCENT (ANNUAL)

DO YOU WISH A COMPLETE REPORT?Y

CAPITAL INVESTMENT ANALYSIS

INVESTMENT COST	350000	SALVAGE VALUE	35000
INVESTMENT TAX CREDIT	24500	LIFE OF INVESTMENT	12 YEARS
NET INVESTMENT COST	325500	INCOME TAX RATE	50.00 PERCENT

PERIOD	NORMAL EARNINGS	EXTRA EARNINGS	NORMAL EXPENSES	EXTRA EXPENSES	BEFORE TAX CASH FLOW
1	184320	0	200000	0	-15680
2	184320	0	170000	0	14320
3	184320	0	142727	0	41593
4	184320	0	118182	0	66138
5	184320	0	96364	25000	62956
6	184320	0	77273	0	107047
7	184320	0	60909	0	123411
8	184320	0	47273	0	137047
9	184320	0	36364	0	147956
10	184320	0	28182	25000	131138
11	184320	0	22727	0	161593
12	184320	35000	20000	0	199320

PERIOD	DEPRECIATION	TAXABLE INCOME	INCOME TAX	AFTER TAX CASH FLOW	DISCOUNTED CASH FLOW
1	48462	-64142	-32071	16391	14608
2	44423	-30103	-15052	29372	23331
3	40385	1208	604	40989	29019
4	36346	29792	14896	51242	32333
5	32308	30649	15324	47632	26787
6	28269	78778	39389	67658	33912
7	24231	99180	49590	73821	32978
8	20192	116855	58427	78620	31302
9	16154	131802	65901	82055	29118
10	12115	119023	59511	71627	22653
11	8077	153516	76758	84835	23913
12	4038	195282	97641	101679	25545

TOTAL DISCOUNTED CASH FLOW 325500
 INITIAL INVESTMENT 325500
 NET PRESENT VALUE OF INVESTMENT 0

DO YOU WISH TO (1)QUIT, (2)ENTER NEW SET OF DATA, OR (3)CHANGE CURRENT ?3

CHANGE OPTIONS:

- 1-BASIC DATA
- 2-EARNINGS DATA
- 3-EXPENSE DATA
- 4-DEPRECIATION DATA
- 5-EXIT

WHICH CHANGE OPTION?3

CHANGE EXPENSE OPTIONS?Y

EXPENSE OPTIONS:

- 1-EXPENSES FOR EACH PERIOD ARE ENTERED
- 2-UNIFORM EXPENSES
- 3-STRAIGHT LINE DECLINE
- 4-RAPID DECLINE IN EARLY YEARS
- 5-RAPID DECLINE IN LATER YEARS
- 6-EXIT

WHICH OPTION?5

ENTER EXPENSE LIFE IN YEARS?12

INITIAL EXPENSE?200000

ENTER % OF INITIAL EXPENSE TO BE FINAL VALUE?10

CHANGE EXTRAORDINARY EXPENSES?N

ANY MORE CHANGES?N

RETURN ON INVESTMENT IS 3.8019 PERCENT (ANNUAL)

DO YOU WISH A COMPLETE REPORT?Y

CAPITAL INVESTMENT ANALYSIS

INVESTMENT COST	350000	SALVAGE VALUE	35000
INVESTMENT TAX CREDIT	24500	LIFE OF INVESTMENT	12 YEARS
NET INVESTMENT COST	325500	INCOME TAX RATE	50.00 PERCENT

PERIOD	NORMAL EARNINGS	EXTRA EARNINGS	NORMAL EXPENSES	EXTRA EXPENSES	BEFORE TAX CASH FLOW
1	184320	0	200000	0	-15680
2	184320	0	197273	0	-12953
3	184320	0	191818	0	-7498
4	184320	0	183636	0	684
5	184320	0	172727	25000	-13407
6	184320	0	159091	0	25229
7	184320	0	142727	0	41593
8	184320	0	123636	0	60684
9	184320	0	101818	0	82502
10	184320	0	77273	25000	82047
11	184320	0	50000	0	134320
12	184320	35000	20000	0	199320

PERIOD	DEPRECIATION	TAXABLE INCOME	INCOME TAX	AFTER TAX CASH FLOW	DISCOUNTED CASH FLOW
1	48462	-64142	-32071	16391	15790
2	44423	-57376	-28688	15735	14604
3	40385	-47883	-23941	16443	14702
4	36346	-35663	-17831	18515	15948
5	32308	-45715	-22857	9450	7842
6	28269	-3040	-1520	26749	21383
7	24231	17362	8681	32912	25346
8	20192	40491	20246	40438	30002
9	16154	66348	33174	49328	35257
10	12115	69932	34966	47081	32419
11	8077	126243	63122	71198	47229
12	4038	195282	97641	101679	64978

TOTAL DISCOUNTED CASH FLOW	325500
INITIAL INVESTMENT	325500
NET PRESENT VALUE OF INVESTMENT	0

DO YOU WISH TO (1)QUIT, (2)ENTER NEW SET OF DATA, OR (3)CHANGE CURRENT ?1

DONE

TITLE: CAPITAL INVESTMENT ANALYSIS

DESCRIPTION: CAPINV provides a listing of gross cash flow, annual depreciation, annual tax, net cash flow, and discounted cash flow, for a long-term capital investment.

INSTRUCTIONS: The user will be required to input the following values:

A1 = initial investment
A2 = number of cash flows
A(I) = for I = 1 to A2, the values for the cash flow
A3 = depreciable amount
A4 = depreciable life
A5 = salvage value
A6 = method of depreciation:

1. straight line
2. double-declining balance to straight line
3. sum-of-the-years digits

A7 = discount rate
A8 = tax rate

SPECIAL CONSIDERATIONS: 50 years of cash flows

ACKNOWLEDGEMENTS:

RUN

GET-\$CAPINV
 RUN
 CAPINV

* CAPITAL INVESTMENT ANALYSIS *

THIS PROGRAM PRINTS THE GROSS CASH FLOW, ANNUAL DEPRECIATION, ANNUAL TAX, NET CASH FLOW, AND DISCOUNTED CASH FLOW FOR A LONG-TERM CAPITAL INVESTMENT.

WHAT IS THE INITIAL INVESTMENT?25000

HOW MANY CASH FLOWS DO YOU WISH TO ENTER?10

ENTER 10 GROSS CASH FLOWS?2-3500,3000,3000,2750,2750,2500,2500,2000
 ??1750,1600

TYPE DEPRECIABLE AMOUNT, LIFE, AND SALVAGE VALUE?15000,12,8000

DEPRECIATION METHODS:

- 1. STRAIGHT LINE
- 2. DOUBLE DECLINING TO STRAIGHT LINE
- 3. SUM-OF-THE-YEARS DIGITS

ENTER NUMBER OF DEPRECIATION METHOD?2

ENTER DISCOUNT RATE AND TAX RATE?.333,.450

YEAR	GROSS CASH FLOW	ANNUAL DEPREC	ANNUAL TAX	NET CASH FLOW	DISCNTD CASH FLOW
1	3500	2500	450	3050	2288.07
2	3000	2083.33	412.5	2587.5	1456.2
3	3000	1736.11	568.75	2431.25	1026.45
4	2750	1446.76	586.458	2163.54	685.243
5	2750	1205.63	694.965	2055.04	488.28
6	2500	1004.69	672.888	1827.11	325.675
7	2500	837.245	748.24	1751.76	234.241
8	2000	697.704	586.033	1413.97	141.84
9	1750	581.42	525.861	1224.14	92.1212
10	1600	484.517	501.967	1098.03	61.9889
TOTAL	25350	12577.4	5747.66	19602.3	6800.11

DO YOU WISH ANOTHER RUN; 1=YES, 2=NO?2

DONE

TITLE:

CASH FLOW ANALYSIS

DESCRIPTION:

Program calculates:

1. Present value of up to 4 cash flows for a given cost of capital.
2. Implicit rate of return which equates the present value of the cash flow to zero.
3. Period in which the payback occurs if applicable.

INSTRUCTIONS:

You will be asked to type in:

1. Cost of capital in % per period.
2. Number of periods (less than 121).
3. Number of cash flows being considered.

**SPECIAL
CONSIDERATIONS:**

None

ACKNOWLEDGEMENTS:

RUN

RUN
CSHFL

WHAT IS THE ESTIMATED COST OF CAPITAL IN PERCENT?15
WHAT IS NUMBER OF PERIODS?5

HOW MANY FLOWS ARE BEING CONSIDERED,1,2,3,OR 4?4

ENTER CASH FLOWS, SEPARATE BY COMMAS,MINUS FOR OUTLAYS
FLOW 1,FLOW 2,FLOW 3,FLOW 4

PERIOD 0	INCOME? -100,-100,-100,-100
PERIOD 1	INCOME? 50,40,30,20
PERIOD 2	INCOME? 40,30,20,10
PERIOD 3	INCOME? 30,20,10,50
PERIOD 4	INCOME? 20,10,50,40
PERIOD 5	INCOME? 10,50,40,30

FLOW 1

PAYBACK FOR INITIAL INVESTMENT ON FLOW 1 IS IN PERIOD 4

PRESENT VALUE OF FLOW 1 IS 9.85631

RATE OF RETURN EQUATING P.V. OF FLOW TO ZERO IS 20.272 PERCENT

FLOW 2

PAYBACK FOR INITIAL INVESTMENT ON FLOW 2 IS IN PERIOD 5

PRESENT VALUE OF FLOW 2 IS 1.19359

RATE OF RETURN EQUATING P.V. OF FLOW TO ZERO IS 15.5199 PERCENT

FLOW 3

PRESENT VALUE OF FLOW 3 IS -3.7403

RATE OF RETURN EQUATING P.V. OF FLOW TO ZERO IS 13.5603 PERCENT

FLOW 4

PRESENT VALUE OF FLOW 4 IS -4.38605

RATE OF RETURN EQUATING P.V. OF FLOW TO ZERO IS 13.3588 PERCENT

DONE

CONTRIBUTED PROGRAM **BASIC****TITLE:**

CTC MANUFACTURING PARTS CONTROL

CTC1
36210**DESCRIPTION:**

These CTC Manufacturing Parts Control programs are part of a total accounting system written by Computer Terminal Corporation for the HP 2000A. (See A706-36213 CTC Payroll Program, A717-36212 CTC Projection Programs, A711-36214 CTC Accounts Receivable, and A708-36211 CTC Inventory Control for Finished Products.) Abstracts of the 23 manufacturing parts control programs are on the following page along with an index to the documentation.

INSTRUCTIONS:

Supplementary documentation is required. Order HP 36210, Option D00 for complete documentation.

**SPECIAL
CONSIDERATIONS:**

This package was written for a 2000A with a non-standard disc. The file structure has 200 physical records per file.

Teleprinter output is directed to a 132 column AB Dick printer.

Non-printing control characters direct the cursor on the HP 2600A CRT. (The characters are ignored by a standard teletype.)

These differences mean that the user will need to modify the software to run on a standard HP 2000A system. Although it will RUN without modification on an HP 2000C, its 64 word/record limitation makes inefficient use of the system.

ACKNOWLEDGEMENTS:

Jackie Shelton
Computer Terminal Corporation

INDEX TO MANUFACTURING PARTS CONTROL PROGRAMS

I. INTRODUCTION

- A. Brief Description of Programs
- B. File Structure
 - 1. Basic Data Files
 - 2. Sub-Assembly-Component File
 - 3. Multiple Pull File
 - 4. Transaction File
 - 5. Auxiliary File
 - 6. Scratch Files
- C. File Set Up Procedures

II. DETAILED INSTRUCTIONS TO PROGRAMS

- A. UPDTG Provides direct updating of (1) any entry within a part number, or (2) a particular entry for several part numbers. Under type (1) a display of all the information stored on the part number is given.
- B. UPDTQ Provides automatic on order or on hand updates including multiple pulls and returns for subassembly-component groups.
- C. MULFIL Creates a file which is used in doing a play multiple pull. 'X' sub-assemblies are entered with the quantity to be pulled. Each component part involved and the total quantity to be pulled is placed on this file.
- D. MULPRT This program uses the file created in program MULFIL to do a play multiple pull. It pretends to pull the quantity listed for each component part found on the play pull file. The print-out lists the part numbers, the on hand value before and after the pull, and flags the parts which are short. A listing of only those parts which are short can also be made.
- E. DELAD1 Provides deletion of a part number, addition of a part number, or the change of a part number on the file to another number not on the file.
- F. SUBDIS Provides a quick display of a subassembly with its component parts and the number of times each is used in the subassembly.
- G. CSTANL Calculates (1) the total cost of all parts on file: on hand, on order, (2) the total cost of 'A' items: on hand, on order, (3) the total cost of 'B' items: on hand, on order, (4) the total cost of 'C' items: on hand, on order, (5) the total maximum cost on hand, (6) the total minimum cost on hand, and various \$ usage values.
- H. UPDTSB Provides updating of the subassembly-component file which contains each subassembly and a list of its component parts.
- I. IPRT Provides formatted data of the entire inventory file.
- J. TPRT Provides formatted data of the whole transaction file or just the last five transactions made.
- K. FSUBP Provides formatted data of the subassembly-component file.
- L. OBSPRT Provides formatted data of obsolete parts (those having all usages as zero).
- M. CATPRT Gives three types of catalogues of the inventory files: (1) part number and description, (2) part number, description and standard cost, or (3) part number, description, standard cost, quantity on hand and cost on hand. The listing is in order of part number.
- N. MODGØ Allows for modification of the auxiliary file.
- O. AVE\$T Figures the total average dollar weekly usage for all parts and places this value on the auxiliary file. The value is used to figure the category and maximum and minimum values for each part number.
- P. USEPRD Prints all part numbers with their descriptions which are used in the specified product.
- Q. USECNT Prints (1) the total number of different parts used in each product and (2) the total usage of each product.
- R. COUNT Counts the number of parts in files G1 through G9 and figures the number of parts left available in each file.

INDEX TO MANUFACTURING PARTS CONTROL PROGRAMS

- S. CATSRT Prints part numbers belonging to a specified category (A, B, or C). Figures cost on hand for each part printed and totals the cost on hand for each category.
- T. PRDCST The program figures (1) the cost to build each product or (2) the cost of a specified subassembly.
- U. OHCLER This program allows the user to clear the on order value, the on hand value, or the usage of one of the 21 products for all parts on one of the data files (G1 - G9).
- V. TRA\$ This program lets the user input part numbers and quantities. This data is saved on a scratch file which has to be opened before the program is run. The data can be updated and a Transfer of \$ Amounts report printed.
- W. EXTCST With this program, the user can enter a part number and quantity and the program will return with the part description, standard cost, and extended cost (standard cost x quantity).

CONTRIBUTED PROGRAM **BASIC**

TITLE:	CTC INVENTORY CONTROL FOR FINISHED PRODUCTS	CTC2 36211
DESCRIPTION:	These CTC Inventory Control for Finished Products Programs are part of a total accounting system written by Computer Terminal Corporation for the HP 2000A. (See A706-36213 CTC Payroll Program, A708-36210 CTC Manufacturing Parts Control, A711-36214 CTC Accounts Receivable, A717-36212 CTC Projection Programs.) Abstracts of the 31 inventory control programs are on the following page along with an index to the documentation.	
INSTRUCTIONS:	Supplementary documentation is required. Order HP 36211, Option D00 for complete documentation.	
SPECIAL CONSIDERATIONS:	<p>This package was written for a 2000A with a non-standard disc. The file structure has 200 physical records per file.</p> <p>Teleprinter output is directed to a 132 column AB Dick printer.</p> <p>Non-printing control characters direct the cursor on the HP 2600A CRT. (The characters are ignored by a standard teletype.)</p> <p>These differences mean that the user will need to modify the software to run on a standard HP 2000A system. Although it will RUN without modification on an HP 2000C, its 64 word/record limitation makes inefficient use of the system.</p>	
ACKNOWLEDGEMENTS:	Jackie Shelton Computer Terminal Corporation	

INDEX TO INVENTORY CONTROL FOR FINISHED PRODUCTS

I. INTRODUCTION

- A. Brief Description of Programs
- B. File Structure
 - 1. Unit File
 - 2. Transaction File
 - 3. Customer Sort File

II. PROGRAM INSTRUCTIONS

- A. UPDTIC This program allows the user to add a new unit to the unit files or modify a unit already on the files. The user can delete a unit through the modification portion of the program. He can also view the information stored on a unit without making any changes.
- B. ICPRT This program provides formatted output of the unit files. The user can specify the beginning and ending units. He can also control the type of listing to be made by entering values for these ten variables: vendor #, transaction type, sales location, vendor # location, lease status, field service location, terms, salesman, agreement #, and tax rate.
- C. ICTPRT This program provides formatted output of the transaction file which keeps record of any changes made to the unit files.
- D. TASOLD This program provides formatted output of those units which are leases sold to Trans-America. The user can specify the customer number interval he wants printed.
- E. UPDTAQ This program allows the user to add several new units to the files at once. Their data items are the same except for product number, serial number, and the date.
- F. EXLSE This program provides formatted output of leases expiring 'X' days from the current date. The user specifies the unit interval over which the program is to search and the number of days to expiration. Sales location and lease status are variable also.
- G. OWNSUM This program summarizes the ownership of leased and sold units by product.
- H. UNTSUM This program is a summary of ownership by individual units (leased). It calculates the remaining life of the lease, the remaining rental billing and the remaining maintenance billing for each unit.
- I. STPRT User enters customer number unit locations (up to 50) to be printed for all products. All standard information is printed. User also specifies transaction, lease status and state name. He can determine the beginning and ending units to be searched also.
- J. UNTDIS User enters a product type and serial number and the program displays all standard information stored on the specified unit.
- K. CTCSUM The program is a summary of CTC individual leased units. A rental credit figure is calculated in addition to the information given in program UNTSUM (except invoice # and lease status). Totals are given at the end of each product.
- L. ISFPRT User specifies a certain number of sales locations or field service locations over which the program should search for units to be printed. It takes one pass over the files for each location entered (limit of 25), user also can specify the transaction of the units to be printed.
- M. SALPRT Print out of the unit files keyed on sales location. User enters the sales location he wants printed. A new page is started for each sales location. Customer name, transaction and lease status are in decoded form.
- N. SUMALL The program gives a summary count of all units for each product by transaction type.
- O. SUMFS The program summarizes the sold and leased units for each product by sales location. Total units and maintenance is given for each location.
- P. CUS1 The program prints the product number, serial number and transaction code of each unit on file which belongs to a user specified customer. The program can be used for only one customer per pass over the unit files.

INDEX TO INVENTORY CONTROL FOR FINISHED PRODUCTS

- Q. CUSSRT This program prints the units belonging to each customer on file. For each pass over the unit files, the units for 18 sequential customer numbers are found and printed, however, if a customer has over 352 units on file the program will abort. All information stored is printed for each unit found.
- R. ICCSRT This program sorts the units by customer number and agreement number. It sorts 20 customers at a time, placing the customer number and product/serial number of each unit belonging to the customer on the customer sort file. Several reports can be generated from this file.
- S. SALEXP Prints units expiring X days from the current date entered by sales location. The user enters the sales locations (up to 25) to be printed.
- T. ICTANL This program does an analysis on the transaction file. It finds each product/serial number on the file and prints the final status of the unit as found on the unit files.
- U. FREUNT Prints the units (product/serial number) which are provided for in the files but are not yet in use.
- V. AGETRA This program ages the date found on each unit on file. The user has the following options: unit interval to be searched and transaction type. If the transaction type equals 2, the user needs to specify whether the customer number of the unit should be equal to 9999 or not equal to 9999.
- W. INSTLS Prints by product/serial number, the leased units on file whose date falls between a beginning and ending date inclusive specified by the user.
- X. TAPAY Picks up all TA units which are not leases. Prints product, serial number, date and invoice number for each unit found. Columns for lease period, net amount, tax rate, extended tax and total are given to be filled in by user.
- Y. PRT22 This program searches the unit files to find all customers which have 2200 products which are in transit, sold, or leased. The program then sorts them into customer number order and prints their name/addresses (formatted for labels).
- Z. AALSES Prints an analysis of annual leases for account 2801-2802. It picks up only annual leases belonging to TA or CTC. Remaining life and revenue of the lease is also calculated and printed.
- Z-1. CBIPRT This program prints the cycle billing each month. The program prints invoices for each customer falling in an interval specified by the user. It picks up the leased units only from the customer sort file. Thus, that file must be up to date when the cycle billing is run.
- Z-2. ICMODQ This program allows the user to quickly update a particular data item of several units. The user picks the data item he wants to modify and enters the product/serial number and new value of each unit to be modified.
- Z-3. ICCPRT This program prints units by customer and agreement number as found on the customer sort file. The user can specify the transaction and lease status of the units to be printed.
- Z-4. NACBIL Prints the NAC leased units by customer as found on the customer/unit sort file.
- Z-5. EXLSEA Prints units expiring in X days by customer and agreement number as found on the customer/unit sort file.

III. APPENDIX

- A. General Procedures
- B. Serial Number Limits
- C. Data Entry Boundaries (Code Breakdown)

BUSINESS AND MANUFACTURING APPLICATIONS (700)
CONTRIBUTED PROGRAM **BASIC**

CTC3
36212

TITLE:

CTC PROJECTION PROGRAMS

DESCRIPTION:

These CTC Projection Programs are part of a total accounting system written by Computer Terminal Corporation for the HP 2000A. (See A706-36213 CTC Payroll Program, A708-36210 CTC Manufacturing Parts Control, A711-36214 CTC Accounts Receivable, and A708-36211 CTC Inventory Control for Finished Projects.) Abstracts of the 10 projection programs are on the following page along with an index to the documentation.

INSTRUCTIONS:

Supplementary documentation is required. Order HP 36212, Option D00 for complete documentation.

**SPECIAL
CONSIDERATIONS:**

This package was written for a 2000A with a non-standard disc. The file structure has 200 physical records per file.

Teleprinter output is directed to a 132 column AB Dick printer.

Non-printing control characters direct the cursor on the HP 2600A CRT. (The characters are ignored by a standard teletype.)

These differences mean that the user will need to modify the software to run on a standard HP 2000A system. Although it will RUN without modification on an HP 2000C, its 64 word/record limitation makes inefficient use of the system.

ACKNOWLEDGEMENTS:

Jackie Shelton
Computer Terminal Corporation

INDEX TO PROJECTION PROGRAMS

I. INTRODUCTION

- A. Brief Description of Programs
- B. File Structure
 - 1. Basic Input File (IN1)
 - 2. Intermediate File (IN2)
 - 3. Income Statement File (R1)
 - 4. Cash Flow File (R2)
 - 5. Balance Sheet File (R3)

II. DETAILED INSTRUCTIONS TO PROGRAMS

- A. INMAIN This program provides complete maintenance of the input file (IN2). The user can (1) create the input file, (2) modify any item of the input file, (3) obtain a listing of the input file, or (4) destroy the input file (set all values to zero).
- B. IN2CAL This program calculates the intermediate file (IN2).
- C. INST1 This program sets up the income statement file (R1). The user enters manual inputs needed which he can also modify. The user can indicate the month interval over which the program should calculate (1 to 48).
- D. R1PRT This program sets up the income statement. User indicates the projected year to be printed and if he wants the listing by month or quarter.
- E. PJPLAC The program shows the projected placement of each product by sale type; i.e., the number of units projected for each product. Totals are given at the end of each product. A separate listing of totals only is given at the end of the program.
- F. CSHFLO This program sets up the projected cash flow file (R2). Manual inputs for initial and monthly items are needed which can be modified also. User indicates the month interval to be set up (1 to 48).
- G. R2PRT This program prints the cash flow statement. User indicates the projected year to be printed and if he wants the listing by month or quarter.
- H. BSHEET This program sets up the balance sheet file (R3). User can enter and modify beginning balances. He also specifies the monthly interval (1 to 48) over which the file is to be set up.
- I. R3PRT This program prints the balance sheet. User indicates projected year to be printed and if he wants the listing by month or quarter.
- J. EXPROJ Allows the user to expand the data on the basic data file (IN1) and the monthly constants on the income statement file (R1) from a base year and month through year 4, month 12. This is done on a yearly % which eliminates the user manually inputting each quantity and constant.

III. APPENDIX

- A. Sales Types and Abbreviations Used (Listed in Order Stored)
- B. Product Model Numbers (Listed in Order Stored)
- C. Description of Intermediate File Calculations
- D. Income Statement Format and Calculations
- E. Income Statement Constants
- F. Cash Flow Format and Calculations
- G. Cash Flow Constants
- H. Balance Sheet Format and Calculations
- I. Balance Sheet Constants

TITLE: CTC PAYROLL PROGRAMS

DESCRIPTION: These CTC Payroll Programs are part of a total accounting system written by Computer Terminal Corporation for the HP 2000A. (See A717-36212 CTC Projection Programs, A708-36210 CTC Manufacturing Parts Control, A711-36214 CTC Accounts Receivable, A708-36211 CTC Inventory Control for Finished Products.) Abstracts of the 34 payroll programs are on the following page along with an index to the documentation.

INSTRUCTIONS: Supplementary documentation is required. Order HP 36213, Option D00 for complete documentation.

SPECIAL CONSIDERATIONS: This package was written for a 2000A with a non-standard disc. The file structure has 200 physical records per file.

Teleprinter output is directed to a 132 column AB Dick printer.

Non-printing control characters direct the cursor on the HP 2600A CRT. (The characters are ignored by a standard teletype.)

These differences mean that the user will need to modify the software to run on a standard HP 2000A system. Although it will RUN without modification on an HP 2000C, its 64 word/record limitation makes inefficient use of the system.

ACKNOWLEDGEMENTS: Jackie Shelton
Computer Terminal Corporation

I. INTRODUCTION

- A. Brief Description of Each Program
- B. Description of File Structure
 - 1. Employee Data Base Files
 - 2. Employee Pay Records
 - 3. Payroll Transaction File
 - 4. Auxiliary File
 - 5. Commission/Adjustment File
 - 6. State/Department/Employee # Sort File
 - 7. Alphabetic Sort File
 - 8. Employee Earnings History Files

II. DETAILED DESCRIPTION OF EACH PROGRAM

- A. EADD Adds a new employee to the employee data base files. The employee number is assigned sequentially by the program beginning with number 1001.
- B. EMOD Modifies any item under the specified employee number in the employee data base files.
- C. EFPRT Provides formatted output of the employee data base files.
- D. ETPRT Provides formatted output of the payroll transaction file which keeps record of any changes made to the payroll files.
- E. ESRT1 Sorts the employee names into alphabetical order printing the employee numbers in that order on a separate file.
- F. ECAT Prints a cross reference employee catalogue. One listing prints the employee numbers in ascending order with their corresponding names; the other listing prints the employee names in alphabetical order with their corresponding numbers.
- G. PAYPER Allows entry of the bi-weekly payroll hours, commissions, or adjustments.
- H. PAYPRF Provides formatted output of the regular bi-weekly payroll hours entered with program PAYPER.
- I. PAYREC
 - 1. Allows the clearing of all employee accrued vacation or accrued sick hours in the current pay records.
 - 2. Allows the modification of any item of the current pay records (i.e., hours or earnings).
 - 3. Allows the initialization or modification of the accumulated quarter-to-date (QTD) and year-to-date (YTD) totals.
 - 4. Allows the clearing of all QTD, YTD, or both totals.
- J. CLRAJ Clears the commission/adjustment file. All information on the file is lost.
- K. C/APRF
 - 1. Gives a proof of commissions entered with program PAYPER. The F.I.C.A., Federal, Disability, and Net Pay is figured during this run. User indicates when commissions are to be added to the QTD and YTD totals.
 - 2. Gives a proof of adjustments entered with program PAYPER. User indicates when adjustments are to be made to the QTD and YTD totals.
- L. MODAJ Enables user to modify the commission and/or adjustments input with program PAYPER.
- M. ST/DPT Sorts all employee numbers on file into states and into departments within each state printing the state, department, and employee numbers on a file in that order.
- N. PAYFIG Figures the current earnings, F.I.C.A., and Federal tax for the current bi-weekly payroll. This information is stored in each employee's current pay record.
- O. CKREG Formatted print out of the information to be printed on the checks. Program assigns check numbers and adjustments, commissions and YTD totals are included in the listing. Department, state, and company totals are given for both adjustments and the current pay (regular and commissions). Current pay is not added to QTD and YTD totals with this program!!
- P. EMPCNT Counts the number of active employees in each state giving a listing of this count.
- Q. ACCPRT Prints the QTD and YTD accumulated totals for all employees on file.
- R. QTRLEG Prints the quarterly payroll tax ledger required at the end of each quarter with state and company totals.
- S. 941A Prints the 941A forms required at the end of each quarter with state and company totals.
- T. W2FORM Prints the W-2 Forms required at the end of each year.
- U. EMPLAB Prints (1) data base information of specified employee on labels, or (2) time card labels for all active, non-exempt employees.
- V. EDIT Prints the payroll calculation edit required after each bi-weekly payroll run.

(continued on next page)

II. DETAILED DESCRIPTION OF EACH PROGRAM (continued)

- W. CURADD Adds the payroll for the current period to the QTD and YTD totals. It also places in the employee earnings file each check amount, number, and date issued an employee that current pay period (regular check, adjustment check, and commission check). This should be run after the check register and before the checks are printed.
- X. EMPDEL Deletes employees from the payroll files. User can also instruct the program to pick up all the deleted employee numbers so they can be re-assigned to new employees with program EADD. This program should be run at the end of each year.
- Y. LABDIS Prints the labor distribution report required after each bi-weekly payroll run.
- Z. CKPRT Prints checks for either the regular payroll or the commissions.
- Z-1. WKCOMP Prints the workman's compensation distribution report required at the end of each bi-weekly payroll.
- Z-2. ERNHIS The program provides 3 user options: (1) a complete earnings history for each employee on file, (2) an earnings history for one particular employee only, or (3) to clear the earnings history files for a new quarter.
- Z-3. SALREV This is a special report which prints the information stored in the data base files which pertains to each employee's salary. User enters the department numbers of those he wants printed.
- Z-4. VACSIC The user has 2 options: (1) to add the monthly accrued vacation and sick hours to each employee's pay records, or (2) to deduct the vacation and sick hours earned during the current pay period from the accrued vacation and sick hours.
- Z-5. VSPRT This program gives formatted output by state and department of each employee's accrued vacation and sick hours. State and company totals are given also.
- Z-6. INTVS Allows user to quickly initialize the vacation or sick accrued hours of specified employees.
- Z-7. CKA/C Prints a check register on commissions and adjustments only.

III. APPENDIX

- A. General Procedures
- B. Bi-Weekly Payroll Procedures
- C. Quarterly Procedures
- D. Yearly Procedures
- E. List of State Codes and Corresponding Cut-offs
- F. Department Codes

BUSINESS AND MANUFACTURING APPLICATIONS (700)

CONTRIBUTED PROGRAM **BASIC**

TITLE:	CTC ACCOUNTS RECEIVABLE	CTC5 36214
DESCRIPTION:	These CTC Accounts Receivable programs are part of a total accounting system written by Computer Terminal Corporation for the HP 2000A. (See A717-36212 CTC Projection Programs, A706-36213 CTC Payroll Programs, A708-36210 CTC Manufacturing Parts Control, A708-36211 Inventory Control for Finished Products.) Abstracts of the 13 accounts receivable programs are on the following page along with an index to the documentation.	
INSTRUCTIONS:	Supplementary documentation is required. Order HP 36214, Option D00 for complete documentation.	
SPECIAL CONSIDERATIONS:	This package was written for a 2000A with a non-standard disc. The file structure has 200 physical records per file. Teleprinter output is directed to a 132 column AB Dick printer. Non-printing control characters direct the cursor on the HP 2600A CRT. (The characters are ignored by a standard teletype.) These differences mean that the user will need to modify the software to run on a standard HP 2000A system. Although it will RUN without modification on an HP 2000C, its 64 word/record limitation makes inefficient use of the system.	
ACKNOWLEDGEMENTS:	Jackie Shelton Computer Terminal Corporation	

INDEX TO ACCOUNTS RECEIVABLE

I. INTRODUCTION

- A. Brief Description of Programs
- B. File Structure
 - 1. Name File
 - 2. Invoice File
 - 3. Transaction File
 - 4. Alphabetic File
 - 5. Auxiliary File
 - 6. Accounting Distribution File
- C. File Set Up Procedures

II. DETAILED INSTRUCTIONS TO PROGRAMS

- A. INV Provides (1) entry of new invoices, credit invoices and payments or (2) modification of existing invoices under a specified customer number.
- B. CUSADR Allows user to add a new customer to the name/address file or modify the name/address of a customer already on file.
- C. NEWAGE Provides three types of formatted listings of the files: (1) an aged listing of CTC owned invoices only, (2) an aged listing of TA owned invoices only, and (3) an aged listing of all invoices on file. The user can obtain a listing of all customers, one customer, or just the grand total of the type of listing specified.
- D. CATLOG Provides the formatted output of two catalogues: (1) a customer number-name/address-listing and (2) a customer name/address-number alphabetical listing.
- E. SORT2 Sorts the name file into alphabetical order printing the customer numbers in that order on a separate file which is used in Program--CATLOG.
- F. NEWTRA Provides (1) formatted output of the entire accounting transaction file and (2) formatted output of just the LAST X transactions on file.
- G. ACCLEG Provides additional formatted output of the transaction file. It picks up only those transactions which are new invoices, credit invoices, payments or deletions made with Program--INV. Totals are given at the end of the listing to enable the user to check for data entry errors.
- H. AGETOP Ages the top X customers who have accounts more than 60 days over due. User specifies the top X he wants aged up to 50.
- I. AGEPG Ages a specified interval or group of customer numbers placing each customer's aging on a separate page with separate headings. No grand totals are given.
- J. AGE60 Ages invoices over 60 days old only. The program prints the aging in order of of customer number. Grand totals are given at the end.
- K. ARNLAB Prints customer names and addresses on mailing labels. The labels may be in order of customer number or alphabetically.
- L. ARINPT Allows the user to (1) input account data groups onto the account distribution file or (2) obtain a formatted listing of the account distribution file.
- M. ARSORT Sorts the account data groups on the account distribution file by account number or reference number. Only 350 groups can be sorted at one time.

TITLE: CTC ACCOUNTS PAYABLE CTC6
36638

DESCRIPTION: These CTC Accounts Payable programs are part of a total accounting system written by Computer Terminal Corporation, now named Datapoint Corporation. (See also A706-36213 CTC Payroll Program, A717-36212 CTC Projection Programs, A711-36214 CTC Accounts Receivable, A708-36211 CTC Inventory Control for Finished Products, and A708-36210 CTC Manufacturing Parts Control.) Abstracts of the 24 accounts payable programs are on the following page along with an index to the documentation.

INSTRUCTIONS: Supplementary documentation is required. Order HP 36638, Option D00 for complete documentation.

SPECIAL CONSIDERATIONS:

This package was written for a 2000A with a non-standard disc, but has been modified to run on a 2000F.

Teleprinter output may be directed to a 132 column AB Dick, or equivalent printer.

Non-printing control characters direct the cursor on the HP 2600A CRT. (The characters are ignored by a standard teletype.)

Programs APDTAP and APDSTP make use of a Datapoint 2200 Computer with cassette tape facilities. They are included in this package as an optional feature for any users who have this capability.

These differences mean that the user will need to modify the software to run on a standard HP 2000A system. Although it will RUN without modification on an HP 2000C, or 2000C'/F, its 64 word/record limitation makes inefficient use of the system.

ACKNOWLEDGEMENTS: Jackie Shelton
Datapoint Corporation

INDEX TO ACCOUNTS PAYABLE PROGRAMS

I. INTRODUCTION

- A. Brief Description of Programs
- B. File Structure
 - 1. Name/Address File
 - 2. Daily Input File
 - 3. Checks Held File
 - 4. Check History File
 - 5. Auxillary Data and Name Sort File
 - 6. Scratch Files
- C. File Set Up Procedures

II. Detailed Program Instructions

- A. APNAME This program allows the user to enter new vendors into the name/address file or modify the name/address of a vendor already on file.
- B. APNSRT This program sorts the vendor names into alphabetical order printing the vendor numbers in that order on the auxiliary data and sort file.
- C. APNCAT With this program, the user can obtain (1) a formatted catalogue of vendor number order or alphabetically; or (2) a list of all vendor numbers not in use.
- D. APCHIS This program prints the check history of all vendors who have one. User specifies the vendor number interval to be printed.
- E. APCHPT This program allows the user to obtain (1) a quick display of all checks in the checks held file for a particular vendor or (2) a formatted print out of the checks held by vendor type and vendor number or (3) a grand total only of check amounts on the file.
- F. APINPT/
APIPRT This program allows the user to input invoices for vendors on file, modify invoices already on the input file, print the input file (in order of entry), or clear all data from the input file. (Chains to APIPRT)
- G. APCKRG This program prints the check register. Auto checks (checks printed by the computer) are listed first with a total amount at the end. Hand written checks follow with a total amount also. A total of both auto and hand checks is given at the end. The check numbers are assigned to each invoice with Program--APCKAS. When that program is finished, it automatically runs APCKRG. However, APCKRG can be run alone if the check numbers have been assigned.
- H. APCKPT
APCK1 This program prints the auto checks found on the check register. Proper check forms need to be loaded into the printer. The two programs have slightly different formatting.
- I. APDIST This program prints an account distribution determined from the account numbers of the invoices on the input file. Totals for each account number and a grand total are also given.
- J. APADCH This program adds each check found on the check register to the checks held file. This should be run only after a correct check register has been obtained.
- K. APPERG This program allows the user to delete checks from the checks held file. The user indicates if the checks to be deleted are voided or released and then enters the checks he wants purged. The program deletes the checks from the checks held file and adds them to the check history file if there is an appropriate history.
- L. APCKAS This program assigns auto check numbers to the invoices on the input file. When all check numbers have been assigned, the program will go on to print the check register (Program--APCKRG).
- M. APCH#P This program prints the checks held file in check number order.
- N. APDTAP/
APDSTP This program prints an account distribution as in program APDIST. However, at the end of the distribution report, APDTAP chains to APDSTP which prints an 80 character string (general ledger entry) for each account number, grand total, and batch total of the distribution on a cassette tape in the front deck of a 2200 version II machine.
- O. APNLAB This program prints vendor name/addresses on tab labels in vendor number or alphabetical order, or prints a group of user specified vendor numbers.
- P. APCHAG This program provides the user with an aging of the checks held file in order of vendor number.
- Q. APCHGA This program ages the checks held file as in program APCHAG but prints the grand totals only.
- R. APAGV/
APAGVP A combination of these two programs will provide the user with an aging of the checks held file as in APCHAG; however, this aging is sorted by vendor type also.

- S. APAGPG Ages the checks held file by vendor placing each vendor on a separate page. The user may specify an interval or group of vendor numbers he wishes to be aged.
- T. CTC6 This program may be used to initialize the files. Just GET and RUN CTC6 to perform the initialization.

CONTRIBUTED PROGRAM **BASIC**DEPCOM
36082**TITLE:**

DEPRECIATION METHOD COMPARISON

DESCRIPTION:

This program computes and prints the monthly depreciation of a given investment by four methods: straight line, double declining balance, sum-of-the-year's-digits, and 150% declining balance, and provides an output for easy, direct comparison.

INSTRUCTIONS:

After RUN, DEPCOM is mostly self-explanatory.

If the user is familiar with the program, and would rather use READ statements than INPUT statements, alter the program as follows:

```
9003 READ Z$,I1,S1,L1,A1,Z1,R,Y
```

```
9005 GOTO 9088
```

```
9900 DATA Y if yearly summary, N if not, investment salvage  
value, life, month, year of investment,  
rate of return, option indication.
```

**SPECIAL
CONSIDERATIONS:**

Depreciable life must be an integer greater than one and less than 76.
(To alter high value, change dimension statements for A,B,C,D,H,I,J,K
in lines 9112 and 9114, and check in line 9046.)

ACKNOWLEDGEMENTS:

RUN

GET-\$DEPCOM
 RUN
 DEPCOM

** DEPRECIATION METHOD COMPARISON **

THIS PROGRAM COMPUTES AND PRINTS DEPRECIATION BY MONTHS BY FOUR METHODS: STRAIGHT LINE, DOUBLE DECLINING BALANCE, SUM-OF-THE-YEARS-DIGITS, AND 150 PERCENT DECLINING BALANCE.

IF ONLY A YEARLY SUMMARY IS DESIRED TYPE Y, OTHERWISE N.
 ?N

WHAT IS THE AMOUNT OF YOUR INVESTMENT??35000

WHAT IS THE SALVAGE VALUE??15000

WHAT IS THE DEPRECIABLE LIFE (IN YEARS)??5

IN WHICH MONTH, AND IN WHICH YEAR, IS YOUR INVESTMENT MADE?
 (PLEASE ENTER AS MM,19YY)?7,1969

WHAT IS THE DISCOUNT RATE (IN DECIMAL NOTATION) FOR COMPUTING THE PRESENT VALUE OF THE ANNUAL DEPRECIATION??0.15

YOU HAVE THE OPTION TO SWITCHOVER FROM THE DOUBLE DECLINING BALANCE METHOD TO THE STRAIGHTLINE METHOD AT APPROPRIATE TIMES. TO PREVENT ANY SWITCHOVER PLEASE TYPE 0. TO SPECIFY A SPECIFIC YEAR OF SWITCHOVER, PLEASE TYPE THE YEAR. TO OBTAIN AN AUTOMATIC SWITCHOVER WHEN THE ANNUAL STRAIGHTLINE DEPRECIATION BECOMES GREATER THAN THE DOUBLE DECLINING BALANCE VALUE, PLEASE TYPE 1.?1

DATE	STRAIGHTLINE	DBL DECLINING	SUM-OF-THE	150% DECLINING
YR MO	BALANCE	BALANCE	YEARS'-DIGITS	BALANCE
1969 1	0	0	0	0
1969 2	0	0	0	0
1969 3	0	0	0	0
1969 4	0	0	0	0
1969 5	0	0	0	0
1969 6	0	0	0	0
1969 7	0	0	0	0
1969 8	333.333	666.667	555.556	500
1969 9	333.333	666.667	555.556	500
1969 10	333.333	666.667	555.556	500
1969 11	333.333	666.667	555.556	500
1969 12	333.333	666.667	555.556	500
TOTAL 1969	1666.67	3333.33	2777.78	2500
CUM DEPR	1666.67	3333.33	2777.78	2500
UNDEPR BAL	18333.3	16666.7	17222.2	17500

1970 1	333.333	666.667	555.556	500
1970 2	333.333	666.667	555.556	500
1970 3	333.333	666.667	555.556	500
1970 4	333.333	666.667	555.556	500
1970 5	333.333	666.667	555.556	500
1970 6	333.333	666.667	555.556	500
1970 7	333.333	666.667	555.556	500
1970 8	333.333	400	444.444	350
1970 9	333.333	400	444.444	350
1970 10	333.333	400	444.444	350
1970 11	333.333	400	444.444	350
1970 12	333.333	400	444.444	350
TOTAL 1970	4000.	6666.67	6111.11	5250
CUM DEPR	5666.67	10000	8888.89	7750
UNDEPR BAL	14333.3	10000	11111.1	12250

1971	1	333.333	400	444.444	350
1971	2	333.333	400	444.444	350
1971	3	333.333	400	444.444	350
1971	4	333.333	400	444.444	350
1971	5	333.333	400	444.444	350
1971	6	333.333	400	444.444	350
1971	7	333.333	400	444.444	350
1971	8	333.333	200	333.333	245
1971	9	333.333	200	333.333	245
1971	10	333.333	200	333.333	245
1971	11	333.333	200	333.333	245
1971	12	333.333	200	333.333	245
TOTAL 1971		4000.	3800	4777.78	3675
CUM DEPR		9666.67	13800	13666.7	11425
UNDEPR BAL		10333.3	6200	6333.33	8575

1972	1	333.333	200	333.333	245
1972	2	333.333	200	333.333	245
1972	3	333.333	200	333.333	245
1972	4	333.333	200	333.333	245
1972	5	333.333	200	333.333	245
1972	6	333.333	200	333.333	245
1972	7	333.333	200	333.333	245
1972	8	333.333	200	222.222	171.5
1972	9	333.333	200	222.222	171.5
1972	10	333.333	200	222.222	171.5
1972	11	333.333	200	222.222	171.5
1972	12	333.333	200	222.222	171.5
TOTAL 1972		4000.	2400	3444.44	2572.5
CUM DEPR		13666.7	16200	17111.1	13997.5
UNDEPR BAL		6333.33	3800	2888.89	6002.5

1973	1	333.333	200	222.222	171.5
1973	2	333.333	200	222.222	171.5
1973	3	333.333	200	222.222	171.5
1973	4	333.333	200	222.222	171.5
1973	5	333.333	200	222.222	171.5
1973	6	333.333	200	222.222	171.5
1973	7	333.333	200	222.222	171.5
1973	8	333.333	200	111.111	120.05
1973	9	333.333	200	111.111	120.05
1973	10	333.333	200	111.111	120.05
1973	11	333.333	200	111.111	120.05
1973	12	333.333	200	111.111	120.05
TOTAL 1973		4000.	2400	2111.11	1800.75
CUM DEPR		17666.7	18600	19222.2	15798.2
UNDEPR BAL		2333.33	1400	777.781	4201.75

1974	1	333.333	200	111.111	120.05
1974	2	333.333	200	111.111	120.05
1974	3	333.333	200	111.111	120.05
1974	4	333.333	200	111.111	120.05
1974	5	333.333	200	111.111	120.05
1974	6	333.333	200	111.111	120.05
1974	7	333.333	200	111.111	120.05
1974	8	0	0	0	0
1974	9	0	0	0	0
1974	10	0	0	0	0
1974	11	0	0	0	0
1974	12	0	0	0	0
TOTAL 1974		2333.33	1400	777.778	840.35
CUM DEPR		20000	20000	20000.	16638.6
UNDEPR BAL		0	0	0	3361.4

THE PRESENT VALUE OF THE DEPRECIATION AT THE BEGINNING OF 1969
AT .15 IS AS FOLLOWS:
13408.6 14729.5 14647.5 12219.2

DONE

CONTRIBUTED PROGRAM **BASIC**DROIPB
36179**TITLE:**

DISCOUNTED RETURN ON INVESTMENT AND PAYBACK

DESCRIPTION:

DROIPB is a BASIC language program for calculating Discounted Return on Investment and PayBack.

INSTRUCTIONS:

1. The program will first ask for INITIAL INVESTMENT, which you should enter without commas between thousands and hundreds (because commas are input delimiters), followed by carriage return. Then you will be asked to type in LIFE of the investment, which you should also follow by carriage return.
2. After initial investment and life, you will be asked for CAPITAL COST and DEPRECIABLE LIFE (YRS) in separate queries. The CAP COST query is repeated, allowing you to enter the total investment in smaller parts, each with its own depreciable life. When you've typed in the last CAP COST and DEPR LIFE you wish to enter, type a zero in response to the CAP COST query to continue with the remainder of the program.

NOTE: Do not enter a depreciable life greater than the useful LIFE typed in answer to the second query.

3. The program next lists three choices of depreciation method and 'asks' you which method you want to use in figuring return on investment and payback. For straight line depreciation, you would type in a '1', as in the Program Use Example. For double declining balance to straight line depreciation, you would type a '2', and for sum-of-years digits depreciation, you would type a '3'.
4. The next step is entry of cash flow figures for each year of the investment's useful LIFE. As with all the other queries, your answers must be followed by carriage return.
5. After you type in your answer to the TAX RATE %? query and carriage return, the program prints out interim calculations of depreciation, taxable income, taxes, and cash flow after tax. If you are using depreciation method 2 or 3, depreciation may be greater than first or even second year cash flow. When that is true, the DROIPB program lists a negative taxable income for the investment and adds the reduction in taxes to cash flow after taxes. When the investment is recovered, the program types out years to payback and rate or return, as shown in the example. If the investment is not recovered, the program tells you so, along with other information.

ACKNOWLEDGEMENTS:

Ted Proske
Hewlett-Packard/Automatic Measurements Division

RUN

RUN
DROIPB

* DISCOUNTED RETURN ON INV *

INIT INV \$:129876.80
LIFE (YRS):7
CAP COST \$:120200
DEPR LIFE (YRS):5
CAP COST \$:9676.7-80
DEPR LIFE (YRS):1
CAP COST \$:0

DEPR METHODS: 1. STRT LINE, 2. DBL DECL BAL TO STRT LINE,
3. SUM OF YRS DIGITS. *** USE METHOD NO.:1

CASH FLOW

YEAR 1 7125314.56
YEAR 2 7150377.47
YEAR 3 7169174.66
YEAR 4 7169174.66
YEAR 5 7169174.66
YEAR 6 7169174.66
YEAR 7 7169174.66

TAX RATE %52

CASH FLOW	DEPR	TAXABLE INCOME	TAXES	CASH FLOW AFTER TAX
125315.	33716.8	91597.8	47630.8	77683.7
150377.	24040	126337.	65695.5	84682.
169175.	24040	145135.	75470.	93704.6
169175.	24040	145135.	75470.	93704.6
169175.	24040	145135.	75470.	93704.6
169175.	0	169175.	87970.8	81203.8
169175.	0	169175.	87970.8	81203.8

YEARS TO PAY BACK = 1.61634
RATE OF RETURN = 62.8425 %

DONE

CONTRIBUTED PROGRAM **BASIC**EQUITY
36083**TITLE:**

COST OF EQUITY CAPITAL

DESCRIPTION:

EQUITY computes the cost of equity capital by computing the dividends and the share price for future periods, and finds the discount rate by equating the present value of the stream to the current share price.

INSTRUCTIONS:

The user must enter the following values:

- P = current price per share
- D(I) = current dividend per share
- N = number of growth segments (each segment is assumed to have a different growth rate, and may cover one or more periods).
- G(I) = for each segment the growth rate in decimal
- L(I) = for each segment the last period covered by the growth rate of that segment

**SPECIAL
CONSIDERATIONS:**

1. 20 growth segments, and 100 periods
To increase, change dim-statements in lines 9105 and 9110
2. 100 iterations on the search and compare routine

ACKNOWLEDGEMENTS:

RUN
GET-EQUITY
RUN
EQUITY

* COST OF EQUITY CAPITAL *

THIS PROGRAM WILL COMPUTE THE COST OF EQUITY CAPITAL BY COMPUTING DIVIDENDS AND THE SHARE PRICE FOR FUTURE PERIODS, (BASED ON THE GORDON MODEL), AND THEN FIND THE DISCOUNT RATE BY EQUATING THE PRESENT VALUE OF THE STREAM TO THE CURRENT SHARE PRICE.

PLEASE ENTER THE CURRENT PRICE/SHARE, AND DIVIDEND/SHARE?1 100,10

HOW MANY GROWTH SEGMENTS ARE THERE?8

FOR EACH GROWTH SEGMENT, ENTER THE GROWTH RATE IN DECIMAL, & THE LAST EFFECTIVE PERIOD FOR
STOP
RUN
EQUITY

* COST OF EQUITY CAPITAL *

THIS PROGRAM WILL COMPUTE THE COST OF EQUITY CAPITAL BY COMPUTING DIVIDENDS AND THE SHARE PRICE FOR FUTURE PERIODS, (BASED ON THE GORDON MODEL), AND THEN FIND THE DISCOUNT RATE BY EQUATING THE PRESENT VALUE OF THE STREAM TO THE CURRENT SHARE PRICE.

PLEASE ENTER THE CURRENT PRICE/SHARE, AND DIVIDEND/SHARE?100,10

HOW MANY GROWTH SEGMENTS ARE THERE?8

FOR EACH GROWTH SEGMENT, ENTER THE GROWTH RATE IN DECIMAL, & THE LAST EFFECTIVE PERIOD FOR EACH SEGMENT.

SEGMENT 1	? .02,2
SEGMENT 2	? .03,4
SEGMENT 3	? .04,6
SEGMENT 4	? .05,10
SEGMENT 5	? .06,12
SEGMENT 6	? .07,15
SEGMENT 7	? .08,20
SEGMENT 8	? .10,25

A SHARE PRICE OF \$ 100 , DIVIDEND OF \$ 10 , AND INITIAL GROWTH RATE OF 2 % , YIELD A COST OF EQUITY CAPITAL OF 15.74 PERCENT.

DO YOU WISH TO RUN SOME DIFFERENT DATA?
ENTER '0' FOR ALL NEW INFORMATION.
ENTER '1' FOR SAME SHARE PRICE & DIVIDEND, NEW GROWTH RATES OR PERIODS.
ENTER '2' FOR SAME GROWTH RATES & PERIODS, NEW SHARE PRICE OR DIVIDEND.
ENTER '3' TO TERMINATE. ?2

PLEASE ENTER THE CURRENT PRICE/SHARE, AND DIVIDEND/SHARE?100,5

A SHARE PRICE OF \$ 100 , DIVIDEND OF \$ 5 , AND INITIAL GROWTH RATE OF 2 % , YIELD A COST OF EQUITY CAPITAL OF 12.45 PERCENT.

DO YOU WISH TO RUN SOME DIFFERENT DATA?
ENTER '0' FOR ALL NEW INFORMATION.
ENTER '1' FOR SAME SHARE PRICE & DIVIDEND, NEW GROWTH RATES OR PERIODS.
ENTER '2' FOR SAME GROWTH RATES & PERIODS, NEW SHARE PRICE OR DIVIDEND.
ENTER '3' TO TERMINATE. ?3

DONE

TITLE:

EXTENDED RISK ANALYSIS

DESCRIPTION:

Dependent upon a number of estimates, EXDRSK performs an extended risk analysis, determining the advantages or disadvantages involved in making certain financial investments. The output is in the form of the average cash flows per future period, the expected payback period, the expected rate of return, and the probability of various rates of return.

INSTRUCTIONS:

In order to determine the potential risk involved in making a given investment, some estimates of expenditures are needed for future periods. Eight factors are considered:

1. Investment amount
2. Market Size (units)
3. Selling price/unit
4. Share of market
5. Variable costs (\$/unit)
6. Fixed cost (\$/period)
7. Useful life (periods)
8. Residual value

For each factor you will be asked to give 3 estimates. The first is the value which you think the factor has only one chance in ten of falling below -- that is, a low guess. The second estimate should be that which you believe to be the most likely. The third is that which you figure the factor has only one chance in ten of exceeding.

Thus the estimates should be typed: '*FACTOR X: low, most likely, high'.

ACKNOWLEDGEMENTS:

RUN

GET-EXDRSK
 RUN
 EXDRSK

* EXTENDED RISK ANALYSIS *

DEFINITION OF FACTORS

NUMBER	FACTOR
1	INVESTMENT
2	MARKET SIZE (UNITS)
3	SELLING PRICE PER UNIT
4	SHARE OF MARKET
5	VARIABLE COSTS (\$/UNIT)
6	FIXED COST (\$/PERIOD)
7	USEFUL LIFE (PERIODS)
8	RESIDUAL VALUE

IF PRICE, SALES AND OPERATING COSTS ARE INTERDEPENDENT
 TYPE 1; OTHERWISE, TYPE 0?1

DO YOU NEED INPUT INSTRUCTIONS? (Y OR N)?Y

FOR EACH FACTOR YOU WILL BE ASKED TO GIVE 3 ESTIMATES. THE FIRST IS THE VALUE WHICH YOU THINK THE FACTOR HAS ONLY ONE CHANCE IN TEN OF FALLING BELOW -- THAT IS, A LOW GUESS. THE SECOND ESTIMATE SHOULD BE THAT WHICH YOU BELIEVE TO BE THE MOST LIKELY. THE THIRD IS THAT WHICH YOU FIGURE THE FACTOR HAS ONLY ONE CHANCE IN TEN OF EXCEEDING.

THUS THE ESTIMATES SHOULD BE TYPED: '* FACTOR X: LOW,MOST LIKELY,HIGH'

ENTER ESTIMATES FOR:

* FACTOR 1 :

PERIOD 1	?6000,10000,13000
PERIOD 3	?10000,15000,18000
PERIOD 5	?1000,3000,5000
PERIOD 7	?0,1000,3000

* FACTOR 2 :

PERIOD 1	?0,0,0
PERIOD 3	?0,500,750
PERIOD 5	?500,3500,4000
PERIOD 7	?2000,5000,6500

* FACTOR 3 :

PERIOD 1	?0,0,0
PERIOD 3	?5,75,100
PERIOD 5	?50,50,50
PERIOD 7	?50,50,50

* FACTOR 4 :

PERIOD 1	?0,0,0
PERIOD 3	?05,.075,.10
PERIOD 5	?075,.10,.15
PERIOD 7	?10,.15,.25

* FACTOR 5 :

PERIOD 1	?50,75,100
PERIOD 3	?40,70,90
PERIOD 5	?30,40,50
PERIOD 7	?20,25,30

* FACTOR 6 :

PERIOD 1	?1000,1500,2000
PERIOD 3	?1000,1500,2000
PERIOD 5	?500,750,1000
PERIOD 7	?450,700,850

* FACTOR 7 : ?15,20,25

* FACTOR 8 : ?0,0,0

SIMULATION ITERATIONS FOLLOW. AFTER EACH INTERNAL ITERATION
 A '-' WILL BE PRINTED. USUALLY 20 ITERATIONS ARE NECESSARY.
 PLEASE BE PATIENT!

-
 -
 -

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-

AVERAGE CASH FLOWS -- 20 SIMULATIONS

PERIOD 1 -11010.1
 PERIOD 2 -1997.07
 PERIOD 3 -16100.5
 PERIOD 4 -1557.01
 PERIOD 5 -684.212
 PERIOD 6 10012.9
 PERIOD 7 25352.7
 PERIOD 8 23504.1
 PERIOD 9 21835.8
 PERIOD 10 22715.5
 PERIOD 11 24369.5
 PERIOD 12 29071.9
 PERIOD 13 21144.
 PERIOD 14 19676.4
 PERIOD 15 23934.7

EXPECTED PAYBACK PERIOD BETWEEN 1 AND 2 PERIODS.

EXPECTED RATE OF RETURN .29209

RATE OF RETURN PROBABILITY

-.15	0
-.1	0
-.05	0
0	0
.05	0
.1	0
.15	0
.2	0
.25	.15
.3	.85

TYPE 1 IF YOU WANT AVERAGE VALUES PRINTED FOR FACTORS 1-6; OTHERWISE 0?1

FACTOR AVERAGE VALUE PERIOD

1	9526.49	1
1	0	2
1	14255.5	3
1	0	4
1	3056.95	5
1	0	6
1	1487.59	7
1	1285.99	8
1	1140.59	9
1	1013.91	10
1	1621.54	11
1	1479.5	12
1	1193.32	13
1	1424.61	14
1	1361.03	15
2	0	1
2	248.333	2
2	469.456	3
2	1617.31	4

2	2448.23	5
2	3325.08	6
2	4856.89	7
2	4430.28	8
2	4264.9	9
2	4411.69	10
2	4721.97	11
2	5083.49	12
2	4412.26	13
2	4157.02	14
2	4758.68	15

3	0	1
3	29.5523	2
3	59.4255	3
3	52.0968	4
3	50	5
3	50	6
3	50	7
3	50	8
3	50	9
3	50	10
3	50	11
3	50	12
3	50	13
3	50	14
3	50	15

4	0	1
4	4.75013E-02	2
4	9.48336E-02	3
4	.119901	4
4	.137695	5
4	.185985	6
4	.229494	7
4	.226453	8
4	.227589	9
4	.21975	10
4	.229688	11
4	.231371	12
4	.222942	13
4	.211108	14
4	.227492	15

5	77.7686	1
5	70.9821	2
5	66.9793	3
5	50.8399	4
5	40.5705	5
5	32.5466	6
5	25.3845	7
5	24.455	8
5	25.2716	9
5	25.3307	10
5	25.204	11
5	23.1036	12
5	25.7729	13
5	25.0214	14
5	25.9379	15

6	1483.62	1
6	1525.26	2
6	1369.7	3
6	1091.37	4
6	761.521	5
6	761.268	6
6	682.592	7
6	650.594	8
6	616.5	9
6	646.957	10
6	668.708	11
6	685.373	12
6	696.134	13
6	648.356	14
6	693.68	15

DONE

TITLE:

BUDGET EXPENDITURES VS TARGETS MONITOR

DESCRIPTION:

This program can be used to create, update or list budgetary data. Expenditure vs targets can be continuously monitored. Up to 15 files can be handled, each with up to 20 accounts or major items. Each file represents one location code in the Hewlett-Packard accounting system, although a code for major programs, projects, etc., could easily be substituted. Under each location code the account numbers and/or major projects are listed, one per record. For each entry, the program lists the record number, name, dollars expended, and dollars targeted. For each location code, the program also lists the total targeted and total expended. NOTE: This program creates its own data base.

INSTRUCTIONS:

Load the program.

```
OPEN-FL1,20
OPEN-FL2,20
  ⋮
  ⋮
OPEN-FL15,20
OPEN-FL16,48
```

Before running the first time (or to clear all the files at the beginning of a new period) enter the following:

```
7 LET Z = 0
8 PRINT # 16, 16; Z
9 STOP
RUN
```

When the program stops, delete the three statements you executed. The purpose of this exercise is to ensure that all of the files have been cleared of old data.

Records can be any combination of account numbers and major items (projects). The example shown illustrates major items accumulated under account numbers; hence, the figures for the account numbers are in effect subtotals. Data could just as easily be listed the other way; i.e., with various account numbers subtalled under a major item. The program is self-instructional for generating, updating, and listing data.

**SPECIAL
CONSIDERATIONS:**

To prevent double entry of items when listing subtotals use minus signs (the program ignores all figures preceded by a minus sign).

ACKNOWLEDGEMENTS:

Jack Peters
HP, Data Systems Division

RUN

CRE-

OPE-FL1,20
 OPE-FL2,20
 OPE-FL3,20
 OPE-FL4,20
 OPE-FL5,20
 OPE-FL6,20
 OPE-\
 OPE-FL7,20
 OPE-FL8,20
 OPE-FL9,20
 OPE-FL10,20
 OPE-FL11,20
 OPE-FL12,20
 OPE-FL13,20
 OPE-FL14,,-20
 OPE-FL15,20
 OPE-FL16,48

7 LET Z=0
 8 PRINT #16,11-6;Z
 9 STOP

RUN
 EXPEND

DONE
 7
 8
 9

RUN
 EXPEND

DO YOU WISH INSTRUCTIONS?YES
 THIS PROGRAM CAN BE USED TO CREATE, UPDATE, OR LIST
 BUDGETARY DATA SO AS TO PERMIT CONTINUOUS MONITORING
 OF EXPENDITURES VS TARGETS. NOTE THAT THE PROGRAM CAN
 HANDLE UP TO 15 LOCATION CODES WITH 20 ACCOUNTS AND/
 OR MAJOR ITEMS PER LOCATION CODE.
 THE NAME OF EACH RECORD CAN BE UP TO 32 CHARACTERS
 INCLUDING SPACES. EACH RECORD ALSO INCLUDES \$
 EXPENDED AND \$ TARGETED (UP TO 8 DIGITS)
 DO YOU WISH TO 'GENERATE'NEW FILES(S), 'UPDATE'
 EXISTING FILES, OR 'LIST' DATA?
 ?GENERATE
 DO YOU NEED THE FILE NO. LIST?
 ?YES

FILE NO.	NAME
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0

THERE ARE 15 FILES AVAILABLE
 HOW MANY NEW FILES?1
 INPUT THE NUMBER OF AN AVAILABLE FILE?2
 INPUT NEW FILE NAME
 ?FLIP
 HOW MANY RECORDS (ONE PER ACCOUNT OR NAME) DO YOU REQUIRE?1
 INPUT YOUR BUDETARY DATA
 NAME OR ACCOUNT NUMBER

\$ EXPENDED
 \$ TARGETED
 ENTER RECORD NO. 1
 ?PRINTING
 ??1000
 ??3000
 ENTER DATE?7/25/73
 7/25/73

FINISHED?NO
 DO YOU WISH TO 'GENERATE'NEW FILES(S), 'UPDATE'
 EXISTING FILES, OR 'LIST' DATA?
 ?GENERATE
 DO YOU NEED THE FILE NO. LIST?
 ?YES

FILE NO.	NAME
1	FLIP
2	FLIP
3	0
4	0
5	0
6	0
7	0
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0

THERE ARE 14 FILES AVAILABLE
 HOW MANY NEW FILES?1
 INPUT THE NUMBER OF AN AVAILABLE FILE?3
 INPUT NEW FILE NAME

?FLIP1
 HOW MANY RECORDS (ONE PER ACCOUNT OR NAME) DO YOU REQUIRE?10
 INPUT YOUR BUDETARY DATA
 NAME OR ACCOUNT NUMBER

\$ EXPENDED
 \$ TARGETED
 ENTER RECORD NO. 1
 ?LABOR
 ??500
 ??400

ENTER RECORD NO. 2
 ?SHIPPING
 ??300
 ??350

ENTER RECORD NO. 3
 ?POSTAGE
 ??250

??300
 ENTER RECORD NO. 4
 ?ORDER PROCESSING
 ??600
 ??500

ENTER RECORD NO. 5
 ?TRAVEL
 ??1245
 ??500

ENTER RECORD NO. 6
 ?TRADE SHOWS
 ??0
 ??0

ENTER RECORD NO. 7
 ?CLERICAL
 ??279
 ??200

ENTER RECORD NO. 8
 ?FACILITIES
 ??2500
 ??2500

ENTER RECORD NO. 9
 ?MARKETING
 ??2990
 ??2000

ENTER RECORD NO. 10
 ?ADVERTISING
 ??350
 ??300
 ENTER DATE?7/27/73
 7/27/73

FINISHED?NO
 DO YOU WISH TO 'GENERATE'NEW FILES(S), 'UPDATE'
 EXISTING FILES, OR 'LIST' DATA?
 ?UPDATE
 DO YOU NEED THE FILE NO. LIST?
 ?NO
 INPUT THE NO. OF THE FILE TO BE CHANGED?1
 DO YOU WISH TO DELETE THIS FILE?NO
 DO YOU WANT DATA LISTED FOR THIS FILE?YES

DATA FOR FLIP TOTAL TARGETED \$ 3000

RECORD	NAME	EXPENDED	TARGETED
1	PRINTING	1000	3000

TOTAL EXPENDED \$ 1000
 DO YOU WISH TO UPDATE EXPENDITURES?N-YES
 INPUT RECORD NO.?1
 HOW MANY NEW EXPENDITURES?1
 NEXT EXPENDITURE ?1400
 MORE EXPENDITURES TO BE UPDATED?NO
 DO YOU WISH TO ADD RECORDS?NO
 DO YOU WISH TO CHANGE ANY OTHER RECORDS?NO
 DO YOU WISH TO CHANGE ANY OTHER FILE?NO
 ENTER DATE?7/27/73
 7/27/73

DO YOU WANT ANY LISTING?YES
 DO YOU WANT ALL FILES LISTED?YES
 7/27/73

DATA FOR FLIP TOTAL TARGETED \$ 3000

RECORD	NAME	EXPENDED	TARGETED
1	PRINTING	2400	3000

TOTAL EXPENDED \$ 2400

DATA FOR FLIP TOTAL TARGETED \$ 0

RECORD	NAME	EXPENDED	TARGETED
TOTAL EXPENDED \$ 0			

DATA FOR FLIP1 TOTAL TARGETED \$ 7050

RECORD	NAME	EXPENDED	TARGETED
1	LABOR	500	400
2	SHIPPING	300	350
3	POSTAGE	250	300
4	ORDER PROCESSING	600	500
5	TRAVEL	1245	500
6	TRADE SHOWS	0	0
7	CLERICAL	279	200
8	FACILITIES	2500	2500
9	MARKETING	2990	2000
10	ADVERTISING	350	300

TOTAL EXPENDED \$ 9014

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

DATA FOR 0 TOTAL TARGETED \$ 0

FINISHED?YES

DONE

TITLE:

EXPONENTIAL SMOOTHING ON PRICE DATA

DESCRIPTION:

EXSM00 uses exponential smoothing to forecast data which is thought to have a trend and/or seasonal effect. Output is provided per period as a comparison between different methods of smoothing.

S_t = Actual demand in month t

\bar{S}_t = Moving average of S_t after month t

a = Smoothing constant (0.1 - 0.2)

$S_t = C_1 + C_2 * t + C_3 * F_t + \text{error}$

C_1 is the average coefficient

C_2 is the trend coefficient

C_3 is the seasonal coefficient

INSTRUCTIONS:

$$\left. \begin{array}{l} \bar{S}_t = \bar{S}_{t-1} + a(S_t - \bar{S}_{t-1}) \\ \text{New estimate} = \text{Old estimate} + a(\text{Actual} - \text{Old estimate}) \end{array} \right\} \text{Straight}$$

$$\left. \begin{array}{l} \bar{S}_t = (S_t / (F_t - L)) + (1 - a) * \bar{S}_{t-1} \\ \text{where: } F_t = \beta(S_t / \bar{S}_t) + (1 - \beta) * (F_t - L) \text{ for next year} \\ L = \text{Number of periods in cycle} \end{array} \right\} \text{Seasonality}$$

INSTRUCTIONS:

You will be asked to input the following data:

N1 = The number of months (periods)

N2 = The number of periods to be used for the initialization of the forecasting methods

N3 = The number of periods in the periodicity of the seasonal effect

A1 = The smoothing constant a

Then the actual values for each period are to be entered. This can be done with input or data-statements.

To enter data internally, begin at line 9900 and enter the actual amounts for each period to be considered, and enter "D" in answer to the question on how the data is to be entered.

Also note that the number of periods in the seasonality must be less than the number of periods provided for the initialization of the forecasting methods.

SPECIAL
CONSIDERATIONS:

As it stands, EXSM00 will handle only up to 8 years (i.e., 72 periods) of forecasting. For enlargement change dim-statement 9116 to bounds of N1 + 2.

ACKNOWLEDGEMENTS:

RUN

GET-\$EXSM00

RUN

EXSM00

* EXPONENTIAL SMOOTHING *

DO YOU NEED A PROBLEM DESCRIPTION? ('Y' OR 'N') ?N

FOR HOW MANY PERIODS WILL YOU ENTER DATA?30

HOW MANY OF THESE PERIODS ARE TO BE USED TO INITIALIZE THE FORECASTING METHODS?12

WHAT IS THE PERIODICITY OF THE SEASONAL EFFECT? E.G. 12 FOR YEARLY.
NOTE: THIS VALUE MUST BE LESS THAN YOUR ANSWER TO THE PREVIOUS QUESTION.
?6

WHAT IS YOUR ALPHA FOR SMOOTHING FORECASTS?.10

WHAT IS THE ALPHA FOR SMOOTHING THE SEASONAL EFFECT?.20

WHAT IS THE ALPHA FOR THE TREND EFFECT?.15

DO YOU WISH TO ENTER YOUR DATA FROM THE TELETYPE, OR INTERNALLY WITH DATA-STATEMENTS? ('T' FOR TELETYPE, OTHERWISE 'D')?T

WHAT IS THE VALUE FOR THE FIRST PERIOD?100

SECOND PERIOD?75

NEXT?73

NEXT?72

NEXT?70

NEXT?60

NEXT?100

NEXT?90

NEXT?80

NEXT?70

NEXT?60

NEXT?50

NEXT?110

NEXT?50

NEXT?

DONE

RUN

EXSM00

* EXPONENTIAL SMOOTHING *

DO YOU NEED A PROBLEM DESCRIPTION? ('Y' OR 'N') ?N

FOR HOW MANY PERIODS WILL YOU ENTER DATA?30

HOW MANY OF THESE PERIODS ARE TO BE USED TO INITIALIZE THE FORECASTING METHODS?12

WHAT IS THE PERIODICITY OF THE SEASONAL EFFECT? E.G. 12 FOR YEARLY.
NOTE: THIS VALUE MUST BE LESS THAN YOUR ANSWER TO THE PREVIOUS QUESTION.
?6

WHAT IS YOUR ALPHA FOR SMOOTHING FORECASTS?.10

WHAT IS THE ALPHA FOR SMOOTHING THE SEASONAL EFFECT?.20

WHAT IS THE ALPHA FOR THE TREND EFFECT?.15

DO YOU WISH TO ENTER YOUR DATA FROM THE TELETYPE, OR INTERNALLY WITH DATA-STATEMENTS? ('T' FOR TELETYPE, OTHERWISE 'D')?T

WHAT IS THE VALUE FOR THE FIRST PERIOD?100
 SECOND PERIOD?75
 NEXT?73
 NEXT?72
 NEXT?70
 NEXT?60
 NEXT?100
 NEXT?90
 NEXT?80
 NEXT?70
 NEXT?60
 NEXT?50
 NEXT?110
 NEXT?99
 NEXT?85
 NEXT?80
 NEXT?75
 NEXT?70
 NEXT?105
 NEXT?100
 NEXT?95
 NEXT?90
 NEXT?85
 NEXT?80
 NEXT?110
 NEXT?100
 NEXT?75
 NEXT?70
 NEXT?65
 NEXT?60

PERIOD	SALES	EXPONENTIAL SMOOTHING WITH TREND AND SEASONALS	EXPONENTIAL SMOOTHING WITH TREND	EXPONENTIAL SMOOTHING WITH SEASONALS
13	110	99.9594	68.1002	98.8338
14	99	83.5456	78.074	77.6086
15	85	79.0011	83.4328	75.9716
16	80	74.0594	84.2659	74.0971
17	75	68.5953	83.6642	71.1631
18	70	58.9741	81.8989	61.2091
19	105	112.645	79.195	108.98
20	100	94.6555	85.7386	86.6389
21	95	87.2416	89.7833	81.6393
22	90	82.4296	91.7808	79.4361
23	85	77.0604	92.1072	76.3484
24	80	67.777	91.0753	67.093
25	110	124.38	88.9447	116.274
26	100	106.881	94.6806	95.4287
27	75	98.174	96.7984	89.123
28	70	89.6729	92.2166	83.532
29	65	80.919	87.2032	77.6849
30	60	69.2686	81.8599	67.2988

MEAN ABSOLUTE DEVIATION:	10.7023	14.9401	10.0792
THEIL'S 'U' SQUARED:	.356144	.839939	.308655

DONE

CONTRIBUTED PROGRAM **BASIC**

FINFLO
36711

TITLE:

CALCULATES PRESENT VALUE - STREAM OF CASH FLOWS

DESCRIPTION:

This program calculates the present value of a stream of cash flows. The assumption is made that the flows occur at the end of each of the periods after the initial period when the investment is made. Each period is defined as one year unless the cost of capital percentage and number of periods are adjusted accordingly. This program will calculate all rates of return between zero and one hundred percent which equate the P.V. to the initial investment.

INSTRUCTIONS:

Enter figures as requested in program.

ACKNOWLEDGEMENTS:

Babson College
Babson Park, Massachusetts

RUN

RUN
FINFLO

DO YOU WANT INSTRUCTIONS?YES

THIS PROGRAM CALCULATES THE PRESENT VALUE OF A STREAM OF CASH FLOWS. THE ASSUMPTION IS MADE THAT THE FLOWS OCCUR AT THE END OF EACH OF THE PERIODS AFTER THE INITIAL PERIOD WHEN THE INVESTMENT IS MADE. EACH PERIOD IS DEFINED AS ONE YEAR UNLESS THE COST OF CAPITAL PERCENTAGE AND NUMBER OF PERIODS ARE ADJUSTED ACCORDINGLY. THIS PROGRAM WILL CALCULATE ALL RATES OF RETURN BETWEEN ZERO AND ONE HUNDRED PERCENT WHICH EQUATE THE P.V. TO THE INITIAL INVESTMENT.

WHAT IS THE INITIAL INVESTMENT IN PERIOD 0?10000
THIS PROGRAM ASSUMES AN INITIAL OUTLAY FOR THE INVESTMENT
THE SIGN HAS BEEN CHANGED TO REFLECT THIS CONDITION
FOR HOW MANY PERIODS DO YOU WISH TO ENTER CASH FLOWS, PERIOD 1 ON?4

PERIOD #	CASH FLOW
*****	*****
1	?200
2	?4500
3	?6000
4	?5700

ENTER COST OF CAPITAL IN PERCENT?11

DO YOU WANT A LISTING OF THE P.V. IN EACH PERIOD?YES

PERIOD #	P.V.
*****	*****
1	180.18
2	3652.3
3	4387.15
4	3754.77

NET PRESENT VALUE OF ALL FLOWS IS \$ 1974.4

THE CALCULATED RATES OF RETURN BETWEEN 0% AND 100% ARE:
17.9799 %THE P.V. AT THIS RATE OF RETURN IS \$ 9998.12

DONE

TITLE:

RATING INVESTMENT FUNDS

DESCRIPTION:

This program performs an analysis of the type advocated by Treynor in "How to Rate Management of Investment Funds," (Harvard Business Review, January-February 1965). Basically, it fits a least-squares regression line to data on the quarterly rates of return for two entities. Possibilities include: mutual funds, individual stocks, indices of stock returns, and portfolios.

INSTRUCTIONS:

Three data bases can be used with the program. The GPDQI file gives price and dividend data on 98 industrial indices compiled by Standard and Poor's. The GPDQF file contains comparable information on 100 open-end mutual funds. The GPDQS file contains information on the 30 stocks used to compute Dow-Jones' 30 Industrial Stock Average. Any of these files may be invoked by simply responding appropriately when asked. The particular entry desired must be indicated by number. For listings, see the descriptions of the GPDQ files.

If the user chooses a portfolio for analysis, the program will read a file named PDQP in the user's own account. The user-specified number will indicate the record to be read by the program. The record must follow the format used in GPDQF, GPDQI and GPDQS.

The user may opt to have the treasury bill rate subtracted from each return before the remainder of the analysis is performed. This will provide an analysis of excess returns -- i.e., returns over and above the pure interest rate for the quarter in question.

Any period may be requested. The program will utilize only quarters for which the requisite data are available.

(continued on Page 2)

**SPECIAL
CONSIDERATIONS:**

Following a summary of relevant statistics and the information about the regression line, the program provides a scatter diagram of the results. An asterisk represents one point, the digit "2", two points, etc. An approximate regression line may be drawn from the letter "L" through the intersection of the two M's (as illustrated on the sample run).

The program also computes and prints the "differential return" for each quarter. This is the difference between the actual y-value and the product of the x-value and the slope of the regression line. A rough graphic plot is also provided. The asterisks may be connected to obtain a time-plot (as illustrated on the sample run).

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

INSTRUCTIONS: (continued)

GPDQF

GPDQF is a file of data on quarterly prices and dividends paid by 100 open-end mutual funds. The funds were chosen randomly from those for which data were readily available for the period 1965-1970. For each quarter, the following information is given:

"opening price"

- net asset value per share as of the close of the market on the last trading day of the previous quarter.

"dividends"

- all dividends received by an investor who held one share at the beginning of the quarter; any other distributions that qualify as income are also included.

"ending price"

- the total value of the holdings of an investor who held one share at the beginning of the quarter. This includes the net asset value of the share (or shares, in the case of splits) at the close of the market on the last trading day of the quarter. It also includes the value of any distributions received during the quarter that qualify as capital gains.

Each fund is allocated one record on the file. Fund number 1 is on record 1; fund number 2 on record 2, etc. Each record contains 40 quarters of information, as follows:

opening price	1st quarter of 1st year
dividends	1st quarter of 1st year
closing price	1st quarter of 1st year

opening price	2nd quarter of 1st year
dividends	2nd quarter of 1st year
closing price	2nd quarter of 1st year

etc.

Any missing value is represented by -999.

Following the 120 data values on each record are:

- the first year for which data are given (e.g. 1963)
- the name of the fund (up to 20 characters)

This file uses the same format as GPDQI and GPDQS. The funds are listed as follows:

- 1 ABERDEEN FUND
- 2 AFFILIATED FUND INC.
- 3 AMERICAN BUSINESS SHARES INC.
- 4 AMERICAN INVESTORS FUND INC.
- 5 AMERICAN MUTUAL FUND INC.
- 6 ANCHOR - FUNDAMENTAL INVESTORS
- 7 ANCHOR - GROWTH FUND
- 8 ASSOCIATED FUND TRUST
- 9 AXE-HOUGHTON FUND A INC.
- 10 AXE-HOUGHTON FUND B INC.
- 11 AXE-HOUGHTON STOCK FUND INC.
- 12 AXE SCIENCE CORP.
- 13 BOSTON FUND INC.
- 14 BROAD STREET INVESTING CORP.
- 15 BULLOCK FUND LTD.
- 16 CENTURY SHARES TRUST
- 17 CHASE FUND OF BOSTON
- 18 CHASE SHAREHOLDERS TRUST OF BOSTON
- 19 CHEMICAL FUND INC.
- 20 COLONIAL FUND INC.
- 21 AMERICAN EXPRESS INCOME FUND INC.
- 22 AMERICAN EXPRESS INVESTMENT FUND INC.
- 23 AMERICAN EXPRESS STOCK FUND INC.
- 24 COMPOSITE BOND AND STOCK FUND
- 25 COMPOSITE FUND INC.

26 CONCORD FUND INC.
27 DE VEGH MUTUAL FUND INC.
28 DELAWARE FUND INC.
29 BULLOCK -- DIVIDEND SHARES INC.
30 DREYFUS FUND INC.
31 ENERGY FUND INC.
32 EQUITY FUND INC.
33 FIDELITY CAPITAL FUND INC.
34 FIDELITY FUND INC.
35 FINANCIAL INDUSTRIAL FUND
36 FLORIDA GROWTH FUND INC.
37 FOUNDERS MUTUAL FUND
38 GROUP SECURITIES INC. -- COMMON STOCK FUND
39 GROWTH INDUSTRY SHARES INC.
40 GUARDIAN MUTUAL FUND INC.
41 HAMILTON FUNDS INC. -- SERIES HDA
42 INCOME FUND OF BOSTON INC.
43 INVESTMENT COMPANY OF AMERICA
44 INVESTMENT TRUST OF BOSTON
45 INVESTORS RESEARCH FUND INC.
46 ISTEEL FUND INC.
47 JOHNSTON MUTUAL FUND INC.
48 KEYSTONE CUSTODIAN FUND B-1
49 KEYSTONE CUSTODIAN FUND B-2
50 KEYSTONE CUSTODIAN FUND B-4
51 KEYSTONE CUSTODIAN FUND K-1
52 KEYSTONE CUSTODIAN FUND K-2
53 KEYSTONE CUSTODIAN FUND S-1
54 KEYSTONE CUSTODIAN FUND S-2
55 KEYSTONE CUSTODIAN FUND S-3
56 KEYSTONE CUSTODIAN FUND S-4
57 KNICKERBOCKER FUND
58 KNICKERBOCKER GROWTH FUND INC.
59 LIFE INSURANCE INVESTORS INC.
60 LOOMIS-SAYLES MUTUAL FUND
61 MAGNA INCOME TRUST
62 MASSACHUSETTS INVESTORS GROWTH STOCK FUND
63 MASSACHUSETTS INVESTORS TRUST
64 MUTUAL SHARES CORP.
65 MUTUAL TRUST
66 NATIONAL INVESTORS CORP.
67 NATIONAL SECURITIES SERIES - BALANCE SERIES
68 NATIONAL SECURITIES SERIES -- BOND SERIES
69 NATIONAL SECURITIES SERIES -- DIVIDEND SERIES
70 NATIONAL SECURITIES SERIES -- PREFERRED STOCK SERIES
71 NATIONAL SECURITIES SERIES -- INCOME SERIES
72 NATIONAL SECURITIES SERIES -- STOCK SERIES
73 NATIONAL SECURITIES SERIES -- GROWTH STOCK SERIES
74 ONE WILLIAM STREET FUND INC.
75 OPPENHEIMER FUND INC.
76 PENN SQUARE MUTUAL FUND
77 PHILADELPHIA FUND INC.
78 PINE STREET FUND INC.
79 PIONEER FUND INC.
80 PRICE (T. ROWE) GROWTH STOCK FUND
81 PURITAN FUND INC.
82 PUTNAM (GEORGE) FUND
83 PUTNAM GROWTH FUND
84 SCUDDER STEVENS AND CLARK - BALANCED FUND
85 SCUDDER STEVENS AND CLARK - COMMON STOCK FUND
86 SIGMA INVESTMENT SHARES
87 SIGMA TRUST SHARES
88 SOUTHWESTERN INVESTORS INC.
89 SOVEREIGN INVESTORS INC.
90 STEIN ROE AND FARNHAM - BALANCED FUND
91 STEIN ROE AND FARHNAME - STOCK FUND
92 TWENTIETH CENTURY GROWTH INVESTORS
93 VALUE LINE FUND INC.
94 VALUE LINE INCOME FUND INC.
95 VALUE LINE SPECIAL SITUATIONS FUND
96 WALL STREET INVESTING CORP.
97 WASHINGTON MUTUAL INVESTORS FUND INC.
98 WELLINGTON FUND INC.
99 WHITEHALL FUND INC.
100 WISCONSIN FUND INC.

GPDQS

GPDQS is a file of quarterly prices and dividends for the thirty stocks used in 1971 to compute Dow-Jones' Industrial average. For each quarter, the following information is given:

"opening price"

- this is the price of one share of the stock as of the close of trading on the last trading day of the previous quarter.

"dividends"

- this includes all dividends received during the quarter by a person who held one share at the beginning of the quarter. Any distribution treated as income is also included.

"closing price"

- this is the value of the holdings of an investor who held one share at the beginning of the quarter. The value is calculated as of the close of the last trading day in the quarter.

Each stock is allocated one record on the file. Stock number 1 is on record 1; stock 2 on record 2, etc. Each record contains 40 quarter of information as follows:

opening price	1st quarter of 1st year
dividends	1st quarter of 1st year
closing price	1st quarter of 1st year

opening price	2nd quarter of 1st year
dividends	2nd quarter of 1st year
closing price	2nd quarter of 1st year

etc.

Any missing value is represented by -999.

Following the 120 data values on each record are:

- the first year for which data are given (e.g., 1963)
- the name of the stock (up to 20 characters)

The file uses the same format as GPDQI and GPDQF. The stocks are listed as follows:

1	ALLIED CHEMICAL
2	ALUMINUM COMPANY OF AMERICA
3	AMERICAN BRANDS
4	AMERICAN CAN COMPANY
5	AMERICAN TELEPHONE AND TELEGRAPH
6	ANACONDA
7	BETHLEHEM STEEL
8	CHRYSLER CORPORATION
9	DUPONT (E.I.) DE NEMOURS
10	EASTMAN KODAK
11	GENERAL ELECTRIC
12	GENERAL FOODS
13	GENERAL MOTORS
14	GOODYEAR TIRE AND RUBBER
15	INTERNATIONAL HARVESTER
16	INTERNATIONAL NICKEL COMPANY OF CANADA
17	INTERNATIONAL PAPER COMPANY
18	JOHNS-MANVILLE CORPORATION
19	OWENS-ILLINOIS
20	PROCTER AND GAMBLE
21	SEARS ROEBUCK
22	STANDARD OIL OF CALIFORNIA
23	STANDARD OIL OF NEW JERSEY
24	SWIFT AND COMPANY
25	TEXACO
26	UNION CARBIDE
27	UNITED AIRCRAFT
28	U.S. STEEL
29	WESTINGHOUSE ELECTRIC
30	WOOLWORTH (F.W.) COMPANY

GPDQI

GPDQI is a file of quarterly prices and dividends for 98 common stock indices published by Standard and Poor's and returns on 90-day Treasury bills. For each quarter, the following information is given:

"opening price"

- this is the value of the index as of the end of the previous quarter, as reported by Standard and Poor's.

"dividends"

- this is the value of dividends paid by the stocks in the index during the quarter, as reported by Standard and Poor's.

"closing price"

- this is the value of the index as of the end of the quarter, as reported by Standard and Poor's.

Each index is allocated one record on the file. Index number 1 is on record 1; index 2 on record 2, etc. Each record contains 120 numbers, as follows:

opening price	1st quarter of 1st year
dividends	1st quarter of 1st year
closing price	1st quarter of 1st year
opening price	2nd quarter of 1st year
dividends	2nd quarter of 1st year
closing price	2nd quarter of 1st year

Any missing value is represented by -999.

Following the 120 data values on each record are:

- the first year for which data are given (e.g., 1963)
- the name of the index (up to 20 characters)

For 90-day Treasury bills, the three values are:

"opening price"

- the average of the bid and ask prices at the end of the previous quarter for the 90-day bill expiring on the date nearest the end of the quarter (e.g., 98.8)

"dividends"

- zero

"closing price"

- 100

The file uses the same format as GPDQF and GPDQS. The indexes are listed as follows:

1	500 STOCKS
2	425 INDUSTRIALS
3	20 RAILS
4	55 UTILITIES
5	CAPITAL GOODS
6	CONSUMER PRODUCTS
7	HIGH GRADE
8	LOW PRICED
9	AEROSPACE
10	AIR TRANSPORT
11	ALUMINUM
12	AUTOMOBILE
13	AUTO PARTS
14	AUTO TRUCKS & PARTS
15	BREWERS
16	DISTILLERS
17	SOFT DRINKS
18	CEMENT
19	HEATING & PLUMBING

20 ROOFING & WALLBOARD
21 HOME FURNISHINGS
22 CHEMICALS
23 BITUMINOUS COAL
24 CONFECTIONERY
25 CONTAINERS - METAL & GLASS
26 CONTAINERS - PAPER
27 COPPER
28 DRUGS
29 ELECTRICAL EQUIPMENT
30 ELECTRICAL HOUSEHOLD APPLIANCES
31 ELECTRONICS
32 BUILDING MATERIALS COMPOSITE
33 FINANCE COMPANIES
34 SMALL LOAN
35 FOOD - BISCUIT BAKERS
36 FOOD - BREAD & CAKE
37 FOOD - CANNED
38 FOOD - CORN REFINERS
39 FOOD - DIARY PRODUCTS
40 FOOD - MEAT PACKING
41 FOOD - PACKAGED FOODS
42 GOLD MINING
43 LEAD & ZINC
44 MACHINE TOOLS
45 AGRICULTURAL MACHINERY
46 CONSTRUCTION & MATERIAL HANDLING
47 INDUSTRIAL MACHINERY
48 OIL WELL EQUIPMENT
49 SPECIALTY MACHINERY
50 STEAM GENERATING EQUIPMENT
51 METAL FABRICATING
52 METAL MISCELLANEOUS
53 MOTION PICTURES
54 OFFICE EQUIPMENT
55 CRUDE OIL PRODUCERS
56 INTEGRATED OILS - DOMESTIC
57 INTEGRATED OILS - INTERNATIONAL
58 PAPER
59 PUBLISHING
60 RADIO & TV BROADCASTERS
61 RADIO & TV MANUFACTURERS
62 RAILROAD EQUIPMENT
63 TEXTILES - SYNTHETIC FIBERS
64 DISCOUNT STORES
65 DEPARTMENT STORES
66 FOOD STORES
67 MAIL ORDER
68 VARIETY STORES
69 SHIPBUILDING
70 SHIPPING
71 SHOES
72 SOAPS
73 STEEL
74 SUGAR-BEET REFINERS
75 FOOD COMPOSITE
76 SUGAR-CAN REFINERS
77 SULPHUR
78 TEXTILES - APPAREL MAHUFACTURERS
79 TEXTILE PRODUCTS
80 TIRE & RUBBER
81 TOBACCO - CIGARETTE MANUFACTURERS
82 TOBACCO - CIGAR MANUFACTURERS
83 VEGETABLE OILS
84 VENDING MACHINES
85 ELECTRIC COMPANIES
86 NATURAL GAS DISTRIBUTORS
87 PIPELINES
88 TELEPHONE
89 BANKS - NEW YORK CITY
90 BANKS - OUTSIDE NEW YORK CITY
91 OIL COMPOSITE
92 INSURANCE - FIRE & CASUALTY
93 INSURANCE - LIFE
94 INVESTMENT COMPANIES
95 COSMETICS
96 ELECTRONIC MAJOR COMPANIES
97 HOLDING COMPANIES
98 TRUCKERS
99 90-DAY TREASURY BILL

RUN

RUN
GCHLIN

Y-VARIABLE (VERTICAL AXIS)
FUND, INDEX, PORTFOLIO OR STOCK?FUND
NUMBER?2
AFFILIATED

X-VARIABLE (HORIZONTAL AXIS)
FUND, INDEX, PORTFOLIO OR STOCK?INDEX
NUMBER?1
500 STOCKS

DO YOU WANT THE TREASURY BILL RATE SUBTRACTED FROM EACH RETURN?YES

FIRST QUARTER --
YEAR?1964
QUARTER?3

LAST QUARTER--
YEAR?1971
QUARTER?2

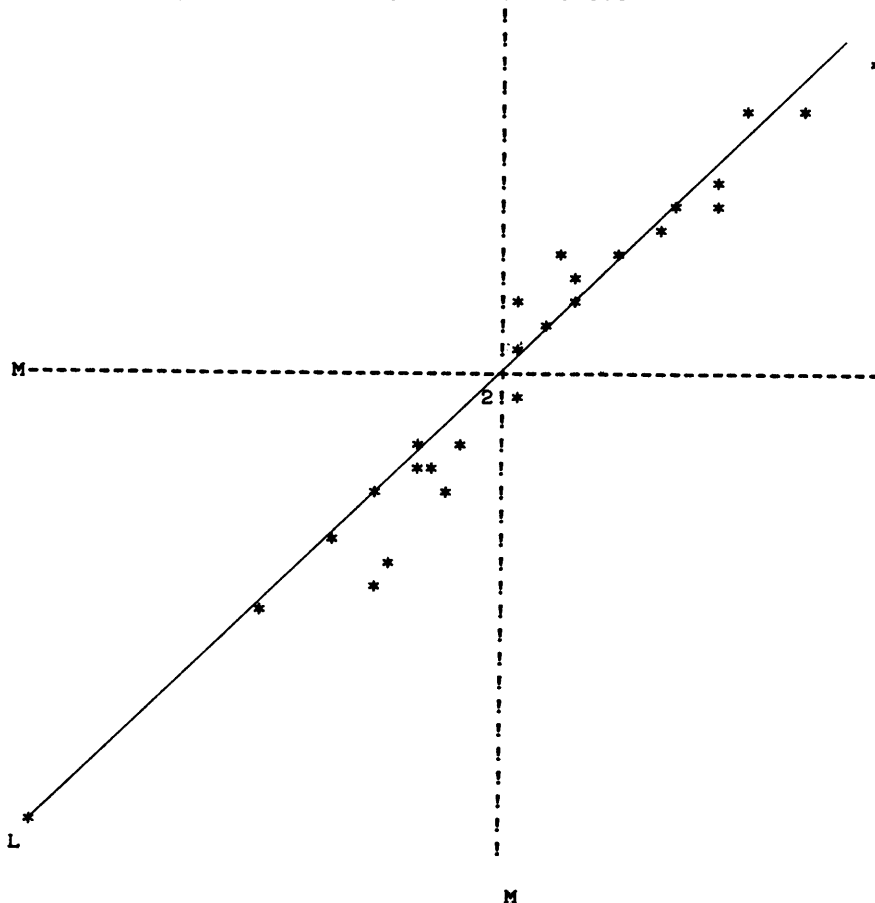
	Y	X
MAXIMUM	13.394	15.377
MINIMUM	-18.146	-19.597
AVERAGE	0.632	0.555
STD DEV	7.020	7.110
AVG/STD DEV	0.090	0.078

REGRESSION LINE --
Y = 0.09507 + 0.96679* X

STANDARD ERRORS: 0.28109 0.03942

R-SQUARED : .958573

EACH AXIS RUNS FROM -19.5969 TO 15.3768

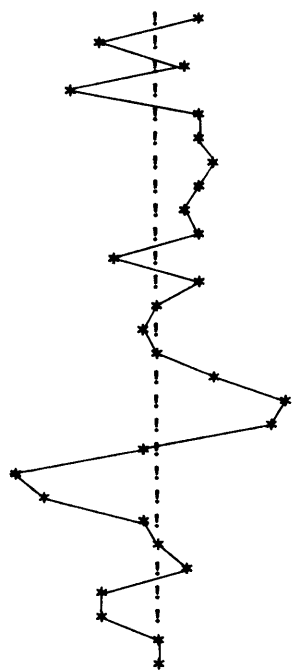


DIFFERENTIAL RETURNS (Y - B*X) --

YEAR QTR VALUE

- 0 +

1964 3 1.181
 1964 4 -1.233
 1965 1 0.841
 1965 2 -2.003
 1965 3 0.963
 1965 4 0.847
 1966 1 1.415
 1966 2 0.852
 1966 3 0.535
 1966 4 1.072
 1967 1 -0.930
 1967 2 1.041
 1967 3 0.108
 1967 4 -0.257
 1968 1 -0.128
 1968 2 1.291
 1968 3 3.093
 1968 4 2.661
 1969 1 -0.195
 1969 2 -3.379
 1969 3 -2.714
 1969 4 -0.331
 1970 1 0.013
 1970 2 0.800
 1970 3 -1.472
 1970 4 -1.373
 1971 1 0.022
 1971 2 -0.057



DONE

CONTRIBUTED PROGRAM **BASIC**GDAPI
36507**TITLE:**

ABNORMAL PERFORMANCE INDEX

DESCRIPTION:

This program allows the user to compute an "abnormal performance index" based on price changes of stocks for which similar events have taken place.

INSTRUCTIONS:

One or more "events" may be analyzed. For each event, the closing price of the relevant stock must be obtained for a specified number of periods prior to the event and for a specified number of periods after the event, as well as the closing price on the day of the event. If the market was closed on the appropriate date of a period, no price should be entered for that period (i.e., it should be skipped entirely). The user must also indicate the "beta" or "market sensitivity" of the stock. A period may be any number of (calendar) days, but every period must be of the same length. The program determines the percentage change in Standard and Poor's 500-stock index for each period, multiplies that value by the stock's market sensitivity, and subtracts the result from the percentage price change for the stock during the period. This difference is the "abnormal" percentage price change for the stock for the period.

Abnormal percentage price changes are computed for the specified number of period prior to and subsequent to each event. The values are then averaged to obtain an "average abnormal percentage price change" for every period in the specified range. Finally, an abnormal price index (API) is constructed from the average values. The index is assigned a beginning value of 100. Each period's value is then obtained by multiplying the previous period's value by one plus the average abnormal percentage price change.

(Instructions continued on page 2)

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

INSTRUCTIONS: (continued)

Enter the data to be analyzed in data statements, beginning at line 5000. For each event, the following information is required:

event description
date of event
market sensitivity (beta) of stock
prices

For example:

5000 DATA "EFFECT OF UAL CRASH ON DOUGLAS STOCK"
5001 DATA "JANUARY 5, 1965"
5002 DATA 1.23
5003 DATA 38,39,38.625,38.5,etc.

The data statements should be followed with an END statement. For example:

9999 END

After entering the data statements, it is possible to save the program and data by typing:

SAVE

This will save the material in the user's account under the name GDAPI. To re-use it at some other time, type:

GET-GDAPI

(instead of GET-\$GDAPI)

Once the data have been entered, the program can be RUN. The user will first be asked if he is using FILES or DATA statements. Assume that the appropriate answer is DATA statements. The user will then indicate the total number of events included in the data statements and whether or not he wishes to analyze them all. If the answer to the latter question is NO, he will be asked to specify the numbers of the events to be analyzed. The program will then ask for the number of days per period. Finally, the number of periods prior to each event and subsequent to each event must be specified. (NOTE: If P1 periods prior to each event and P2 periods subsequent to each event are to be analyzed, the user must have included $P1 + P2 + 1$ prices for each event.)

The program will list the events to be analyzed, perform the required computations, and indicate the minimum and maximum values of the abnormal performance index over the period. The user may then select his own scale for the final graph or let the program automatically select a scale running from the minimum to the maximum value. Finally, the program will print a list of the values and an accompanying graph. The program may be re-run to analyze a different set of events.

For convenience, a file capability is also included. If the user indicates that he is using FILES, the program will request the name of the file to be used. For each event, the description, date and beta of the stock must be included in the DATA statements (as before), but the prices will be obtained from the specified file. The prices for the first stock should be included in record 1, those for the second in record 2, etc. The use of files expands the size of problem that can be analyzed, since only about 2500 numbers can be entered in data statements before the available space will be fully used.

The program uses the values of Standard and Poor's 500-stock index on file GSP5.

GSP5

GSP5 file contains data on the value of Standard and Poor's 500-stock index on a daily basis, beginning with the first day of 1964. Values are in sequence, with one for each day of the year. A day on which the exchange is closed is indicated by an entry of -999. Data for 1964 are on records 1, 2, and 3. Data for 1965 are on records 4, 5, 6, etc. The third record used for every year is filled out with -999 values.

RUN

```

5050 DATA 556.75,570,575.5,566.5,569,564.5,564,558,562.5,568
5060 DATA 568,568.5,575.25,585,588.5,584.5,583.5,579.75,577.25,574.5
5070 DATA 580,582,586.5,588.5,589,594.25,595.25,598,598.5,597
5080 DATA 588.25,584.5,585.25,596.75,590.25,586,584,582.25,585.5,582
5090 DATA 590,594,584,583,581,583.5,576.5,570.25,579.5,584
5100 DATA 584.75
5110 DATA "IBM 370 ANNOUNCEMENT"
5120 DATA "JUNE 30, 1970",.9
5160 DATA 258.5,250.5,245.5,248,241,242,259,267,278,287
5170 DATA 283,283,271.25,270,266.25,268.25,265.5,259.25,259,259
5180 DATA 271,265.75,272,270.25,268.5,257.12,255,258,257.5,257.5
5190 DATA 250,254,250.75,244.5,242.5,242.5,254.25,250.25,247.75,251.25
5200 DATA 252,254,259.5,258,257.75,254,257,253.75,253.25,252.75
5210 DATA 252.5
5220 DATA "IBM SYSTEM 3 ANNOUNCEMENT"
5230 DATA "JULY 30, 1969",.9
5270 DATA 313.5,314.25,314.25,314,312.25,315.5,325.5,320.5,329.75,331.5
5280 DATA 337.75,337.5,348,351.25,348,336,333.5,327,331.5,321.5
5290 DATA 323.5,328.5,327.5,323,318.25,320.25,317,316.5,313.12,313
5300 DATA 315.5,324.5,329.5,326.75,334.5,336,333.75,333.5,329.25,330.5
5310 DATA 335,338.75,339.5,341.25,342,346.87,349,350.25,341,340
5320 DATA 342.75
5330 DATA "CDC 7600 ANNOUNCEMENT"
5340 DATA "DECEMBER 3, 1968",1.47
5380 DATA 140.12,139.75,141,143.5,143.75,141.62,137.75,141.75,141.62
5385 DATA 140.12
5390 DATA 138,138.75,137.12,137.37,135.25,135.62,135.62,140,147,142.62
5400 DATA 141.75,140,141.62,147,154.25,157.12,155.62,156.62,157.87
5405 DATA 157.12
5410 DATA 159,161,161,158,147.62,155,150,148.87,150,150.75
5420 DATA 146.75,144.25,147,146.75,146.25,144,144.25,143.75,142.37,139
5430 DATA 138
5440 DATA "CDC 70 ANNOUNCEMENT"
5450 DATA "MARCH 18, 1971",1.47
5490 DATA 59.75,60.5,60.5,62.62,62.25,61.62,60.75,61.25,58.75,61
5500 DATA 60.75,59.5,58.25,58.62,59.62,58,57.5,56.75,56.87,56.37
5510 DATA 58.5,60.5,61,62,65,65,63.75,65.25,65.5,65
5520 DATA 64.62,65.64,37,63.25,62.12,62.25,62.62,62.5,63,63.75
5530 DATA 63.62,63.5,63.25,63.62,64.75,65.12,68.5,67,67.25,66.62
5540 DATA 65
5550 END

```

```

RUN
GDAPI

```

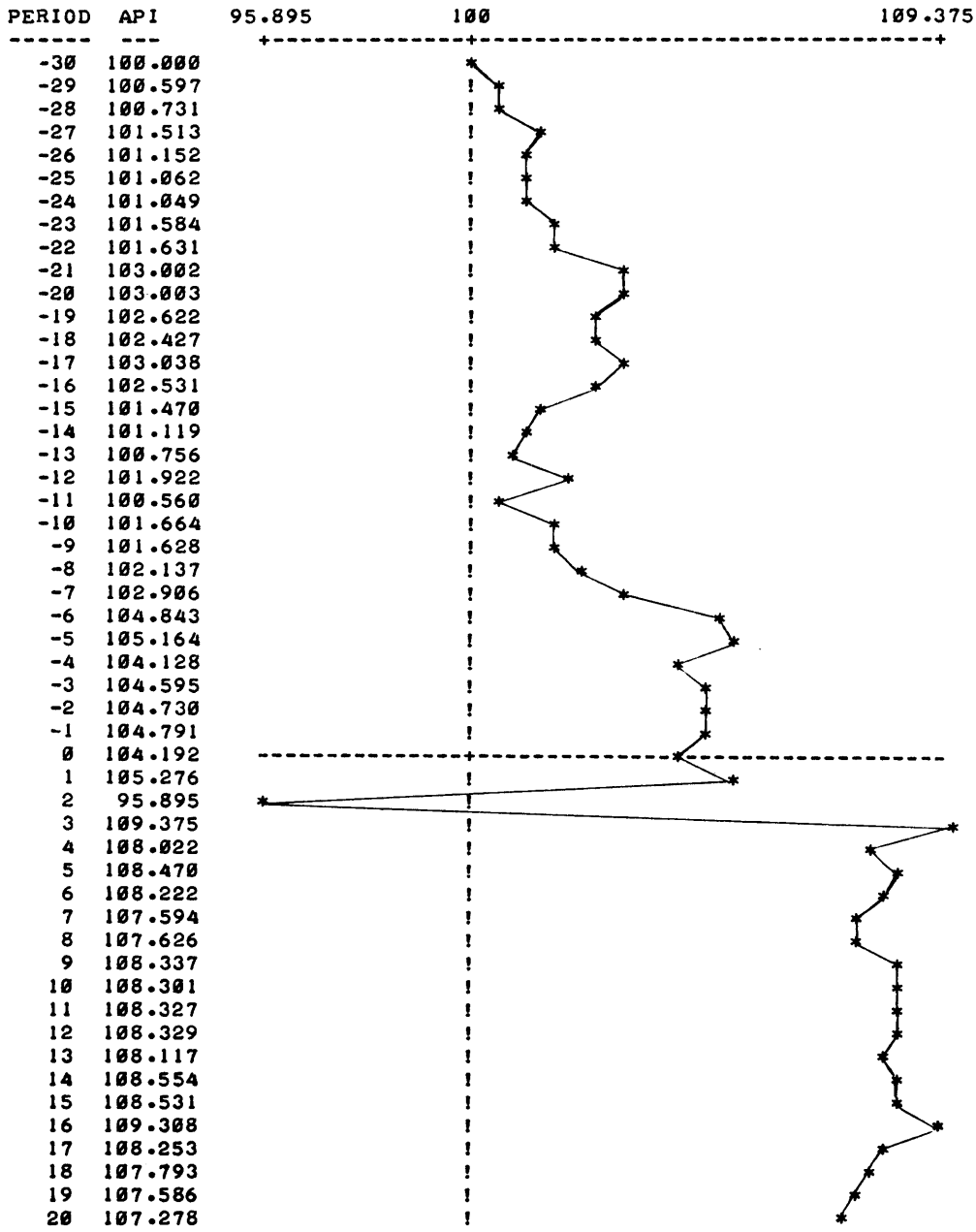
```

ARE YOU USING 'FILES' OR 'DATA' STATEMENTS ?DATA
HOW MANY EVENTS DO YOU HAVE IN ALL?5
DO YOU WISH TO ANALYZE THEM ALL?YES
HOW MANY DAYS ARE THERE PER PERIOD (E.G. 1 FOR
DAILY DATA, 7 FOR WEEKLY DATA). NUMBER OF DAYS?1
FOR HOW MANY PERIODS PRIOR TO EACH EVENT DO YOU
HAVE PRICES?30
FOR HOW MANY PERIODS AFTER EACH EVENT DO YOU
HAVE PRICES?20

```

#	EVENT DATE	EVENT
1	APRIL 7,1964	IBM 360 ANNOUNCEMENT
2	JUNE 30, 1970	IBM 370 ANNOUNCEMENT
3	JULY 30, 1969	IBM SYSTEM 3 ANNOUNCEMENT
4	DECEMBER 3,1968	CDC 7600 ANNOUNCEMENT
5	MARCH 18,1971	CDC 70 ANNOUNCEMENT

MINIMUM API = 95.89482 MAXIMUM API = 109.37471
 DO YOU WANT TO CHOOSE THE SCALE?NO



DONE

TITLE:

EFFICIENT "CORNER" PORTFOLIOS

DESCRIPTION:

This program finds the set of efficient "corner" portfolios from a set of up to 100 securities. The amount invested in each security must lie within specified bounds. The program assumes that returns follow the "single-index" or "diagonal" model:

$$R_i = A_i + B_i R_m + c_i$$

where:

R_i = return on security i

A_i, B_i = constants

R_m = an index (usually of the return on some "market portfolio")

c_i = a random variable with a mean of zero and a variance of Q_i

INSTRUCTIONS:

Inputs to the program should be inserted beginning with line 5000 as DATA statements. The values (in order) are:

- 1) expected value of R_m
- 2) variance of R_m
- 3) number of securities
- 4) lower limit on each holding (e.g., .02 for 2%)
- 5) upper limit on each holding (e.g., .10 for 10%)
- 6) for each security:
 - a) the value of A_i
 - b) the value of B_i
 - c) the value of Q_i

(Continued on Page 2)

**SPECIAL
CONSIDERATIONS:**

This program uses the critical line algorithm developed by Markowitz. In some cases, round-off problems may cause the procedure to produce erroneous results. This is usually evident from the composition of the portfolios. Slight changes in the inputs may cure the problem.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

INSTRUCTIONS: (continued)

The section of the program that reads the data is located between lines 1000 and 1050 and may be changed to (1) read the data from a file and/or (2) to set different upper and lower bounds for different securities.

When the program is run, it will first ask:

STARTING, CONTINUING OR FINISHING?

Respond with STARTING (or just S). The program will then determine all the corner portfolios, beginning with the one offering the greatest expected return. For selected corner portfolios, the following information will be printed:

portfolio number: (in sequence, used for later identification)

expected return

standard deviation of return

associated interest rate (that pure rate of interest that would make the portfolio optimal if funds could be freely borrowed or lent at the pure rate of interest)

Information about some corner portfolios will not be printed if they differ insignificantly from those for which information is shown.

After this phase, the program will again ask:

STARTING, CONTINUING OR FINISHING?

This time, respond CONTINUING (or just C). The program will then ask for the LOWEST-NUMBERED PORTFOLIO YOU WOULD LIKE TO SEE. Use the numbers from the previous printout. The program will indicate the percent to be invested in each security (except those for which the percent is zero). When you do not wish to see another portfolio, simply respond with a portfolio number larger than any shown on the previous printout. The program will again ask:

STARTING, CONTINUING OR FINISHING?

Respond with FINISHING, (or simply F), and the program will terminate.

RUN

RUN
GDPA

STARTING, CONTINUING, OR FINISHING?S

PORT	EXP RTN	STD DEV	ASSOC. INT RATE
----	-----	-----	-----
1	2.63903	.667977	
2	2.63896	.66796	2.62654
3	2.63856	.660434	2.61667
7	2.62528	.651724	1.5445
8	2.61913	.648087	1.50027
9	2.6085	.641963	1.48642
10	2.57222	.621961	1.39845
11	2.56347	.617367	1.37759
12	2.56241	.616813	1.37474
13	2.55962	.615364	1.37342
14	2.53189	.601056	1.3609
15	2.47137	.570292	1.33783
16	2.46151	.565374	1.31717
17	2.46108	.565162	1.31553
18	2.46054	.564898	1.31383
19	2.45555	.562452	1.30121
20	2.44827	.558914	1.29639
21	2.40004	.535779	1.26948
22	2.37004	.521658	1.25443
23	2.36306	.5184	1.25071
24	2.33072	.503413	1.23759
25	2.27052	.475986	1.21354
26	2.27031	.475896	1.21344
27	2.18365	.437799	1.16069
28	2.16712	.430769	1.147
29	2.16033	.427914	1.14006
30	2.15239	.4246	1.13
31	2.14712	.422415	1.12458
32	2.12216	.412283	1.08771
33	2.11055	.407726	1.0568
34	2.09365	.401449	.965182
35	2.09151	.400691	.946533
37	2.09151	.400691	.79256
38	2.0915	.40069	.703653
39	2.07266	.395631	.476815
40	2.03619	.388058	-.292809
41	2.02612	.38649	-.639503
42	2.00468	.383862	-1.83871
43	2.00018	.383522	-5.4019
44	1.99761	.383455	

STARTING, CONTINUING, OR FINISHING?C

LOWEST-NUMBERED PORTFOLIO YOU WOULD LIKE TO SEE?1

SEC	PERCENT
----	-----
1	10
3	10
4	10
7	10
9	10
10	10
12	10
13	10
15	10
20	10

NEXT (LOWEST-NUMBERED) PORTFOLIO YOU WOULD LIKE TO SEE?21

SEC	PERCENT
---	-----
1	8
2	10
3	8.08
4	5.64
6	10
7	7.05
9	10
10	10
12	10
13	.28
15	3.48
16	4.71
17	10
18	2.77

NEXT (LOWEST-NUMBERED) PORTFOLIO YOU WOULD LIKE TO SEE?44

SEC	PERCENT
---	-----
2	10
5	10
6	10
7	2.78
11	10
12	5.19
13	2.03
14	10
16	10
17	10
18	10
19	10

NEXT (LOWEST-NUMBERED) PORTFOLIO YOU WOULD LIKE TO SEE?100

STARTING, CONTINUING, OR FINISHING?F

DONE

CONTRIBUTED PROGRAM **BASIC**GFNRAT
36510**TITLE:**

FINANCIAL RATIOS

DESCRIPTION:

This program uses balance sheet and income statement data to compute various financial ratios. The data may be entered either via the terminal or in data statements.

INSTRUCTIONS:

If data are entered by the user as the program is being run, the order will be indicated as the program proceeds. If the user elects to enter the data in data statements, the same order should be followed, with the statements entered beginning at line 9000.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

RUN
GFNRAT

PLEASE INDICATE INPUT SOURCE --

'T' FOR TERMINAL

'D' FOR DATA STATEMENTS

SOURCE -- ?T

NET RECEIVABLES -- ?53985080

NET INVENTORIES -- ?141576993

NET INVENTORIES -- PREVIOUS YEAR-END -- ?109814927

CURRENT ASSETS -- ?225925178

TOTAL ASSETS -- ?323223797

CURRENT LIABILITIES -- ?107781631

PREFERRED STOCK -- ?0

COMMON STOCK -- ?40569128

CAPITAL AND EARNED SURPLUS -- ?120721744

NET SALES -- ?344740452

COST OF GOODS SOLD -- ?229779697

SELLING, GENERAL AND ADMINISTRATIVE EXPENSES -- ?73472649

NET PROFIT -- ?13584388

DIVIDENDS ON PREFERRED STOCK -- ?0

CURRENT RATIO: 2.09614

ACID TEST RATIO: .782584

RECEIVABLES TURNOVER: 6.38585 TIMES

AVERAGE INVENTORY TURNOVER: 1.82806 TIMES

LT DEBT/TOTAL CAPITALIZATION: .25135

TOTAL DEBT TO EQUITY: 1.00398

GROSS PROFIT MARGIN: 33.347 PERCENT

SELLING, GENERAL AND ADMIN. EXPENSES TO SALES: 21.3125 PERCENT

NET PROFIT MARGIN: 3.94047 PERCENT

RATE OF RETURN ON COMMON STOCK EQUITY: 8.42229 PERCENT

TURNOVER RATIO: 1.06657 TIMES

EARNING POWER: 4.20278 PERCENT

DONE

TITLE: INVESTMENT RETURN (CASH FLOW)

DESCRIPTION: This program calculates internal rates of return and/or present values for sets of cash inflows and outflows over time.

INSTRUCTIONS:

The data may be entered from the terminal or from data statements. The investment is assumed to begin at time period zero. The flow at period 1 is assumed to occur at the end of the first period; that at period 2 at the end of the second period, etc. If all flows except the initial one are the same, the program does not require each to be entered explicitly.

To determine the internal rate of return, respond IRR when asked for the next choice. To determine the present value, respond PV; the program will then request a discount rate. To do a new problem, respond NEW. To stop the program, respond STOP.

Every outflow must be entered as a minus number (including the one in period zero). Inflows must be entered as positive numbers -- the plus sign is optional.

If data statements are used, the following information should be included for each investment:

- the number of periods
- the cash flow for period zero
- the cash flow for period one
- "YES" if all the rest of the flows are the same;
"NO" if the remaining flows differ from the first
- if the remaining flows differ:
 - flow for the second period
 - flow for the third period, etc.

Data statements should be entered beginning at line 9000. Additional investments may be included by adding more data statements.

ACKNOWLEDGEMENTS: Graduate School of Business
Stanford University

RUN

PLEASE INDICATE INPUT SOURCE --

T (FOR TERMINAL)

D (FOR DATA STATEMENTS)

SOURCE?T

NUMBER OF PERIODS AFTER PERIOD ZERO?5

+ REPRESENTS A NET INFLOW, - REPRESENTS A NET OUTFLOW

INITIAL CASH FLOW IN PERIOD ZERO?-18000

CASH FLOW IN FIRST PERIOD?5600

ARE ALL THE REST OF THE FLOWS THE SAME?YES

WHAT NEXT (IRR,PV,NEW OR STOP)?IRR

THE INTERNAL RATE OF RETURN IS 16.8 PERCENT

WHAT NEXT (IRR,PV,NEW OR STOP)?PV

DISCOUNT RATE (IN PERCENT)?10

NET PRESENT VALUE IS 3228.41

WHAT NEXT (IRR,PV,NEW OR STOP)?NEW

NUMBER OF PERIODS AFTER PERIOD ZERO?5

+ REPRESENTS A NET INFLOW, - REPRESENTS A NET OUTFLOW

INITIAL CASH FLOW IN PERIOD ZERO?-3500

CASH FLOW IN FIRST PERIOD?200

ARE ALL THE REST OF THE FLOWS THE SAME?NO

PERIOD 2 FLOW?2000

PERIOD 3 FLOW?1400

PERIOD 4 FLOW?600

PERIOD 5 FLOW?-100

WHAT NEXT (IRR,PV,NEW OR STOP)?PV

DISCOUNT RATE (IN PERCENT)?10

NET PRESENT VALUE IS -265.732

WHAT NEXT (IRR,PV,NEW OR STOP)?STOP

DONE

CONTRIBUTED PROGRAM **BASIC**GKASSF
36514**TITLE:**

WARRANT PRICE CALCULATION

DESCRIPTION:

This program allows the user to calculate the "normal" price of a warrant and the "normal" change in the warrant's price per dollar change in the price of the associated stock.

INSTRUCTIONS:

Required inputs are requested by the program, as shown in the sample run.

**SPECIAL
CONSIDERATIONS:**

The formula used is that given on page 204 of Beat the Market by Kassouf and Thorpe.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

**RUN
GKASSF**

**COMMON STOCK PRICE?45
NUMBER OF SHARES PER WARRANT?1
EXERCISE PRICE?50
PREVIOUS YEAR'S HIGH FOR STOCK?60
PREVIOUS YEAR'S LOW FOR STOCK?40
MONTHS REMAINING BEFORE EXPIRATION?72
CURRENT YIELD (E.G. .05)?.03
NUMBER OF OPTIONS OUTSTANDING?50000
NUMBER OF COMMON SHARES OUTSTANDING?150000**

**'NORMAL' WARRANT PRICE = 15.5202
'NORMAL' CHANGE IN WARRANT PRICE PER DOLLAR CHANGE IN STOCK
PRICE = .645292**

DONE

CONTRIBUTED PROGRAM **BASIC**GKCOST
36515**TITLE:**

PRICE/EARNINGS RATIO CALCULATION

DESCRIPTION:

This program calculates the theoretical P/E ratio for a given firm. It takes advantage of the fact that most firms' financial future may be thought of as years segmented into periods of similar financial policy. Within each segment, the firm's growth rate, dividend payout ratio and discount rate are assumed constant. The common stock P/E ratio is calculated assuming an initial EPS of \$1.00. To get the theoretical market price of the stock, you need only multiply the P/E ratio by the actual beginning EPS.

INSTRUCTIONS:

To use this program, segment your firm's future into years of similar financial nature, then input the starting year and ending year of each segment as well as its characteristic growth rate, payout ratio, and discount rate for each segment. For your final ending year, Type "0". The program uses an infinite model for the last year.

Be sure to remember that when entering ratios and rates percentages are input as "33", not ".33" or "33%".

There are two output formats, a long and short form. The long form prints out all intermediate calculations while the short form prints out just the answer.

**SPECIAL
CONSIDERATIONS:**

You may rerun this program using a modified version of your initial data as follows:

- "No" change in the existing values
- "Individually" change each segment's value
- "Percentage" change in all segment values
- "One" new value to be applied to all segments

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

RUN
GKCOST

SHARE PRICE (P/E) CALCULATIONS

DO YOU WISH DIRECTIONS ?NO

HOW MANY SEGMENTS WILL YOU USE (MAX IS 20) ?4

PLEASE INPUT YOUR DATA IN THE FOLLOWING ORDER, SEPARATED BY COMMAS:

STARTING YEAR, ENDING YEAR, GROWTH RATE, PAYOUT RATIO, DISCOUNT RATE

?1,5,25,0,12
?6,10,15,20,12
?11,20,10,30,12
?21,0,4,60,12

'LONG' OR 'SHORT' FORMAT ?LONG

SHARE PRICE (P/E) CALCULATIONS

SEGMENT NO.	YEARS S	E	GROWTH RATE	DIVIDEND PAYOUT	DISCOUNT RATE
1	1	5	0.250	0.000	0.120
2	6	10	0.150	0.200	0.120
3	11	20	0.100	0.300	0.120
4	21	0	0.040	0.600	0.120

PRIOR SEGMENT EPS	COMPOUND GROWTH FACTOR	CURRENT BEGINNING EPS	DIVIDEND PAYOUT RATIO	G-P.V. X DISCOUNT FACTOR	SEGMENT DIVIDEND VALUE
0.00	0.00	1.00	0.00	7.04	0.00
1.00	3.05	3.05	0.20	5.42	3.31
3.05	2.01	6.14	0.30	9.07	16.70
6.14	2.59	15.92	0.60	13.00	124.18

SEGMENT DIVIDEND VALUE	PRICE + DISCOUNT	TOTAL VALUE
0.00	20.13	20.13
3.31	32.16	35.47
16.70	39.98	56.68
124.18	0.00	124.18

DESIRED RERUN OPTION:
'MODIFY', 'START' OVER, 'END' RUN ?MODIFY

MODIFICATION OPTIONS:
'NO' CHANGE, 'INDIVIDUALLY', 'PERCENTAGE', 'ONE' VALUE

MODIFY GROWTH RATE ?NO

MODIFY PAYOUT RATIO ?INDIVIDUALLY

HOW MANY SEGMENTS ?2

WHICH ONES ?2,4

SEGMENT 2 ?25

SEGMENT 4 ?75

MODIFY DISCOUNT RATE ?PERCENTAGE
 WHAT PERCENTAGE CHANGE DO YOU WISH ?50

DIRECTIONS THIS RERUN ?NO

'LONG' OR 'SHORT' FORMAT ?SHORT

SHARE PRICE (P/E) CALCULATIONS

SEGMENT NO.	YEARS S E		GROWTH RATE	DIVIDEND PAYOUT	DISCOUNT RATE	TOTAL VALUE
1	1	5	0.250	0.000	0.180	7.223
2	6	10	0.150	0.250	0.180	16.524
3	11	20	0.100	0.300	0.180	29.720
4	21	0	0.040	0.750	0.180	88.702

DESIRED RERUN OPTION:
 'MODIFY', 'START' OVER, 'END' RUN ?END

DONE

TITLE:

SECURITIES PORTFOLIO ANALYSIS AND DETERMINATION

DESCRIPTION:

GNMRVB traces out the relationship between minimum non-market risk and market sensitivity (beta) for portfolios composed from a set of stocks. GMRGB finds the portfolio which gives the minimum amount of non-market risk for a given level of market sensitivity (beta). Formally, they solve the following problem:

$$\begin{aligned} \text{Minimize: } & \sum_{i=1}^N X_i^2 R_i^2 \\ \text{subject to: } & \sum_{i=1}^N X_i B_i = \bar{B} \\ & \sum_{i=1}^N X_i = 1 \\ & X_i > 0 \text{ for all } i \end{aligned}$$

The value of X_i is the proportion of the portfolio invested in security i . R_i is a measure of the security i 's relative non-market risk. B_i is a measure of security i 's market sensitivity (beta). \bar{B} is the level of beta for the entire portfolio. The relative non-market risk of the portfolio is given by:

$$\sqrt{\sum_{i=1}^N X_i^2 R_i^2}$$

GNMRVB is used in conjunction with GMRGB. After the relationship between minimum non-market risk and beta has been traced out, the "best" combination can be chosen. The corresponding value of beta can then be used with program GMRGB to find the composition of that portfolio.

INSTRUCTIONS:

GNMRVB and GMRGB require data statements beginning at line 9000 as follows:

- 1) the number of securities
- 2) for each security:
 - a) the value of beta
 - b) the security's relative non-market risk

GNMRVB requests a "STEP SIZE". This is the interval for calculation and printing of beta levels. Values are always selected so that 1.00 is included. The smaller the step size, the more detailed the results (and, of course, the longer the time required to obtain them).

**SPECIAL
CONSIDERATIONS:**

These programs use a special case of Markowitz' critical line algorithm. In some cases, they may produce errors due to roundoff problems. In such circumstances, the difficulty may be avoided by changing the data slightly.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

9000 DATA 5
 9010 DATA .84,.386
 9012 DATA 1.06,.374
 9014 DATA 1.17,.791
 9016 DATA 1.01,.540
 9018 DATA 1.70,1.562
 RUN
 GMRVB

HAVE YOU ENTERED YOUR DATA?YES
 STEP SIZE?.05

BETA REL. NON-MKT RISK

BETA	REL. NON-MKT RISK
1.700	1.562
1.650	1.417
1.600	1.276
1.550	1.142
1.500	1.017
1.450	0.902
1.400	0.789
1.350	0.680
1.300	0.576
1.250	0.479
1.200	0.392
1.150	0.323
1.100	0.275
1.050	0.241
1.000	0.228
0.950	0.239
0.900	0.286
0.850	0.365

DONE

RUN
 GMRGB

HAVE YOU ENTERED YOUR DATA?NO

ENTER DATA BEGINNING AT LINE 9000
 FIRST, THE NUMBER OF SECURITIES
 THEN, FOR EVERY SECURITY --

- 1) THE VALUE OF BETA
- 2) THE SECURITY'S RELATIVE NON-MARKET RISK

WHEN YOU HAVE ENTERED YOUR DATA STATEMENTS,
 RE-RUN THE PROGRAM

DONE
 9000 DATA 5
 9010 DATA .84,.386
 9012 DATA 1.06,.374
 9014 DATA 1.17,.791
 9016 DATA 1.01,.540
 9018 DATA 1.70,1.562
 RUN
 GMRGB

HAVE YOU ENTERED YOUR DATA?YES
 DESIRED LEVEL OF BETA?1

SEC	PERCENT
1	34.14
2	37.32
3	8.45
4	17.80
5	2.30

BETA = 1.00
 RELATIVE NON-MARKET RISK = 0.23

DONE

GNPSUM
36086

TITLE:

GROSS NATIONAL PRODUCT SUMMARY

DESCRIPTION:

GNPSUM produces figures for GNP, consumption, investment, and government spending for a series of years from a model in which consumption is a function of income in the previous period, and investment depends in part on changes in consumption.

INSTRUCTIONS:

The following coefficients are to be input by the user:
(Note: All dollar values should be entered in exponential notation.
Example: \$6 million = 6E + 6.)

The first four values refer to a base period:

A = the fraction consumption was of personal income
B = the actual value of investment expenditures
E = the value of government spending in this base period
Y(1) = the total GNP for this base period

The next five values are general information:

N = the number of periods the user wishes to analyze
G = the fraction disposable income is of total GNP
C = the additional investment added each period
F = the additional government spending each period
D = the fraction of the consumption increment that is to be added to investment each period
N\$ = 'Yes' implies $H=1$, and the business investment does have a random component
'No' implies $H=0$, and the business investment does not have a random component
The random component has a rectangular distribution, and ranges from +10% to -10% of the value of $B + (C * T)$

For a user familiar with GNPSUM, the following changes can be made to read data-statements instead of the long input routine:

```
9146 READ A,B,E,Y(1),N,G,C,F,D,N$
9147 GOTO 9320
```

Add data-statements for the values in 9146 beginning in line 9900.

SPECIAL
CONSIDERATIONS:

Maximum of 29 periods. To increase this dimension alter line 9345.

ACKNOWLEDGEMENTS:

RUN

GET-\$GNPSUM

RUN

GNPSUM

* GNP SUMMARY *

THIS PROGRAM PRINTS A SUMMARY OF FIGURES FOR GNP, CONSUMPTION, INVESTMENT, AND GOVERNMENT SPENDING FOR A SERIES OF CONSECUTIVE YEARS.

THE FOLLOWING FOUR QUESTIONS REFER TO A BASE PERIOD:

FOR THE BASE PERIOD, WHAT FRACTION OF PERSONAL INCOME WAS CONSUMPTION
?.91

WHAT WAS THE TOTAL INVESTMENT DURING THIS PERIOD? (IN DOLLARS)?10E+9

WHAT WAS THE GOVERNMENT SPENDING FOR THIS PERIOD?112E+9

AND WHAT WAS THE TOTAL GNP FOR THIS BASE PERIOD?465E+9

HOW MANY PERIODS DO YOU WISH TO ANALYZE?12

FOR THIS MODEL, WHAT FRACTION OF GNP SHOULD BE USED AS DISPOSABLE INCOME
?.72

HOW MUCH NEW INVESTMENT SHOULD BE ADDED EACH PERIOD?2.5E+6

HOW MUCH NEW GOVERNMENT SPENDING SHOULD BE ADDED EACH PERIOD?100E+6

WHAT FRACTION OF THE CHANGE IN CONSUMPTION FROM PERIOD TO PERIOD SHOULD
BE RE-INVESTED?.333

DOES THE NORMAL BUSINESS INVESTMENT HAVE A RANDOM COMPONENT?YES

YEAR	GNP	CONSUMPTION	INVESTMENT	GOV'T. EXP.
----	-----	-----	-----	-----
0	4.65000E+11	3.43000E+11	1.00000E+10	1.12000E+11
1	4.26771E+11	3.04668E+11	1.00025E+10	1.12100E+11
2	3.88622E+11	2.79620E+11	-3.29849E+09	1.12300E+11
3	3.67908E+11	2.54625E+11	8.83005E+08	1.12400E+11
4	3.54477E+11	2.41053E+11	9.23935E+08	1.12500E+11
5	3.50012E+11	2.32253E+11	5.15860E+09	1.12600E+11
6	3.48810E+11	2.29328E+11	6.78220E+09	1.12700E+11
7	3.50575E+11	2.28540E+11	9.23503E+09	1.12800E+11
8	3.52299E+11	2.29697E+11	9.70215E+09	1.12900E+11
9	3.54436E+11	2.30826E+11	1.06095E+10	1.13000E+11
10	3.56365E+11	2.32226E+11	1.10390E+10	1.13100E+11
11	3.56676E+11	2.33491E+11	9.98527E+09	1.13200E+11
12	3.57383E+11	2.33694E+11	1.03885E+10	1.13300E+11

DONE

TITLE:

RISK ANALYSIS IN CAPITAL INVESTMENT

DESCRIPTION:

The evaluation of a capital investment project starts with the principle that the productivity of capital is measured by the rate of return we expect to receive over some future period. A dollar received next year is worth less to us than a dollar in hand today. Expenditures three years hence are less costly than expenditures of equal magnitude two years from now. For this reason we cannot calculate the rate of return realistically unless we take into account (a) when the sums involved in an investment are spent and (b) when the returns are received.

Comparing alternative investments is thus complicated by the fact that they usually differ not only in size but also in the length of time over which expenditures will have to be made and benefits returned.

It is these facts of investment life that long ago made apparent the shortcomings of approaches that simply averaged expenditures and benefits, or lumped them, as in the number-of-years-to-pay-out method. These shortcomings stimulated students of decision making to explore more precise methods for determining whether one investment would leave a company better off in the long run than would another course of action.

It is not surprising, then, that much effort has been applied to the development of ways to improve our ability to discriminate among investment alternatives. The focus of all of these investigations has been to sharpen the definition of the value of capital investments to the company. The controversy and furor that once came out in the business press over the most appropriate way of calculating these values has largely been resolved in favor of the discounted cash flow method as a reasonable means of measuring the rate of return that can be expected in the future from an investment made today.

Thus we have methods which, in general, are more or less elaborate mathematical formulas for comparing the outcomes of various investments and the combinations of the variables that will affect the investments.¹ As these techniques have progressed, the mathematics involved has become more and more precise, so that we can now calculate discounted returns to a fraction of a percent.

**SPECIAL
CONSIDERATIONS:**

Analysis of the sort advocated by Hertz in "Risk Analysis in Capital Investment," (Harvard Business Review, January-February 1964) can be performed using this program. This documentation contains excerpts from the article; permission to reprint has been granted by the publishers.

¹ See for example, Joel Dean, Capital Budgeting (New York, Columbia University Press, 1951); "Return on Capital as a Guide to Managerial Decisions," National Association of Accounts Research Report No. 35, December 1, 1959; and Bruce F. Young, "Overcoming Obstacles to Use of Discounted Cash Flow for Investment Shares," NAA Bulletin, March 1963, p. 15.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

DESCRIPTION: (continued)

Summary of New Approach

After examining present methods of comparing alternative investments, Mr. Hertz reports on his firm's experience in applying a new approach to the problem. Using this approach, management takes the various levels of possible cash flows, return on investment, and other results of a proposed outlay and gets an estimate of the odds for each potential outcome.

Currently, many facilities decisions are based on discounted cash flow calculations. Management is told, for example, that Investment X has an expected internal rate of return of 9.2%, while for Investment Y a 10.3% return can be expected.

By contrast, the new approach would put in front of the executive a schedule which gives him the most likely return from X, but also tells him that X has 1 chance in 20 of being a total loss, 1 in 10 of earning from 4% to 5%, 2 in 10 of paying from 8% to 10%, and 1 chance in 50 of attaining a 30% rate of return. From another schedule he learns what the most likely rate of return is from Y, but also that Y has 1 chance in 10 of resulting in a total loss, 1 in 10 of earning from 3% to 5% return, 2 in 10 of paying between 9% and 11%, and 1 chance in 100 of 30%.

In this instance, the estimates of the rates of return provided by the two approaches would not be substantially different. However, to the decision-maker with the added information, Investment Y no longer looks like the clearly better choice, since with X the chances of substantial gain are higher and the risks of loss lower.

Two things have made this approach appealing to managers who have used it:

1. Certainly in every case it is a more descriptive statement of the two opportunities. And in some cases it might well reverse the decision, in line with particular corporate objectives.
2. This is not a difficult technique to use, since much of the information needed is already available - or readily accessible - and the validity of the principles involved has, for the most part, already been proved in other applications.

The enthusiasm with which managements exposed to this approach have received it suggests that it may have wide application. It has particular relevance, for example, in such knotty problems as investments relating to acquisitions or new products, and in decisions that might involve excess capacity.

INSTRUCTIONS:

The program will first ask how many trials (iterations) you want. Each trial simulates one possible set of outcomes. Since each takes some time, it is a good idea to limit the analysis to forty or fifty trials, at least at first.

The program will ask if you want price, sales, and operating costs to be interdependent. If you say NO, each will be drawn "randomly", without regard to the values drawn for the other two. If you say YES, they will be determined together. One draw will be made: if price and operating costs are especially high, the share of market will be especially low, and vice-versa.

The program will also ask if you want to select the output format. If you say NO, the program will summarize the possible rates of return from -15% to +30%, in ranges of 5%. If you say YES, the program will allow you to select the ranges to be used.

The program will next request three estimates for each of nine factors. These have the following interpretations:

- | | |
|----------------------|--|
| "low value: | there should be roughly 9 chances out of 10 that the actual value will exceed this estimate. |
| "most likely" value: | this is the best single estimate of the actual value |
| "high" value: | there should be roughly 1 chance out of 10 that the actual value will exceed this estimate |

Given this information, the program will perform the desired number of simulations and provide the requested summary information.

Warning: If the number of trials is not large, the results may depend to a considerable extent on the particular "draws" made during the simulation.

RUN

RUN
GRISKA

RISK ANALYSIS PROGRAM

HOW MANY ITERATIONS (TRIALS) DO YOU WANT?40

DO YOU WANT PRICE, SALES AND OPERATING COSTS
TO BE INTERDEPENDENT?YES

DO YOU WANT TO SELECT THE OUTPUT FORMAT?YES

RATE OF RETURN RANGE --

FROM (%)?-10

TO (%)?+40

INTERVAL WIDTH (%)?5

FOR EACH FACTOR, ENTER THREE ESTIMATES --

LOW, MOST LIKELY, HIGH

INVESTMENT (IN DOLLARS)?900,1000,1100

MARKET SIZE (IN UNITS)?800,1000,1200

SELLING PRICE (IN DOLLARS)?.90,1.00,1.10

MARKET GROWTH RATE (% PER YEAR)?-10,0,10

SHARE OF MARKET (%)?40,50,60

RESIDUAL VALUE OF INVESTMENT (IN DOLLARS)?0,100,200

OPERATING COSTS (IN DOLLARS PER UNIT)?.35,.50,.65

FIXED COSTS (IN DOLLARS PER YEAR)?40,50,60

USEFUL LIFE (IN YEARS)?9,10,11

AVERAGE CASH FLOWS

YEAR 1	209.55
YEAR 2	218.00
YEAR 3	227.16
YEAR 4	237.11
YEAR 5	247.94
YEAR 6	259.73
YEAR 7	272.59
YEAR 8	286.62
YEAR 9	326.03
YEAR 10	172.21
YEAR 11	37.11

AVERAGE TOTAL INVESTMENT = 999.433

EXPECTED PAYBACK PERIOD: 3 TO 4 YEARS

EXPECTED RATE OF RETURN (%): 18.4275

RATE OF RETURN (%)		PROB.	PROB. R IS GREATER
FROM	TO		
-----	-----	-----	-----
BELOW	-10	0	1
-10	-5	0.000	1.000
-5	0	0.025	0.975
0	5	0.000	0.975
5	10	0.250	0.725
10	15	0.125	0.600
15	20	0.200	0.400
20	25	0.200	0.200
25	30	0.075	0.125
30	35	0.050	0.075
35	40	0.025	0.050
ABOVE	40	.05	0.000

FACTOR	AVERAGE VALUE
INVESTMENT (IN DOLLARS)	999.43
SELLING PRICE (IN DOLLARS)	1.00
MARKET GROWTH RATE (% PER YEAR)	2.80
SHARE OF MARKET (%)	49.55
RESIDUAL VALUE OF INVESTMENT (IN DOLLARS)	107.86
OPERATING COSTS (IN DOLLARS PER UNIT)	0.51
FIXED COSTS (IN DOLLARS PER YEAR)	49.84
USEFUL LIFE (IN YEARS)	9.87

DONE

CONTRIBUTED PROGRAM **BASIC**GSTKVL
36545

TITLE:

STOCK VALUATION

DESCRIPTION:

The program computes the present value of a stock, based on alternative assumptions about the growth rates for dividends and earnings, the terminal price/earnings ratio, and the relevant rate of discount.

INSTRUCTIONS:

The user must include data statements, beginning at line 1000, indicating for each of a number of time segments:

- a) the growth rate in dividends per share
- b) the payout ratio
- c) the final period of the segment

The program will request:

- a) the current earnings per share
- b) a range of terminal price/earnings ratios to be analyzed
- c) a range of returns (discount rates) to be analyzed

The ranges will be divided into equally spaced values and a table of implied present values for the stock printed.

Example

Florida Power has averaged about 9% growth in EPS over the past few years. We assume that eventually this unusually rapid growth will slow. Presumably at that time Florida Power's P/E ratio will drop to that of a "non-growth" utility (currently 10 to 13) and the firm will probably be paying out about 70% of earnings in dividends; the current payout ratio is 55%. Based on this and other information, suppose we make the following projections:

<u>Time Period</u>	<u>EPS Growth Rate</u>	<u>Payout Ratio</u>
Next 5 years	8%	.60
Years 6 - 10	6%	.65

Furthermore, we assume that in year 10, Florida Power shares will sell at 10 to 13 times earnings. Latest 12 month EPS are \$2.94. High grade bonds are yielding around 8%. The attached example run shows how to find the prices we could pay for Florida Power stock and earn annual returns of between 8 and 15 percent over the next 10 years, assuming our forecasts are valid.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

RUN
GSTKVL

HAVE YOU ENTERED YOUR DATA STATEMENTS?NO

EACH CASE REQUIRES THE FOLLOWING DATA --
 THE NUMBER OF SEGMENTS
 THEN, FOR EACH SEGMENT --
 THE GROWTH RATE IN DIVIDENDS PER SHARE
 PAYOUT RATIO
 FINAL PERIOD OF THE SEGMENT

ENTER DATA STATEMENTS BEGINNING AT LINE 1000
 FOR MULTIPLE RUNS, SIMPLY PROVIDE ADDITIONAL SETS OF DATA
 AFTER DATA STATEMENTS HAVE BEEN ENTERED, RE-RUN THE PROGRAM

DONE
 1000 DATA 2, .06, .6, 5, .06, .65, 10
 RUN
 GSTKVL

HAVE YOU ENTERED YOUR DATA STATEMENTS?YES

CURRENT EARNINGS/SHARE?2.94

GROWTH RATES --
 PERIOD 1 .06
 PERIOD 2 .06

RANGE OF TERMINAL P/E RATIOS --
 LOW?10
 HIGH?13
 RANGE OF RETURNS DESIRED (DECIMAL) --
 LOW?.08
 HIGH?.15

RETURN	----- P/E RATIO -----			
	10	11	12	13
.08	40.7778	43.2166	45.6553	48.0941
.0975	35.5739	37.6506	39.7272	41.8038
.115	31.1527	32.9254	34.6982	36.471
.1325	27.3835	28.9007	30.4178	31.9349
.15	24.1597	25.4611	26.7626	28.064

CODES FOR NEXT TASK:
 0: ALL NEW DATA
 1: SAME CURRENT EPS, NEW PROJECTIONS
 2: NEW EPS, SAME PROJECTIONS
 3: STOP
 NEXT TASK?3

DONE

GTHOR
36553**TITLE:**

SECURITIES EPS GROWTH

DESCRIPTION:

This program finds the number of years of constant growth in earnings per share required to justify the current price of a stock. It also provides the present values of the dividends and terminal share price for one less year of growth.

INSTRUCTIONS:

All input is from the terminal. The program asks the user to enter the growth rate, the current share price, earnings per share, initial growth rate in EPS, number of years of declining growth, discount rate, and current payout ratio.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

RUN

RUN
GTHOR

DO YOU WANT INSTRUCTIONS?YES

THIS PROGRAM FINDS THE NUMBER OF YEARS OF CONSTANT GROWTH IN EARNINGS PER SHARE REQUIRED TO JUSTIFY THE CURRENT SHARE PRICE. YOU MUST SPECIFY THE INITIAL GROWTH RATE IN EPS AND THE NUMBER OF YEARS DURING WHICH THIS GROWTH RATE WILL DECLINE TO 4 PERCENT (OR .04) PER YEAR.

IN ADDITION TO PROVIDING THE NUMBER OF YEARS OF CONSTANT GROWTH REQUIRED AT THE RATE YOU SPECIFY, THE PROGRAM ALSO PROVIDES THE PRESENT VALUES OF THE DIVIDENDS AND TERMINAL SHARE PRICE FOR ONE LESS YEAR OF GROWTH. THIS ENABLES YOU TO EXAMINE THE SENSITIVITY OF YOUR ASSUMPTIONS.

IN COMPUTING ANNUAL DIVIDENDS THE PROGRAM ASSUMES THAT THE PAYOUT RATIO WILL REMAIN AT ITS CURRENT LEVEL FOR FIVE YEARS AND THEN CHANGE GRADUALLY UNTIL IT REACHES .6 IN THE YEAR WHEN ANNUAL GROWTH IN EPS DROPS TO 4 PERCENT.

IF YOU WANT TO USE A FINAL GROWTH RATE OTHER THAN .04 TYPE IT (AS A DECIMAL); OTHERWISE TYPE .04
GROWTH RATE?.04

WHAT IS THE CURRENT SHARE PRICE?66
EARNINGS PER SHARE?2.87
INITIAL GROWTH RATE IN EPS (AS A DECIMAL)?.10
NUMBER OF YEARS OF DECLINING GROWTH?6
THE DISCOUNT RATE (AS A DECIMAL)?.12
THE CURRENT PAYOUT RATIO (AS A DECIMAL)?.48

YOUR INPUT IMPLIES A FINAL P/E RATIO OF 7.5
IF THIS IS NOT SATISFACTORY YOU MAY CHANGE IT BY TYPING ANOTHER P/E RATIO; OTHERWISE TYPE 0. VALUE?12

PRICE OF 66 ASSUMES 41 YEARS OF CONSTANT GROWTH IN EPS.
THE PRESENT VALUE(INTRINSIC VALUE) IS 59.1801
INTRINSIC VALUE FOR N1= 40 IS 58.7523
SHARE PRICE IN 46 YEARS= 2337.91

DO YOU WANT TO RUN MORE DATA?NO

DONE

GVPDQT
36554**TITLE:**

PLOTTING DATA

DESCRIPTION:

These two programs allow the user to plot data from the GPDQ data bases and/or his own data bases. GVPDQT uses a teletype for output, and VPDQ uses the Tektronix 4010 terminal for output. For further information about the files, see the descriptions contained in this documentation, and a similar program, GCHLIN, HP No. 36503A.

INSTRUCTIONS:

By and large, the programs provide the information required for their use. The user can select a fund from the GPDQF file, an index from the GPDQI file, a stock from the GPDQS file, or a record from a file in his own account named PDQP. Another file, STRING, whose entries form a subset of the ASCII character set, is also used by this program.

(continued on page 2)

**SPECIAL
CONSIDERATIONS:**

For detailed instructions for using the Tektronix 4010 display, see "Special Considerations" section of VSUB, HP No. 36558, page 3.

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

INSTRUCTIONS: (continued)

GPDQF

GPDQF is a file of data on quarterly prices and dividends paid by 100 open-end mutual funds. The funds were chosen randomly from those for which data were readily available for the period 1965-1970. For each quarter, the following information is given:

"opening price"

- net asset value per share as of the close of the market on the last trading day of the previous quarter.

"dividends"

- all dividends received by an investor who held one share at the beginning of the quarter; any other distributions that qualify as income are also included.

"ending price"

- the total value of the holdings of an investor who held one share at the beginning of the quarter. This includes the net asset value of the share (or shares, in the case of splits) at the close of the market on the last trading day of the quarter. It also includes the value of any distributions received during the quarter that qualify as capital gains.

Each fund is allocated one record on the file. Fund number 1 is on record 1; fund number 2 on record 2, etc. Each record contains 40 quarters of information, as follows:

opening price	1st quarter of 1st year
dividends	1st quarter of 1st year
closing price	1st quarter of 1st year
opening price	2nd quarter of 1st year
dividends	2nd quarter of 1st year
closing price	2nd quarter of 1st year

etc.

Any missing value is represented by -999.

Following the 120 data values on each record are:

- the first year for which data are given (e.g. 1963)
- the name of the fund (up to 20 characters)

This file uses the same format as GPDQI and GPDQS. The funds are listed as follows:

- 1 ABERDEEN FUND
- 2 AFFILIATED FUND INC.
- 3 AMERICAN BUSINESS SHARES INC.
- 4 AMERICAN INVESTORS FUND INC.
- 5 AMERICAN MUTUAL FUND INC.
- 6 ANCHOR - FUNDAMENTAL INVESTORS
- 7 ANCHOR - GROWTH FUND
- 8 ASSOCIATED FUND TRUST
- 9 AXE-HOUGHTON FUND A INC.
- 10 AXE-HOUGHTON FUND B INC.
- 11 AXE-HOUGHTON STOCK FUND INC.
- 12 AXE SCIENCE CORP.
- 13 BOSTON FUND INC.
- 14 BROAD STREET INVESTING CORP.
- 15 BULLOCK FUND LTD.
- 16 CENTURY SHARES TRUST
- 17 CHASE FUND OF BOSTON
- 18 CHASE SHAREHOLDERS TRUST OF BOSTON
- 19 CHEMICAL FUND INC.
- 20 COLONIAL FUND INC.
- 21 AMERICAN EXPRESS INCOME FUND INC.
- 22 AMERICAN EXPRESS INVESTMENT FUND INC.
- 23 AMERICAN EXPRESS STOCK FUND INC.
- 24 COMPOSITE BOND AND STOCK FUND
- 25 COMPOSITE FUND INC.

26 CONCORD FUND INC.
27 DE VEGH MUTUAL FUND INC.
28 DELAWARE FUND INC.
29 BULLOCK -- DIVIDEND SHARES INC.
30 DREYFUS FUND INC.
31 ENERGY FUND INC.
32 EQUITY FUND INC.
33 FIDELITY CAPITAL FUND INC.
34 FIDELITY FUND INC.
35 FINANCIAL INDUSTRIAL FUND
36 FLORIDA GROWTH FUND INC.
37 FOUNDERS MUTUAL FUND
38 GROUP SECURITIES INC. -- COMMON STOCK FUND
39 GROWTH INDUSTRY SHARES INC.
40 GUARDIAN MUTUAL FUND INC.
41 HAMILTON FUNDS INC. -- SERIES HDA
42 INCOME FUND OF BOSTON INC.
43 INVESTMENT COMPANY OF AMERICA
44 INVESTMENT TRUST OF BOSTON
45 INVESTORS RESEARCH FUND INC.
46 ISTEEL FUND INC.
47 JOHNSTON MUTUAL FUND INC.
48 KEYSTONE CUSTODIAN FUND B-1
49 KEYSTONE CUSTODIAN FUND B-2
50 KEYSTONE CUSTODIAN FUND B-4
51 KEYSTONE CUSTODIAN FUND K-1
52 KEYSTONE CUSTODIAN FUND K-2
53 KEYSTONE CUSTODIAN FUND S-1
54 KEYSTONE CUSTODIAN FUND S-2
55 KEYSTONE CUSTODIAN FUND S-3
56 KEYSTONE CUSTODIAN FUND S-4
57 KNICKERBOCKER FUND
58 KNICKERBOCKER GROWTH FUND INC.
59 LIFE INSURANCE INVESTORS INC.
60 LOOMIS-SAYLES MUTUAL FUND
61 MAGNA INCOME TRUST
62 MASSACHUSETTS INVESTORS GROWTH STOCK FUND
63 MASSACHUSETTS INVESTORS TRUST
64 MUTUAL SHARES CORP.
65 MUTUAL TRUST
66 NATIONAL INVESTORS CORP.
67 NATIONAL SECURITIES SERIES - BALANCE SERIES
68 NATIONAL SECURITIES SERIES -- BOND SERIES
69 NATIONAL SECURITIES SERIES -- DIVIDEND SERIES
70 NATIONAL SECURITIES SERIES -- PREFERRED STOCK SERIES
71 NATIONAL SECURITIES SERIES -- INCOME SERIES
72 NATIONAL SECURITIES SERIES -- STOCK SERIES
73 NATIONAL SECURITIES SERIES -- GROWTH STOCK SERIES
74 ONE WILLIAM STREET FUND INC.
75 OPPENHEIMER FUND INC.
76 PENN SQUARE MUTUAL FUND
77 PHILADELPHIA FUND INC.
78 PINE STREET FUND INC.
79 PIONEER FUND INC.
80 PRICE (T. ROWE) GROWTH STOCK FUND
81 PURITAN FUND INC.
82 PUTNAM (GEORGE) FUND
83 PUTNAM GROWTH FUND
84 SCUDDER STEVENS AND CLARK - BALANCED FUND
85 SCUDDER STEVENS AND CLARK - COMMON STOCK FUND
86 SIGMA INVESTMENT SHARES
87 SIGMA TRUST SHARES
88 SOUTHWESTERN INVESTORS INC.
89 SOVEREIGN INVESTORS INC.
90 STEIN ROE AND FARNHAM - BALANCED FUND
91 STEIN ROE AND FARHNAME - STOCK FUND
92 TWENTIETH CENTURY GROWTH INVESTORS
93 VALUE LINE FUND INC.
94 VALUE LINE INCOME FUND INC.
95 VALUE LINE SPECIAL SITUATIONS FUND
96 WALL STREET INVESTING CORP.
97 WASHINGTON MUTUAL INVESTORS FUND INC.
98 WELLINGTON FUND INC.
99 WHITEHALL FUND INC.
100 WISCONSIN FUND INC.

GPDQS

GPDQS is a file of quarterly prices and dividends for the thirty stocks used in 1971 to compute Jow-Jones' Industrial Average. For each quarter, the following information is given:

"opening price"

- this is the price of one share of the stock as of the close of trading on the last trading day of the previous quarter.

"dividends"

- this includes all dividends received during the quarter by a person who held one share at the beginning of the quarter. Any distribution treated as income is also included.

"closing price"

- this is the value of the holdings of an investor who held one share at the beginning of the quarter. The value is calculated as of the close of the last trading day in the quarter.

Each stock is allocated one record on the file. Stock number 1 is on record 1; stock 2 on record 2, etc. Each record contains 40 quarters of information as follows:

opening price	1st quarter of 1st year
dividends	1st quarter of 1st year
closing price	1st quarter of 1st year
opening price	2nd quarter of 1st year
dividends	2nd quarter of 1st year
closing price	2nd quarter of 1st year
etc.	

Any missing value is represented by -999.

Following the 120 data values on each record are:

- the first year for which data are given (e.g., 1963)
- the name of the stock (up to 20 characters)

The file uses the same format as GPDQI and GPDQF. The stocks are listed as follows:

1	ALLIED CHEMICAL
2	ALUMINUM COMPANY OF AMERICA
3	AMERICAN BRANDS
4	AMERICAN CAN COMPANY
5	AMERICAN TELEPHONE AND TELEGRAPH
6	ANACONDA
7	BETHLEHEM STEEL
8	CHRYSLER CORPORATION
9	DUPONT (E.I.) DE NEMOURS
10	EASTMAN KODAK
11	GENERAL ELECTRIC
12	GENERAL FOODS
13	GENERAL MOTORS
14	GOODYEAR TIRE AND RUBBER
15	INTERNATIONAL HARVESTER
16	INTERNATIONAL NICKEL COMPANY OF CANADA
17	INTERNATIONAL PAPER COMPANY
18	JOHNS-MANVILLE CORPORATION
19	OWENS-ILLINOIS
20	PROCTER AND GAMBLE
21	SEARS ROEBUCK
22	STANDARD OIL OF CALIFORNIA
23	STANDARD OIL OF NEW JERSEY
24	SWIFT AND COMPANY
25	TEXACO
26	UNION CARBIDE
27	UNITED AIRCRAFT
28	U.S. STEEL
29	WESTINGHOUSE ELECTRIC
30	WOOLWORTH (F.W.) COMPANY

GPDQI

GPDQI is a file of quarterly prices and dividends for 98 common stock indices published by Standard and Poor's and returns on 90-day Treasury bills. For each quarter, the following information is given:

"opening price"

- this is the value of the index as of the end of the previous quarter, as reported by Standard and Poor's.

"dividends"

- this is the value of dividends paid by the stocks in the index during the quarter, as reported by Standard and Poor's.

"closing price"

- this is the value of the index as of the end of the quarter, as reported by Standard and Poor's.

Each index is allocated one record on the file. Index number 1 is on record 1; index 2 on record 2, etc. Each record contains 120 numbers, as follows:

opening price	1st quarter of 1st year
dividends	1st quarter of 1st year
closing price	1st quarter of 1st year
opening price	2nd quarter of 1st year
dividends	2nd quarter of 1st year
closing price	2nd quarter of 1st year

Any missing value is represented by -999.

Following the 120 data values on each record are:

- the first year for which data are given (e.g., 1963)
- the name of the index (up to 20 characters)

For 90-day Treasury bills, the three values are:

"opening price"

- the average of the bid and ask prices at the end of the previous quarter for the 90-day bill expiring on the date nearest the end of the quarter (e.g., 98.8)

"dividends"

- zero

"closing price"

- 100

The file uses the same format as GPDQF and GPDQS. The indexes are listed as follows:

1	500 STOCKS
2	425 INDUSTRIALS
3	20 RAILS
4	55 UTILITIES
5	CAPITAL GOODS
6	CONSUMER PRODUCTS
7	HIGH GRADE
8	LOW PRICED
9	AEROSPACE
10	AIR TRANSPORT
11	ALUMINUM
12	AUTOMOBILE
13	AUTO PARTS
14	AUTO TRUCKS & PARTS
15	BREWERS
16	DISTILLERS
17	SOFT DRINKS
18	CEMENT
19	HEATING & PLUMBING

20 ROOFING & WALLBOARD
21 HOME FURNISHINGS
22 CHEMICALS
23 BITUMINOUS COAL
24 CONFECTIONERY
25 CONTAINERS - METAL & GLASS
26 CONTAINERS - PAPER
27 COPPER
28 DRUGS
29 ELECTRICAL EQUIPMENT
30 ELECTRICAL HOUSEHOLD APPLIANCES
31 ELECTRONICS
32 BUILDING MATERIALS COMPOSITE
33 FINANCE COMPANIES
34 SMALL LOAN
35 FOOD - BISCUIT BAKERS
36 FOOD - BREAD & CAKE
37 FOOD - CANNED
38 FOOD - CORN REFINERS
39 FOOD - DIARY PRODUCTS
40 FOOD - MEAT PACKING
41 FOOD - PACKAGED FOODS
42 GOLD MINING
43 LEAD & ZINC
44 MACHINE TOOLS
45 AGRICULTURAL MACHINERY
46 CONSTRUCTION & MATERIAL HANDLING
47 INDUSTRIAL MACHINERY
48 OIL WELL EQUIPMENT
49 SPECIALTY MACHINERY
50 STEAM GENERATING EQUIPMENT
51 METAL FABRICATING
52 METAL MISCELLANEOUS
53 MOTION PICTURES
54 OFFICE EQUIPMENT
55 CRUDE OIL PRODUCERS
56 INTEGRATED OILS - DOMESTIC
57 INTEGRATED OILS - INTERNATIONAL
58 PAPER
59 PUBLISHING
60 RADIO & TV BROADCASTERS
61 RADIO & TV MANUFACTURERS
62 RAILROAD EQUIPMENT
63 TEXTILES - SYNTHETIC FIBERS
64 DISCOUNT STORES
65 DEPARTMENT STORES
66 FOOD STORES
67 MAIL ORDER
68 VARIETY STORES
69 SHIPBUILDING
70 SHIPPING
71 SHOES
72 SOAPS
73 STEEL
74 SUGAR-BEET REFINERS
75 FOOD COMPOSITE
76 SUGAR-CAN REFINERS
77 SULPHUR
78 TEXTILES - APPAREL MAHUFACTURERS
79 TEXTILE PRODUCTS
80 TIRE & RUBBER
81 TOBACCO - CIGARETTE MANUFACTURERS
82 TOBACCO - CIGAR MANUFACTURERS
83 VEGETABLE OILS
84 VENDING MACHINES
85 ELECTRIC COMPANIES
86 NATURAL GAS DISTRIBUTORS
87 PIPELINES
88 TELEPHONE
89 BANKS - NEW YORK CITY
90 BANKS - OUTSIDE NEW YORK CITY
91 OIL COMPOSITE
92 INSURANCE - FIRE & CASUALTY
93 INSURANCE - LIFE
94 INVESTMENT COMPANIES
95 COSMETICS
96 ELECTRONIC MAJOR COMPANIES
97 HOLDING COMPANIES
98 TRUCKERS
99 90-DAY TREASURY BILLS

RUN

RUN
GVPDQT

ITEM (A-G, '?' FOR INFORMATION)??
 A) PRICE: STOCK PRICE/SHARE, INDEX LEVEL, FUND NAV/SHARE
 B) PRICE RETURN: PERCENTAGE CHANGE IN (A) PER QUARTER
 C) DIVIDEND
 D) DIVIDEND YIELD; QUARTERLY DIVIDEND/PRICE AT END OF PREVIOUS QUARTER
 E) RETURN: (B) + (C)
 F) CUMULATIVE VALUE WITH DIVIDENDS REINVESTED
 G) CUMULATIVE VALUE WITH DIVIDENDS IGNORED

ITEM (A-G, '?' FOR INFORMATION)?A
 FUND, INDEX, STOCK OR PORTFOLIO?INDEX
 NUMBER?1

DO YOU WANT TO PLOT ANYTHING ELSE?YES

ITEM (1-3, '?' FOR INFORMATION)??

1) THE SAME TYPE OF DATA FOR ANOTHER STOCK, INDEX, FUND OR PORTFOLIO
 2) A STRAIGHT-LINE TREND FIT TO THE DATA BY LEAST-SQUARES REGRESSION
 3) A MOVING AVERAGE OF THE DATA

ITEM (1-3, '?' FOR INFORMATION)?3

NUMBER OF QUARTERS FOR MOVING AVERAGE?4

REGULAR SCALE OR LOGARITHMIC?REGULAR

PRICE

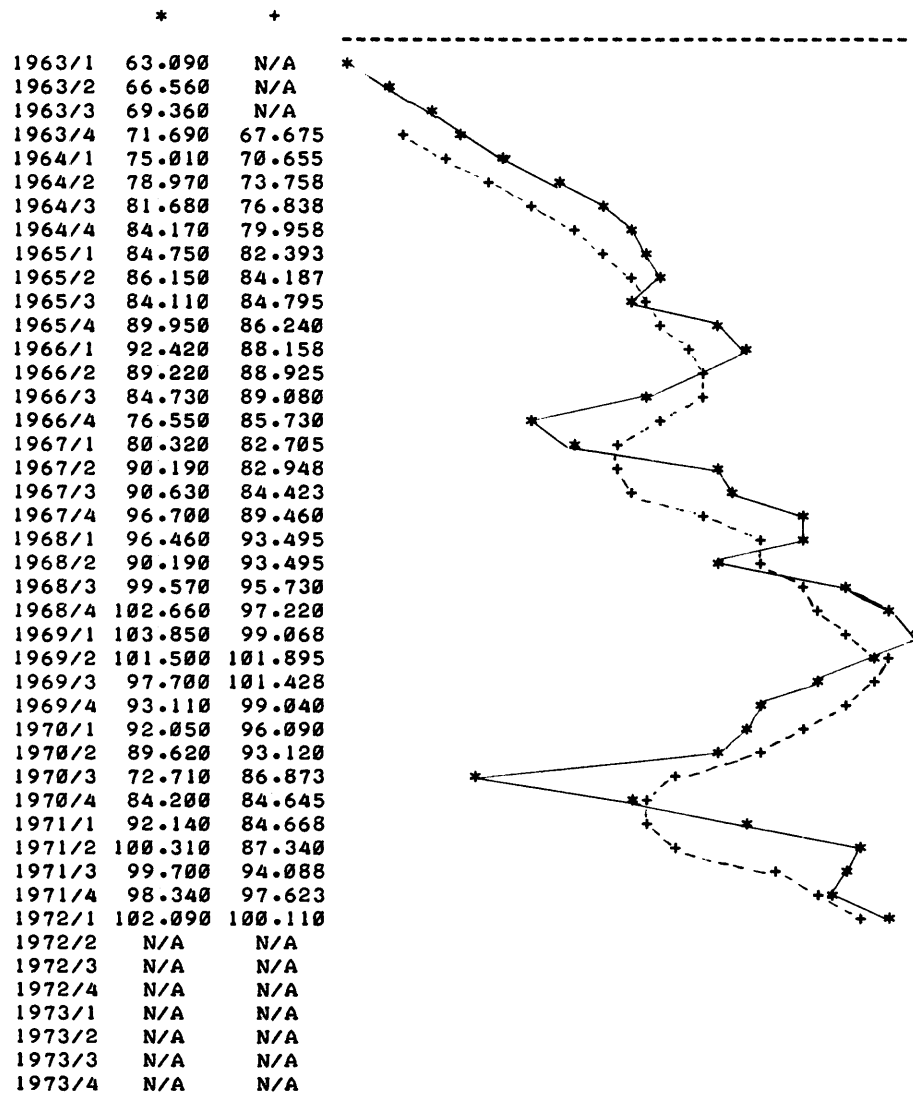
*: 500 STOCKS

+: MOVING AVERAGE

B: BOTH * AND +

MINIMUM VALUE = 63.09

MAXIMUM VALUE = 103.85



CONTRIBUTED PROGRAM **BASIC**IATA⁷¹
36164**TITLE:**

CALCULATE AIRFREIGHT RATES

DESCRIPTION:

IATA.1 calculates the weight breakpoints for a given commodity between any two airports based on: the minimum air waybill charge, the normal rate (under 100 pound rate), and the rates for each weight class within the commodity being rated. The resulting table is generated on the terminal based on data inputted from the keyboard or from the file AIRRAT. The program also provides for file maintenance (additions or deletions).

INSTRUCTIONS:

~~Open~~ ^{CREATE} two files: AIRRAT and RATAIR. Each record of the file holds approximately 3.5 sets of data. Therefore, if you open the files for 20 records, you should have room for 70 sets of rate data.

Limit your inputs as follows: Airport codes=3 letters, specific commodity=5 characters, commodity description=34 characters, date=6 characters (use format DDMMYY). This program consists of 3 sections: 1=data entry from keyboard, 2=data entry from file AIRRAT, 3=additions and/or deletions to file AIRRAT, and 4=terminate program.

Preparing a worksheet with all of the data required (as shown) to use the program beforehand would be advantageous to the user. The option of printing multiple copies may be equal to or less than other means of duplication.

The program is written so that new additions to the file are added after the last existing record on the file, therefore, if you add new rates first and then delete the existing old rates, the program will only delete the first set of data (based on the deletion parameters) encountered which should be the old rate data.

If the user attempts to use data which is not on the file, the program will advise that the record is not on file.

ACKNOWLEDGEMENTS:

Jeff Johnson
Hewlett-Packard/Eastern Sales Region

RUN

CRK OPEN-AIRRAT,10
 CRA OPEN-RATAIR,10

RUN
 IATA.1

INSTRUCTIONS?YES
 IATA.R CALCULATES BREAKPOINT WEIGHTS BASED ON DATA
 SUPPLIED BY THE USER(EITHER FROM THE KEYBOARD OR FILE
 AIRRAT) AND THEN PRINTS A TABLE SUITABLE FOR USE IN RATING,
 PREPARING AND CHECKING AIR WAYBILLS. LIMIT YOUR INPUTS AS
 FOLLOWS:AIRPORT CODES=3 LETTERS,SPECIFIC COMMODITY=5
 CHARACTERS,COMMODITY DESCRIPTION=34 CHARACTERS,DATE=6
 CHARACTERS(USE FORMAT DDMMYY). THIS PROGRAM CONSISTS OF 3
 SECTIONS:1=DATA ENTRY FROM KEYBOARD,2=DATA ENTRY FROM FILE
 AIRRAT,3=ADDITIONS AND/OR DELETIONS TO FILE AIRRAT,AND 4=
 TERMINATE PROGRAM. ENTER THE APPROPRIATE RESPONSE BELOW.
 SECTION (1,2,3,OR 4)?1
 # OF RATE CLASSES IN THIS COMMODITY =?4
 ORIGIN AIRPORT?JFK
 DESTINATION AIRPORT?VIE
 SPECIFIC COMMODITY?4316
 COMMODITY DESCRIPTION?DATA PROCESSING SYSTEM
 EFFECTIVE DATE OF RATES?1AUG0
 MINIMUM AIR WAYBIL CHARGE IN \$?22.00
 NORMAL RATE IN \$?1.51
 ENTER DATA AS REQUIRED
 RATE 1= \$?.54
 WEIGHT 1=?100
 RATE 2= \$?.40
 WEIGHT 2=?440
 RATE 3= \$?.31
 WEIGHT 3=?1100
 RATE 4= \$?.27
 WEIGHT 4=?2200
 HOW MANY COPIES?1

ORIGINATING AIRPORT.....JFK
 DESTINATION AIRPORT.....VIE
 SPECIFIC COMMODITY.....4316
 COMMODITY DESCRIPTION....DATA PROCESSING SYSTEM

ACT GROSS WT	CHARGEABLE WT	RATE/LB	CHARGES
-----	-----	-----	-----
1 TO 14	DECLARE AS MINIMUM		\$ 22.00
15 TO 35	ACTUAL	\$1.5100	AS EXTENDED
36 TO 100	100	\$0.5400	\$ 54.00
101 TO 325	ACTUAL	\$0.5400	AS EXTENDED
326 TO 440	440	\$0.4000	\$ 176.00
441 TO 852	ACTUAL	\$0.4000	AS EXTENDED
853 TO 1100	1100	\$0.3100	\$ 341.00
1101 TO 1916	ACTUAL	\$0.3100	AS EXTENDED
1917 TO 2200	2200	\$0.2700	\$ 594.00
2201 TO	ACTUAL	\$0.2700	AS EXTENDED

EFFECTIVE DATE OF RATES..1AUG0

MORE?NO
 SECTION (1,2,3,OR 4)?3
 ADD OR DELETE?ADD
 ENTER NEW DATA

N=?2
AS=?JFK
DS=?VIE
SS=?710W
CS=?LITERATURE
RS=?1AUG0
M =?22.00
O =?1.51
R1=??.37
W 1= ?100
R2=??.26
W 2= ?1100
DONE?YES
SECTION (1,2,3,OR 4)?4

DONE

TITLE: CALCULATES BREAKPOINT OF IATA CONTAINERS

DESCRIPTION: This program helps any potential user of IATA containers to evaluate his own breakpoint weight and volume for his particular commodity. The breakpoint weights and volume derived under the column headed- Revised- indicate the point at which the shipper will gain no advantage (except better security and lighter packaging) in utilizing a given container, assuming it would cost the user nothing additional to handle, load and unload the container. The program is designed as a simple tool to readily show any shipper interested in using an IATA container what his minimum weight and density of a given commodity must be before he can even consider utilizing IATA containers. In the sample run shown, he must have a minimum of 3267 lbs. with a density of at least 7.78 lbs/ft³ of Specific Commodity 8550 (Electronic Measuring Instruments) to justify using an IATA #3 container from JFK to GLA. This is the break-even point (if no additional costs are involved) at which shipping as a specific commodity or in a container are of equal cost.

INSTRUCTIONS: Limit the following input as shown:

Origin Airport	3 Characters
Destination Airport	3 Characters
Container #	3 Characters
Specific Commodity	5 Characters

Reference: Air Cargo Tariff-Worldwide, #47 dated 1 july 72
published by Swissair and Scandinavian Airlines System.

SPECIAL CONSIDERATIONS: None

ACKNOWLEDGEMENTS: Jeff Johnson
International Commercial Services East

RUN

RUN
IATA:C

INSTRUCTIONS?NO
US OR METRIC?US
ORIGIN AIRPORT?JFK
DESTINATION AIRPORT?GLA
CONTAINER #?3
CONTAINER VOLUME=?420
MINIMUM WEIGHT=?4409
MINIMUM CHARGE=?1176
SPECIFIC COMMODITY?8550
SPECIFIC COMMODITY RATE?.36

ANALYSIS OF BREAKEVEN POINT
FOR UTILIZING CONTAINERS VERSUS
SPECIFIC COMMODITY RATES
FROM JFK TO GLA
FOR IATA CONTAINER #3

	STANDARD	REVISED
VOLUME(CU. FT.)	420	420
MINIMUM CHARGE	\$1176.00	\$1176.00
MINIMUM WGT(LBS)	4409	3267
\$/LB RATE	\$.27	\$.36 (8550)
LBS/CU. FT.	10.50	7.78

MORE?YES
US OR METRIC?METRIC
ORIGIN AIRPORT?JFK
DESTINATION AIRPORT?GLA
CONTAINER #?7
CONTAINER VOLUME=?5.60
MINIMUM WEIGHT=?945
MINIMUM CHARGE=?558
SPECIFIC COMMODITY?8550
SPECIFIC COMMODITY RATE?.80

ANALYSIS OF BREAKEVEN POINT
FOR UTILIZING CONTAINERS VERSUS
SPECIFIC COMMODITY RATES
FROM JFK TO GLA
FOR IATA CONTAINER #7

	STANDARD	REVISED
VOLUME(CU. M)	5.60	5.60
MINIMUM CHARGE	\$ 558.00	\$ 558.00
MINIMUM WGT(KGS)	945	697
\$/KG RATE	\$.59	\$.80 (8550)
KGS/CU. M	169	125

MORE?NO

DONE

CONTRIBUTED PROGRAM **BASIC**IATATA
36876**TITLE:**

IATATA ANALYSIS OF IATA AND ATA UNITIZATION PROGRAM

DESCRIPTION:

IATATA is used in the analysis of the IATA and ATA Unitization (Container) Program. IATATA is structured so that a minimum amount of knowledge is required of the IATA and ATA Unitization Programs as established by the two airline groups. IATATA at the time of its completion (December 1973) is current in all IATA and ATA rules and regulations, with respect to each unitization program. It includes all container types in both programs.

INSTRUCTIONS:

Open two files IATAID (4 records long) and CONTNR (4 records long). Then load and run program LOADR. This program initializes the two files and after it is run it need not be saved. Next load and save IATATA.

IATA containers, IATA ID numbers 1 to 9 have several variations as follows:

P = Pallet with net only.

NSI = Non-Structural Igloo.

SI = Structural Igloo.

Therefore, to access the proper version of each container, indicate the full number such as 3NSI. The author designated IATA 8* so the difference could be shown between LD-1 and LD-3.

The following sample problems reflect some IATA and ATA container shipments. The shipper owned container comparisons do not reflect in the non-IATA or ATA shipments the cost of the equivalent cardboard container. Some IATA problems supplied courtesy of Mike Baumann, Manager Cargo Services Training, Pan American World Airlines and some ATA problems courtesy of Les Milligan, Area Manager Cargo Sales, Trans World Airlines.

SAMPLE PROBLEMS

It has been suggested that shipper owned containers may carry little or no cost value because of the fact they have been used many times. The author assumed in all cases the shipment was one direction only and the full cost of the container is included in the analysis.

Continued on Next Page.

**SPECIAL
CONSIDERATIONS:**REFERENCES

IATA Unitization Program -- a pamphlet issued 15 November 1972 by International Air Transport Association courtesy of Pan American World Airlines.

IATA Unit Load Devices Manual, First Edition -- issued by authority of Traffic Director, International Air Transport Assn. Geneva, Switzerland.

Cargo Air Tariff -- published by Air Canada, et. al., Amsterdam, The Netherlands.

Airline Cargo Tariff -- published by Scandinavian Airline System and Swissair.

CAB Tariff 131 -- issued by Airline Tariff Publishers Inc., Agent, Washington, D.C. on behalf of the U.S. Airlines.

ACKNOWLEDGEMENTS:

Jeff Johnson
HP International Commercial Services East

INSTRUCTIONS: Continued

Sample IATA Problems

1. You have 904 pounds of electronic measuring instruments (parts), Specific Commodity Rate 8550 JFK to STR which moves at \$.41/pound (in a 2200 pound consolidation). You wish to use a DSC-225 IATA registered container with actual tare of 96 pounds costing \$16.44 each. Evaluate.

See Sample RUN -- IATA Problem #1.

2. You have 1105 pounds of literature (Specific Commodity 7103W) and 572 pounds of electronic measuring instruments (8550) which will fit in an IATA 8 (LD-1) between JFK and AMS. The rate for literature is \$.31/pound and instruments is \$.48. The container rate is \$501.00 for 1676 pounds pivot with a rate of \$.26/pound over pivot. Actual tare weight of container is 285 pounds. Evaluate.

See Sample RUN -- IATA Problem #2.

3. You have 5926 pounds of machinery moving LAX to BKK which will fit in an IATA 5 container. The specific commodity rate per pound is \$1.13 whereas the container rate is \$3438.00 for the first 3638 pounds and an over pivot rate of \$.88/pound. The actual tare weight of the container is 550 pounds. Evaluate.

See Sample RUN -- IATA Problem #3.

4. You have 300 pounds of electronic parts (Specific Commodity 8550) which fit in a DSC-221 (COS) moving in a consolidation between SFO and SIN at \$.98/pound. The actual tare is 18 pounds. Cost of the container is \$5.44. Evaluate.

See Sample RUN -- IATA Problem #4.

5. You have 660 pounds of electronic parts (Specific Commodity 8550) and 440 pounds of General Cargo (Q) which fit in a C08 shipper owned container moving in a consolidation between SFO and SIN at \$.98/pound and \$1.55/pound respectively. The actual tare of the container is 93 pounds and costs \$16.66. Evaluate.

See Sample RUN -- IATA Problem #5.

Sample ATA Problems

1. You are shipping between SFO and JFK 100 pounds of printed matter (4915) at .234/pound and 22 pounds of general cargo at \$.52/pound which will fit in an E container costing \$5.44 with an actual tare of 18 pounds. The general cargo rate is .2775.

See Sample RUN -- ATA Problem #1.

2. Same shipment as in Problem #1 except the following changes:

100 pounds of 4915 at .234/pound.
82 pounds of General Cargo at .2854/pound.

See Sample RUN -- ATA Problem #2.

3. The following QD container shipments are SFO to JFK with an actual tare of 13 pounds and the container costs \$4.00 containing the weights shown of cast aluminum wheels (7616).

a.	Net Weight:	92
	Rate/Pound:	.2853
	General Cargo Rate:	.2775

b.	Net Weight:	187
	Rate/Pound:	.2775
	General Cargo Rate:	.2775

See Sample RUN -- ATA Problem #3.

4. Using a B container SFO to JFK costing \$50.00 with actual tare of 200 pounds containing 2000 pounds of printed matter (4915) at .2035 and 2000 pounds of cast aluminum wheels (7616) at .177.

See Sample RUN -- ATA Problem #4.

5. An A-3 container SFO to JFK containing 10,000 pounds of cast aluminum wheels (7616) at .1635 for which the first 3200 pounds in the container costs \$608.00 and the excess above is rated at .137/pound.

See Sample RUN -- ATA Problem #5.

INSTRUCTIONS: Continued

- An A-3 container SFO to JFK contains: 5,000 pounds 7616 at .1635/pound, 5,000 pounds of 0001 at .208/pound, and 2,000 pounds of general cargo at .223.

See Sample RUN -- ATA Problem #6.

- You have 4,000 pounds of floral stock (0625) at .117/pound and 3,500 pounds of grapes (0816) at .1355/pound loaded in an LD-7 moving SFO to JFK for which the base rate is \$595.00 for the first 3100 pounds and the over pivot rate is .137. The actual tare of the container is 550 pounds.

See Sample RUN -- ATA Problem #7.

RUN

GET-IATATA

RUN

IATATA

WOULD YOU LIKE A CONTAINER SUMMARY?YES

SUMMARY OF UNIT LOAD DEVICES

IATA				ATA(US)				
IATA ID	MIN CHARG WGT	TARE	EXT VOLUME	MAX GROSS WGT	ATA ID	MIN CHRG WGT	TARE	MAX GROSS WGT
1	13200	0	1280.0	25000	NONE	0	0	0
2	6297	1000	668.0	15000	NONE	0	0	0
2A	0	0	564.0	0	NONE	0	0	0
2B	0	0	463.0	0	NONE	0	0	0
3P	0	265	465.0	13300	A'S	0	0	0
3NSI	0	550	465.0	13300	A'S	0	0	0
3SI	0	550	465.0	13300	A'S	0	0	0
4P	0	230	365.0	10000	A'S	0	0	0
4NSI	0	500	365.0	10000	A'S	0	0	0
4ANSI	0	500	340.0	8000	A'S	0	0	0
5P	0	265	375.0	8300	LD-7	0	0	10200
5NSI	0	550	360.0	8300	LD-7	0	550	10200
5SI	0	550	350.0	8300	LD-9	0	685	10200
6P	0	0	265.0	5680	NONE	0	0	0
7*P	0	265	198.0	5000	NONE	0	0	0
7P	0	338	198.0	5250	NONE	0	0	0
7NSI	0	0	217.0	5250	NONE	0	0	0
8	0	280	170.0	3500	LD-1	1300	370	3500
8	0	280	162.4	3500	LD-P	1100	350	3500
8*	0	280	160.0	3500	LD-3	1100	340	3500
9P	0	280	160.0	2500	NONE	0	0	0
9NSI	0	280	167.0	2500	NONE	0	0	0
C01	0	565	377.0	10000	A'S	0	0	0
C02	0	480	320.0	10000	A'S	0	0	0
C03	0	293	195.0	6686	B	1800	200	5000
C04	0	277	184.0	6686	B	1800	200	5000
C05	0	241	160.0	4841	B	1800	200	5000
C06	0	225	150.0	4841	B	1800	200	5000
C07	841	142	94.5	4050	LD-N	0	100	2400
C08	551	93	61.9	3303	D	500	63	2000
C09	396	45	44.4	2666	NONE	0	0	0
C00	267	30	30.0	2666	NONE	0	0	0
COJ	565	96	63.4	3383	D	500	63	2000
COS	160	18	18.0	1691	E	130	18	500
VAR.	0	0	393.0	0	A-1	3000	0	13000
VAR.	0	0	457.5	0	A-2	3100	0	13000
VAR.	0	0	476.0	0	A-3	3200	0	13000
NONE	0	0	98.9	0	B-2	900	100	2500
NONE	0	0	12.0	0	QD	100	13	400
NONE	0	0	277.8	0	LD-5	2200	630	5000
NONE	0	0	340.0	0	LD-6	0	0	7000
NONE	0	0	256.6	0	LD-11	1800	0	7000

NOTE: 0 IN MINIMUM CHARGEABLE WEIGHT COLUMN INDICATES PIVOT WEIGHT VARIES BY TARIFF CONFERENCE (OR ORIGIN-DESTINATION COMBINATIONS). ZEROES IN VARIOUS OTHER FIELDS MEANS DATA NOT AVAILABLE OR NOT APPLICABLE. COJ AND COS CONTAINERS ARE FURTHER BROKEN DOWN INTO IATA REGISTRATION NUMBERS FOR VARIATION OF THESE TWO CATEGORIES. IF YOU ARE GOING TO WORK WITH THESE TYPES, MAKE SURE YOU ENTER THE CORRECT REGISTRATION NUMBER (I.E. DSC-221).

SAMPLE IATA PROBLEM No. 1

IATA OR ATA? IATA
 CONTAINER OR REGISTRATION NUMBER? DSC-225
 ACTUAL TARE WEIGHT OF CONTAINER? 96
 HOW MANY COMMODITIES? 1
 WGT 1=?904
 CONTAINER COST? 16.44
 RATE 1=? .41
 ORIGIN AIRPORT? JFK
 DESTINATION AIRPORT? STR

ANALYSIS OF SHIPPING IN SHIPPER OWNED IATA
 CONTAINERS VS. NORMAL PACKAGING
 FROM JFK TO STR
 USING DSC-225 CONTAINER

GROSS COST OF SHIPMENT OF 1000 LBS	\$ 410.00
PLUS CONTAINER COST	16.44
LESS CONTAINER REBATE	-16.20
LESS TARE WEIGHT ALLOWANCE	-39.36
NET COST OF SHIPMENT	370.88
COST IF NET CONTENTS ARE SHIPPED LOOSE	370.64
COST IF SHIPPED IN NON-IATA CONTAINER OF EQUAL TARE WEIGHT	410.00

SAMPLE IATA PROBLEM No. 2

MORE? YES
 IATA OR ATA? IATA
 CONTAINER OR REGISTRATION NUMBER? 8
 ELIGIBLE FOR SHIPPER OWNED CONTAINER DISCOUNT? NO
 MINIMUM CHARGEABLE NET WEIGHT? 1676
 ACTUAL TARE WEIGHT OF CONTAINER? 285
 HOW MANY COMMODITIES? 2
 WGT 1=?1105
 WGT 2=?572
 RATE 1=? .31
 RATE 2=? .48
 ORIGIN AIRPORT? JFK
 DESTINATION AIRPORT? AMS
 CONTAINER CHARGE? 501
 RATE/LB FOR EXCESS ABOVE PIVOT? .26

ANALYSIS OF SHIPPING IN AIRLINE OWNED IATA
 CONTAINER VS. SPECIFIC COMMODITY RATES
 FROM JFK TO AMS
 USING 8 CONTAINER

MINIMUM CHARGEABLE WEIGHT OF 1676 LBS	\$ 501.00
PLUS EXCESS OF 1 LBS	0.26
TOTAL CONTAINER COST	\$ 501.26
COST IF NET CONTENTS ARE SHIPPED LOOSE	\$ 617.11
SAVINGS OR LOSS(-)	\$ 115.85

SAMPLE IATA PROBLEM No. 3

MORE?YES
 IATA OR ATA?IATA
 CONTAINER OR REGISTRATION NUMBER?SNSI
 ELIGIBLE FOR SHIPPER OWNED CONTAINER DISCOUNT?NO
 MINIMUM CHARGEABLE NET WEIGHT?3638
 ACTUAL TARE WEIGHT OF CONTAINER?550
 HOW MANY COMMODITIES?1
 WGT 1=?5926
 RATE 1=?1.13
 ORIGIN AIRPORT?LAX
 DESTINATION AIRPORT?BKK
 CONTAINER CHARGE?3438
 RATE/LB FOR EXCESS ABOVE PIVOT?.88

ANALYSIS OF SHIPPING IN AIRLINE OWNED IATA
 CONTAINER VS. SPECIFIC COMMODITY RATES
 FROM LAX TO BKK
 USING SNSI CONTAINER

MINIMUM CHARGEABLE WEIGHT OF	3638 LBS	\$ 3438.00
PLUS EXCESS OF	2288 LBS	2013.44
TOTAL CONTAINER COST		\$ 5451.44
COST IF NET CONTENTS ARE SHIPPED LOOSE		\$ 6696.38
SAVINGS OR LOSS(-)		\$ 1244.94

SAMPLE IATA PROBLEM No. 4

MORE?Y
 IATA OR ATA?I
 CONTAINER OR REGISTRATION NUMBER?DSC-221
 ACTUAL TARE WEIGHT OF CONTAINER?18
 HOW MANY COMMODITIES?1
 WGT 1=?300
 CONTAINER COST?5.44
 RATE 1=?0.98
 ORIGIN AIRPORT?SFP-O
 DESTINATION AIRPORT?SIN

ANALYSIS OF SHIPPING IN SHIPPER OWNED IATA
 CONTAINERS VS. NORMAL PACKAGING
 FROM SFO TO SIN
 USING DSC-221 CONTAINER

GROSS COST OF SHIPMENT OF	318 LBS	\$ 311.64
PLUS CONTAINER COST		5.44
LESS CONTAINER REBATE		-4.00
LESS TARE WEIGHT ALLOWANCE		-17.64
NET COST OF SHIPMENT		295.44
COST IF NET CONTENTS ARE SHIPPED LOOSE		294.00
COST IF SHIPPED IN NON-IATA CONTAINER OF EQUAL TARE WEIGHT		311.64

SAMPLE IATA PROBLEM No. 5

MORE?Y
 IATA OR ATA?I
 CONTAINER OR REGISTRATION NUMBER?008
 DATA NOT ON FILE.
 IATA OR ATA?I
 CONTAINER OR REGISTRATION NUMBER?008
 DATA NOT ON FILE.
 IATA OR ATA?I
 CONTAINER OR REGISTRATION NUMBER?C08
 ELIGIBLE FOR SHIPPER OWNED CONTAINER DISCOUNT?YES
 ACTUAL TARE WEIGHT OF CONTAINER?93
 HOW MANY COMMODITIES?2
 WGT 1=?660
 WGT 2=?440
 CONTAINER COST?16.44
 RATE 1=?0.98
 RATE 2=?1.55
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?SIN

ANALYSIS OF SHIPPING IN SHIPPER OWNED IATA
 CONTAINERS VS. NORMAL PACKAGING
 FROM SFO TO SIN
 USING C08 CONTAINER

GROSS COST OF SHIPMENT OF 1193 LBS	\$1472.95
PLUS CONTAINER COST	16.44
LESS CONTAINER REBATE	-15.80
LESS TARE WEIGHT ALLOWANCE	-144.15
NET COST OF SHIPMENT	1329.44
COST IF NET CONTENTS ARE SHIPPED LOOSE	1328.80
COST IF SHIPPED IN NON-IATA CONTAINER OF EQUAL TARE WEIGHT	1419.94

SAMPLE ATA PROBLEM No. 1

MORE?Y
 IATA OR ATA?ATA
 CONTAINER NUMBER?E
 ACTUAL TARE WEIGHT OF CONTAINER?18
 HOW MANY COMMODITIES?2
 WGT 1=?100
 WGT 2=?22
 CONTAINER COST?5.44
 RATE 1=?0.234
 RATE 2=?0.52
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?JFK
 GENERAL CARGO RATE?.2775

ANALYSIS OF SHIPPING IN SHIPPER OWNED ATA
 CONTAINERS VS. NORMAL PACKAGING
 FROM SFO TO JFK
 USING E CONTAINER

GROSS COST OF SHIPMENT OF 130 LBS	\$ 36.07
PLUS CONTAINER COST	5.44
NET COST OF SHIPMENT	41.51
COST IF NET CONTENTS ARE SHIPPED LOOSE	34.84
COST IF SHIPPED IN NON-ATA CONTAINER OF EQUAL TARE WEIGHT	39.05

SAMPLE ATA PROBLEM No. 2

MORE?Y
 IATA OR ATA?A
 CONTAINER NUMBER?E
 ACTUAL TARE WEIGHT OF CONTAINER?18
 HOW MANY COMMODITIES?2
 WGT 1=?100
 WGT 2=?82
 CONTAINER COST?5.44
 RATE 1=?234
 RATE 2=?2854
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?JFK
 GENERAL CARGO RATE?.2775

ANALYSIS OF SHIPPING IN SHIPPER OWNED ATA
 CONTAINERS VS. NORMAL PACKAGING
 FROM SFO TO JFK
 USING E CONTAINER

GROSS COST OF SHIPMENT OF 164 LBS	\$ 45.51
PLUS CONTAINER COST	5.44
NET COST OF SHIPMENT	50.95
COST IF NET CONTENTS ARE SHIPPED LOOSE	46.80
COST IF SHIPPED IN NON-ATA CONTAINER OF EQUAL TARE WEIGHT	51.01

SAMPLE ATA PROBLEM No. 3

MORE?Y
 IATA OR ATA?ATA
 CONTAINER NUMBER?0D
 DATA NOT ON FILE.
 IATA OR ATA?ATA
 CONTAINER NUMBER?0D
 ACTUAL TARE WEIGHT OF CONTAINER?13
 HOW MANY COMMODITIES?1
 WGT 1=?92
 CONTAINER COST?4
 RATE 1=?2853
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?JFK
 GENERAL CARGO RATE?.2775

ANALYSIS OF SHIPPING IN SHIPPER OWNED ATA
 CONTAINERS VS. NORMAL PACKAGING
 FROM SFO TO JFK
 USING 0D CONTAINER

GROSS COST OF SHIPMENT OF 100 LBS	\$ 27.75
PLUS CONTAINER COST	4.00
NET COST OF SHIPMENT	31.75
COST IF NET CONTENTS ARE SHIPPED LOOSE	26.25
COST IF SHIPPED IN NON-ATA CONTAINER OF EQUAL TARE WEIGHT	29.96

MORE?Y
 IATA OR ATA?A
 CONTAINER NUMBER?QD
 ACTUAL TARE WEIGHT OF CONTAINER?13
 HOW MANY COMMODITIES?1
 WGT 1=?187
 CONTAINER COST?4
 RATE 1=?2775
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?JFK
 GENERAL CARGO RATE?.2775

ANALYSIS OF SHIPPING IN SHIPPER OWNED ATA
 CONTAINERS VS. NORMAL PACKAGING
 FROM SFO TO JFK
 USING QD CONTAINER

GROSS COST OF SHIPMENT OF 169 LBS	\$ 46.90
PLUS CONTAINER COST	4.00
NET COST OF SHIPMENT	50.90
COST IF NET CONTENTS ARE SHIPPED LOOSE	51.89
COST IF SHIPPED IN NON-ATA CONTAINER OF EQUAL TARE WEIGHT	55.50

SAMPLE ATA PROBLEM No. 4

MORE?Y
 IATA OR ATA?A
 CONTAINER NUMBER?B
 ACTUAL TARE WEIGHT OF CONTAINER?200
 HOW MANY COMMODITIES?2
 WGT 1=?2000
 WGT 2=?2000
 CONTAINER COST?50
 USING THE MIXED SHIPMENT RULE (RULE 12,C.A.B.131),YOU MAY INPUT RATES
 EQUAL TO 4000 LBS FOR EACH COMMODITY IN THE CONTAINER.
 RATE 1=?,-.2035
 RATE 2=?177
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?JFK
 DAYLIGHT OR REGULAR?REGULAR
 CONTAINER CHARGE?312
 RATE/LB FOR EXCESS ABOVE PIVOT?.137

ANALYSIS OF SHIPPING IN SHIPPER OWNED ATA
 CONTAINER VS. SPECIFIC COMMODITY RATES
 FROM SFO TO JFK
 USING B CONTAINER

MINIMUM CHARGEABLE WEIGHT OF 1800 LBS	\$ 312.00
PLUS EXCESS OF 2200 LBS	301.40
PLUS CONTAINER COST	50.00
TOTAL CONTAINER COST	\$ 663.40
MIXED SHIPMENT RULE COST	\$ 781.00
SAVINGS OR LOSS(-)	\$ 117.60

SAMPLE ATA PROBLEM No. 5

MORE?Y
 IATA OR ATA?A
 CONTAINER NUMBER?A-3
 ACTUAL TARE WEIGHT OF CONTAINER?550
 HOW MANY COMMODITIES?1
 WGT 1=?10000
 RATE 1=?1.1635
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?JFK
 DAYLIGHT OR REGULAR?REGULAR
 CONTAINER CHARGE?608
 RATE/LB FOR EXCESS ABOVE PIVOT?.137

ANALYSIS OF SHIPPING IN AIRLINE OWNED ATA
 CONTAINER VS. SPECIFIC COMMODITY RATES
 FROM SFO TO JFK
 USING A-3 CONTAINER

MINIMUM CHARGEABLE WEIGHT OF	3200 LBS	\$ 608.00
PLUS EXCESS OF	6800 LBS	931.60
TOTAL CONTAINER COST		\$ 1539.60
COST IF NET CONTENTS ARE SHIPPED LOOSE		\$ 1635.00
SAVINGS OR LOSS(-)		\$ 95.40

SAMPLE ATA PROBLEM NO. 6

MORE?Y
 IATA OR ATA?A
 CONTAINER NUMBER?A-3
 ACTUAL TARE WEIGHT OF CONTAINER?550
 HOW MANY COMMODITIES?3
 WGT 1=?5000
 WGT 2=?5000
 WGT 3=?2000
 USING THE MIXED SHIPMENT RULE (RULE 12,C.A.B.131),YOU MAY INPUT RATES
 EQUAL TO 12000 LBS FOR EACH COMMODITY IN THE CONTAINER.
 RATE 1=?1.1635
 RATE 2=?1.208
 RATE 3=?1.223
 ORIGIN AIRPORT?SFO
 DESTINATION AIRPORT?JFK
 DAYLIGHT OR REGULAR?REGULAR
 CONTAINER CHARGE?608
 RATE/LB FOR EXCESS ABOVE PIVOT?.137

ANALYSIS OF SHIPPING IN AIRLINE OWNED ATA
 CONTAINER VS. SPECIFIC COMMODITY RATES
 FROM SFO TO JFK
 USING A-3 CONTAINER

MINIMUM CHARGEABLE WEIGHT OF	3200 LBS	\$ 608.00
PLUS EXCESS OF	8800 LBS	1205.60
TOTAL CONTAINER COST		\$ 1813.60
MIXED SHIPMENT RULE COST		\$ 2183.50
SAVINGS OR LOSS(-)		\$ 369.90

SAMPLE ATA PROBLEM NO. 7

MORE?Y
IATA OR ATA?A
CONTAINER NUMBER?LD-7
MINIMUM CHARGEABLE NET WEIGHT?3100
ACTUAL TARE WEIGHT OF CONTAINER?550
HOW MANY COMMODITIES?2
WGT 1=?4000
WGT 2=?3500
USING THE MIXED SHIPMENT RULE (RULE 12,C.A.B.131),YOU MAY INPUT RATES
EQUAL TO 7500 LBS FOR EACH COMMODITY IN THE CONTAINER.
RATE 1=?117
RATE 2=?1355
ORIGIN AIRPORT?SFO
DESTINATION AIRPORT?JFK
DAYLIGHT OR REGULAR?REGULAR
CONTAINER CHARGE?595
RATE/LB FOR EXCESS ABOVE PIVOT?.137

ANALYSIS OF SHIPPING IN AIRLINE OWNED ATA
CONTAINER VS. SPECIFIC COMMODITY RATES
FROM SFO TO JFK
USING LD-7 CONTAINER

MINIMUM CHARGEABLE WEIGHT OF	3100 LBS	\$ 595.00
PLUS EXCESS OF	4400 LBS	602.80
TOTAL CONTAINER COST		\$ 1197.80
MIXED SHIPMENT RULE COST		\$ 867.25
SAVINGS OR LOSS(-)		\$ -330.55

MORE?N

DONE

CONTRIBUTED PROGRAM **BASIC**

INZOUT
36088

TITLE: INPUT/OUTPUT ANALYSIS ON ECONOMIC FLOWS

DESCRIPTION: A hypothetical economy is divided into a certain number of industries, and is analyzed as to the inter-industry flows of goods and services over a period of time. The analysis is based upon the data for a past period, and can be used to predict future flows under different conditions of consumer demand.

INSTRUCTIONS: In this example, the economy is divided into three industries. The number of industries, and their respective names, can be altered by changing the dim-statements and output routines. With the exception of these routines, the program is general, and will accept data for any 'M' number of industries.

Data is read in the following order:

The flows from: Industry #1 to Industry #1
Industry #1 to Industry #2
Industry #1 to Industry #3, etc. to #M
Industry #1 to the Final Consumer
Industry #2 to Industry #1
Industry #2 to Industry #2
Industry #2 to Industry #3, etc. to #M
Industry #2 to the Final Consumer
Industry #3 to Industry #1, etc. to #M
Industry #3 to the Final Consumer
...
Industry #M to the Final Consumer

This is followed by a revised forecast of consumer demand from Industry #1, Industry #2, Industry #3,...,Industry #M

In this example:
Industry #1 is Agriculture
Industry #2 is Industry
Industry #3 is Service

SPECIAL CONSIDERATIONS: INZOUT is restricted as written, to 3 industries. To increase this number, change dimensions in lines 9200, 9205 and 9210. A,B, and X must be M x M. T, V, and C must be M, and D must be 2M + 1. Also change the output routine.

ACKNOWLEDGEMENTS:

RUN

9900 DATA 25,12,8,75
 9901 DATA 15,75,65,99
 9902 DATA 10,51,88,34
 9903 DATA 82,85,40
 9999 END

RUN
 INZOUT

* INPUT/OUTPUT ANALYSIS *

INITIAL INPUT/OUTPUT TABLE:

FROM SECTOR	TO SECTOR			CONSUMERS TOTAL	
	AGRICULTURE	INDUSTRY	SERVICES		
AGRICULTURE	25	12	8	75	120
INDUSTRY	15	75	65	99	254
SERVICES	10	51	88	34	183
SECTOR INCOME	70	116	22	208	
TOTAL	120	254	183		557

REVISED INPUT/OUTPUT TABLE NUMBER 1 :

FROM SECTOR	TO SECTOR			CONSUMERS TOTAL	
	AGRICULTURE	INDUSTRY	SERVICES		
AGRICULTURE	26.7413	11.3027	8.31437	82	128.358
INDUSTRY	16.0448	70.642	67.5542	85	239.241
SERVICES	10.6965	48.0366	91.458	40	190.191
SECTOR INCOME	74.8757	109.26	22.8645	207	
TOTAL	128.358	239.241	190.191		557.791

DONE

TITLE:

NATIONAL INCOME & PRODUCT ACCOUNTS

DESCRIPTION:

INACNT produces a simple set of income and product accounts, dependent upon a number of input gross national product conditions.

INSTRUCTIONS:

In order to use INACNT, the user must know six statistics. They will be requested by input statements. They are:

- A = the fraction of GNP saved by business
- B = the fraction of GNP paid in tax by business
- C = the fraction of personal income paid in personal taxes
- D = the fraction of personal after-tax income spent on consumption

(above 4 values must be entered in decimal notation)

- I4 = dollars of GNP eventually invested
- G3 = dollars for GNP spent by government

(above 2 values must be entered in exponential form. Ex.: \$50 billion = 5E + 10.)

ACKNOWLEDGEMENTS:

RUN

GET-\$INACNT
RUN
INACNT

* NATIONAL INCOME & PRODUCT ACCOUNTS *

THIS PROGRAM PRODUCES A SIMPLE SET OF INCOME AND PRODUCT ACCOUNTS.

PLEASE ANSWER THE FOLLOWING QUESTIONS.

- 1. WHAT FRACTION OF GNP IS SAVED BY BUSINESS?.11
- 2. WHAT FRACTION OF GNP IS PAID IN TAX BY BUSINESS?.32
- 3. WHAT FRACTION OF PERSONAL INCOME IS PAID AS PERSONAL INCOME TAX?.3-21

4. WHAT FRACTION OF THE DISPOSABLE PERSONAL INCOME (I.E. AFTER-TAXES) IS SPENT ON CONSUMPTION?.93

HOW MUCH OF THE GNP IS INVESTED? (IN DOLLARS: EX.: 50 BILLION=5E+10).
?1.4E+11

HOW MUCH OF GNP IS SPENT BY THE GOVERNMENT ?(IN DOLLARS AS ABOVE.)
?2.7E+11

(DO YOU WISH A SENSITIVITY ANALYSIS ON ANY OF THE FIRST 4 INPUTS?)

?YES

WHICH INPUT? (1-4)?1

ENTER THE LOW VALUE, HIGH VALUE, STEP?.10,.12,.01

BUSINESS SAVINGS ARE 11 PERCENT OF GNP
 BUSINESS TAXES ARE 32 PERCENT OF GNP
 PERSONAL INCOME TAX IS 21 PERCENT OF PERSONAL INCOME
 PERSONAL CONSUMPTION IS 93 PERCENT OF DISPOSABLE PERSONAL INCOME

THE GNP MULTIPLIER IS 1.72052
 THE CONSUMPTION MULTIPLIER IS .720516
 THE TAX MULTIPLIER IS .756511

** RUN # 1 ;BUSINESS SAVING/GNP= .1 **

PRODUCTION SECTOR (ACT.#1)

PERSONAL INCOME.....	4.09139E+11	CONSUMPTION.....	3.00594E+11
BUSINESS TAXES.....	2.25732E+11	INVESTMENT.....	1.40000E+11
BUSINESS SAVING.....	7.05411E+10	GOV'T. SPENDING.....	2.70000E+11

GROSS NAT. PRODUCT..	7.05412E+11	GROSS NAT. PRODUCT..	7.05412E+11

PERSONAL SECTOR (ACT.#2)

PERSONAL TAXES.....	8.59191E+10	PERSONAL INCOME.....	4.09139E+11
CONSUMPTION.....	3.00594E+11		
PERSONAL SAVING.....	2.26254E+10		

PERSONAL INCOME.....	4.09139E+11	PERSONAL INCOME.....	4.09139E+11

GOVERNMENT SECTOR (ACT.#3)

INSTMT
36089

TITLE: INCOME STATEMENT

DESCRIPTION: INSTMT prints a simple income statement, and allows a sensitivity check on various input.

INSTRUCTIONS: Self-explanatory.
The following data must be entered before running INSTMT. These are all base year (1971) data entries:
9537 DATA amount of sales
9543 DATA cost of goods sold
9549 DATA cost of advertising
9555 DATA administrative expense
9561 DATA tax loss carry forward
All other DATA-statements remain undisturbed.

SPECIAL CONSIDERATIONS: None

ACKNOWLEDGEMENTS:

RUN

RUN
INSTMT

* INCOME STATEMENT *

THIS PROGRAM WILL PRINT A SIMPLE INCOME STATEMENT, AND WILL ALLOW A SENSITIVITY ANALYSIS ON VARIOUS INPUT.

DO YOU WISH TO USE AVERAGE OR INDIVIDUAL GROWTH RATES? (ENTER 'AVG' OR 'IND')?AVG

PLEASE ENTER THE FOLLOWING VALUES IN PERCENT:

PERCENT GROWTH IN SALES ?10
 PERCENT GROWTH IN COST OF GOODS SOLD?6
 PERCENT GROWTH IN ADVERTISING ?5
 PERCENT GROWTH IN ADMIN & GENERAL EX?8

INCOME STATEMENT
\$ IN THOUSANDS

YEARS	71	72	73	74	75
SALES	1000	1100	1210	1331	1464.1
-CG SOLD	500	530	561.8	595.51	631.24
- ADV	150	157.5	165.38	173.64	182.33
- ADM&GEN	100	108	116.64	125.97	136.05
=OPER INC	250	304.5	366.19	435.88	514.49
*TAX L.C.F.	50	0	0	0	0
- TAXES	89.5	139.66	169.27	202.72	240.45
=NET INCOME	160.5	164.84	196.92	233.16	274.03

PLEASE ENTER ONE OF THE FOLLOWING FOUR VALUES: 1) 'GROW' TO HAVE THE GROWTH PERCENTAGES LISTED; 2) 'PERCENT' TO HAVE THE PERCENTAGE RELATIONSHIPS OF THE ITEMS TO SALES LISTED; 3) 'YES' TO BE GIVEN THE OPTION TO CHANGE THE ORIGINAL INPUT PERCENTAGES AND RETRY; OR 4) 'NO' TO TERMINATE?PERCENT

PERCENT OF SALES

YEARS	71	72	73	74	75
SALES	100	100	100	100	100
-CG SOLD	50	48.18	46.43	44.74	43.11
- ADV	15	14.32	13.67	13.05	12.45
- ADM&GEN	10	9.82	9.64	9.46	9.29
=OPER INC	25	27.68	30.26	32.75	35.14
- TAXES	8.95	12.7	13.99	15.23	16.42
=NET INCOME	16.05	14.99	16.27	17.52	18.72

PLEASE ENTER ONE OF THE FOLLOWING FOUR VALUES: 1) 'GROW' TO HAVE THE GROWTH PERCENTAGES LISTED; 2) 'PERCENT' TO HAVE THE PERCENTAGE RELATIONSHIPS OF THE ITEMS TO SALES LISTED; 3) 'YES' TO BE GIVEN THE OPTION TO CHANGE THE ORIGINAL INPUT PERCENTAGES AND RETRY; OR 4) 'NO' TO TERMINATE?YES

PLEASE ENTER THE FOLLOWING FOUR PARAMETERS A LINE AT A TIME.

- 1)THE FACTOR YOU WISH TO ALTER: 'SAL' FOR SALES,'ADV' FOR ADVERTISING, 'CGS', OR 'ADM'.
- 2)ON THE NEXT LINE, THE YEAR YOU WANT THE NEW PERCENTAGE TO OCCUR: 72,73,74,75. ***NOTE: THE INITIAL PERCENTAGE WILL APPLY TO ALL OTHER YEARS UNLESS SPECIFICALLY CHANGED
- 3)THE NEW PERCENTAGE.
- 4)ON THE FOURTH LINE, 'YES' OR 'NO', INDICATING WHETHER YOU WISH TO CHANGE ANY OTHER FACTOR NOW.

?CGS
 ?74
 ?8
 ?NO

INCOME STATEMENT
 \$ IN THOUSANDS

YEARS	71	72	73	74	75
SALES	1000	1100	1210	1331	1464.1
-CG SOLD	500	530	561.8	606.74	643.15
- ADV	150	157.5	165.38	173.64	182.33
- ADM&GEN	100	108	116.64	125.97	136.05
=OPER INC	250	304.5	366.19	424.64	502.58
*TAX L.C.F.	50	0	0	0	0
- TAXES	89.5	139.66	169.27	197.33	234.74
=NET INCOME	160.5	164.84	196.92	227.31	267.84

PLEASE ENTER ONE OF THE FOLLOWING FOUR VALUES: 1) 'GROW' TO HAVE THE GROWTH PERCENTAGES LISTED; 2) 'PERCENT' TO HAVE THE PERCENTAGE RELATIONSHIPS OF THE ITEMS TO SALES LISTED; 3) 'YES' TO BE GIVEN THE OPTION TO CHANGE THE ORIGINAL INPUT PERCENTAGES AND RETRY; OR 4) 'NO' TO TERMINATE?NO

DONE

CONTRIBUTED PROGRAM **BASIC**LEASIN
36194**TITLE:**

LEASE INCOME

DESCRIPTION:

This program calculates annual lease income from (U) units at sales price (S) leased at lease rate (R) for lease period (L). It also sums the total income by year over (Y) years of lease operation.

INSTRUCTIONS:

Inputs are defined by program at RUN time.

**SPECIAL
CONSIDERATIONS:**

Lease period in years + number of years manufacturing product must be ≤ 50 . Else redimension arrays in #35.

ACKNOWLEDGEMENTS:

Richard T. Barck
Varian Data Machines

RUN

RUN
LEASIN

ON AN ANNUAL BASIS OF SHIPMENTS OVER 'Y' YEARS, THIS PROGRAM
WILL CALCULATE LEASE INCOME BASED ON A VARIABLE-LENGTH
PRODUCT LIFE (LEASE PERIOD).R. T. BARCK 5/17/71

LEASE PERIOD IN YEARS IS?5

WE WILL MANUFACTURE PRODUCTS FOR Y YEARS; Y =?6

ANNUAL SHIPMENTS IN UNITS BY YEAR FOR YEARS 1 TO 6 ARE

1	?17
2	?22
3	?25
4	?5-25
5	?22
6	?14

ENTER AVG SALES PRICE IN \$ 000 FOR EACH YEAR SYSTEMS ARE
INSTALLED AND FOR ALL YEARS SYSTEMS REMAIN ON LEASE

YEAR SALES PRICE

1	?32
2	?32
3	?29
4	?29
5	?29
6	?27.5
7	?27.5
8	?27
9	?26.5
10	?26.5
11	?26

ENTER AVG LEASE RATE IN % OF SALES PRICE PER MONTH (W/O SERVICE)
FOR EACH YEAR SYSTEMS ARE INSTALLED AND REMAIN ON LEASE

YEAR LEASE RATE

1	?2.6
2	?2.6
3	?2.6
4	?2.55
5	?2.55
6	?2.55
7	?2.5
8	?2.5
9	?2.5
10	?2.5
11	?2.5

ANNUAL INCOME FOR THIS PRODUCT WILL BE:

YEAR	INCOME
1	169.728
2	389.376
3	579.072
4	789.786
5	985.014
6	908.82
7	709.5
8	494.1
9	286.2
10	111.3
11	0

DONE

TITLE:

SIMPLE LOAN ANALYSIS

DESCRIPTION:

LENDER calculates the monthly interest charges and outstanding balance of a loan that must be paid off in one year or less.

INSTRUCTIONS:

Self-explanatory.

The following input values will be requested:

B = amount of loan

M = monthly payment

R = interest rate

**SPECIAL
CONSIDERATIONS:**

Loan must be payable within one year.

ACKNOWLEDGEMENTS:

RUN

GET-SLENDER
RUN
LENDER

* SIMPLE LOAN ANALYSIS *

THIS PROGRAM CALCULATES THE MONTHLY INTEREST CHARGES AND OUTSTANDING
BALANCE OF A LOAN THAT MUST BE PAID OFF IN ONE YEAR OR LESS.

WHAT IS THE AMOUNT OF THE LOAN?1000

WHAT IS THE MONTHLY PAYMENT?90

WHAT IS THE INTEREST RATE?7.5

MTH.	PAYMT INT.	APPLIED TO LOAN	BALANCE DUE
1	6.25	83.75	916.25
2	5.73	84.27	831.98
3	5.2	84.8	747.18
4	4.67	85.33	661.85
5	4.14	85.86	575.99
6	3.6	86.4	489.59
7	3.06	86.94	402.65
8	2.52	87.48	315.17
9	1.97	88.03	227.14
10	1.42	88.58	138.56
11	.87	89.13	49.43
12	.31	49.43	0.00

MONTHS TO PAYOFF LOAN: 12
TOTAL INTEREST CHARGES: 39.74

DO YOU HAVE ANOTHER CASE?YES

WHAT IS THE AMOUNT OF THE LOAN?12000

WHAT IS THE MONTHLY PAYMENT?1000

WHAT IS THE INTEREST RATE?8.5

LOAN CANNOT BE PAID OFF IN LESS THAN 1 YEAR.
INCREASE YOUR MONTHLY PAYMENT.

DO YOU HAVE ANOTHER CASE?NO

DONE

TITLE:

LEASE ANALYSIS AS DETERMINED BY THE LESSEE

DESCRIPTION:

LESSEE compares the advantages of leasing vs. purchasing equipment. Investment tax credit is considered and a sensitivity check is available, as is a cashflow diagram.

INSTRUCTIONS:

Values are required for the following variables, beginning in line 9900:

1. P = The purchase price of the equipment
2. T = The lessee's income tax rate
3. R1 = The interest rate on a loan, compounded semi-annually
4. R2 = The opportunity rate that can be earned, after taxes, on new investments, compounded semi-annually
5. M = The monthly rent, payable in advance
6. L = The depreciable life in years
7. S1 = The salvage value for tax purposes
8. S2 = Expected actual salvage value, must be less than P
9. E1 = Expenses of making the lease arrangement
10. E2 = Annual saving in expenses due to the lease
11. Y = The length of the lease in years
12. J = The length of the basic rental period
13. Z = 0 if no investment tax credit is taken, otherwise 1
14. X = The number of the variable for which a sensitivity analysis is to be done; 0 if no analysis; 1 if on purchase price; 2 if on income tax rate, etc.
15. X1 = The lowest value for the variable specified in 14
16. X2 = The highest value of the variable specified in 14

Do not remove the string data in lines 9990-9994.

**SPECIAL
CONSIDERATIONS:**

This program uses the Bower-Williamson Method of Lease Analysis.

ACKNOWLEDGEMENTS:

RUN
GET-LESSEE

9900 DATA 20000,.5,.055,.15,500,10,1000,2000,500,4000,10,10,1
9901 DATA 3,.12,.045

RUN
LESSEE

* LEASE/PURCHASE ANALYSIS *

HAS YOUR DATA ALREADY BEEN ENTERED?YES

DO YOU WANT THE SENSITIVITY ANALYSIS ONLY?NO

COMPARISON OF LEASE WITH PURCHASE

PURCHASE PRICE \$ 20000
TAX RATE .5
INTEREST RATE .055
OPPORTUNITY RATE .15
MONTHLY RENT \$ 500
DEPRECIABLE LIFE 10 YEARS
SALVAGE FOR TAX \$ 1000
EXPECTED SALVAGE \$ 2000
EXPENSE OF ARRANGING LEASE \$ 500
ANNUAL EXPENSE SAVING DUE TO LEASE \$ 4000
LEASE LENGTH 10 YEARS
BASIC RENTAL PERIOD 10 YEARS
SENSITIVITY ANALYSIS ON INTEREST RATE WITH A RANGE OF .12 TO
.045
INVESTMENT TAX CREDIT TO BE TAKEN \$ 1400.

DO YOU WANT TO SEE THE FLOWS?YES

YEAR	PAYMENT	DEPR	LOAN	OP'G FLO DIFF'CE WITH	BASIC CASH FLO SAVING WITH	BASIC CASH FLOW DISC. AT
1	6000	3455	1038	3500	1104	1027
2	6000	3109	951	4000	2970	2391
3	6000	2764	860	4000	3188	2221
4	6000	2418	764	4000	3409	2055
5	6000	2073	663	4000	3632	1895
6	6000	1727	555	4000	3859	1742
7	6000	1382	442	4000	4088	1597
8	6000	1036	323	4000	4321	1460
9	6000	691	196	4000	4556	1333
10	6000	345	63	2000	3296	834
TOTAL	60000.	19000	5855	37500.	34423.	16555

FINANCIAL ADVANTAGE OF LEASE: \$-26411.8

OPERATING ADVANTAGE OF LEASE: \$ 16552.4

NET ADVANTAGE OF LEASE: \$-9859.38

INTEREST RATE	SENSITIVITY ANALYSIS ON INTEREST RATE NET ADVANTAGE OF LEASE
.12	-1475.72
.1125	-2219.66
.105	-3014.65
.0975	-3863.75
.09	-4769.57
.0825	-5736.89
.075	-6767.32
.0675	-7866.06
.06	-9036.63
.0525	-10284.3
.045	-11611.7

DONE

LOAN
36226**TITLE:**

LOAN AMORTIZATION

DESCRIPTION:

This program amortizes a loan on a monthly basis and prints out a monthly and yearly report. The yearly report shows interest accumulated, payments to the principal, total paid and remaining balance. When the balance falls below the maximum allowable monthly payment (set by the user), the final payment is computed.

INSTRUCTIONS:

Follow the instructions given by the program. After each monthly payment is entered, the program prints out the amount of the monthly payment attributed to interest, the cumulative interest, amount attributed to the principal, cumulative principal payments, and principal balance due on the loan. Computations continue until the end of the year when a yearly report is printed out.

**SPECIAL
CONSIDERATIONS:**

None

ACKNOWLEDGEMENTS:

Henry H. Brus III

RUN

RUN
LOAN

INPUT STARTING MONTH # (FEB=2)?6
 MAXIMUM ALLOWABLE PAYMENT/MONTH?300
 AFTER THE FIRST ? INPUT PRINCIPAL AND INTEREST RATE
 AFTER EACH SUCCEEDING ? INPUT THE MONTHLY PAYMENT

INTEREST	CUM INTEREST	PAY TO PRINC	CUM PRINC PAY	BALANCE
?5505				
?? .045				
?150				
20.6437	20.6437	129.356	129.356	5375.64
?250				
20.1587	40.8024	229.841	359.198	5145.8
?25				
19.2968	60.0992	5.70324	364.901	5140.1
?0				
19.2754	79.3745	0	364.901	5159.37
?19				
19.3477	98.7222	0	364.901	5159.72
?300				
19.349	118.071	280.651	645.552	4879.07
?4000				
?-23				
?300				
18.2965	136.368	281.703	927.255	4597.37
YEAR	TOT PAY MADE	YEAR CUM INT	YEAR PRINC PAY	BALANCE
1	1044	136.368	927.255	4597.37
?100				
17.2401	153.608	82.7599	1010.02	4514.61
?43				
16.9298	170.538	26.0702	1036.09	4488.54
?99.5				
16.832	187.37	82.668	1118.75	4405.87
?42				
16.522	203.892	25.478	1144.23	4380.39
?76				
16.4265	220.318	59.5735	1203.81	4320.82
?54				
16.2031	236.521	37.7969	1241.6	4283.02
?18				
16.0613	252.583	1.93867	1243.54	4281.08
?21				
16.0541	268.637	4.94594	1248.49	4276.14
?0				
16.0355	284.672	0	1248.49	4292.17
?300				
16.0956	300.768	283.904	1532.39	4008.27
?299.9				
15.031	315.799	284.869	1817.26	3723.4
?176				
13.9627	329.762	162.037	1979.3	3561.36
YEAR	TOT PAY MADE	YEAR CUM INT	YEAR PRINC PAY	BALANCE
2	1229.4	193.394	1052.04	3561.36

?130				
13.3551	343.117	116.645	2095.94	3444.72
?29				
12.9177	356.034	16.0823	2112.02	3428.63
?250				
12.8574	368.892	237.143	2349.17	3191.49
?222				
11.9681	380.86	210.032	2559.2	2981.46
?10				
11.1805	392.04	0	2559.2	2982.64
?52				
11.1849	403.225	40.8151	2600.01	2941.83
?67				
11.0318	414.257	55.9682	2655.98	2885.86
?98				
10.822	425.079	87.178	2743.16	2798.68
?300				
10.495	435.574	289.505	3032.67	2509.17
?300				
9.4094	444.983	290.591	3323.26	2218.58
?250				
8.31969	453.303	241.68	3564.94	1976.9
?275				
7.41339	460.716	267.587	3832.52	1709.32

YEAR	TOT PAY MADE	YEAR CUM INT	YEAR PRINC PAY	BALANCE
3	1983	130.955	1853.23	1709.32

?215				
6.40994	467.126	208.59	4041.11	1500.73
?193.6				
5.62772	472.754	187.972	4229.08	1312.75
?300				
4.92283	477.677	295.077	4524.16	1017.68
?34				
3.81629	481.493	30.1837	4554.35	987.494
?200				
3.7031	485.196	196.297	4750.64	791.197
?201.16				
2.96699	488.163	198.193	4948.84	593.004
?96				
2.22376	490.387	93.7762	5042.61	499.227
?100				
1.8721	492.259	98.1279	5140.74	401.1
?171.22				
1.50412	493.763	169.716	5310.46	231.384
.867689	494.631	231.384	5541.84	0

YEAR	TOT PAY MADE	YEAR CUM INT	YEAR PRINC PAY	BALANCE
4	1743.23	33.9146	1709.32	0

41 PAYMENTS WERE MADE

DONE

TITLE: SECURITIES PORTFOLIO USING MARKOWITZ MODEL

DESCRIPTION: MARKOW computes the efficient securities portfolios according to the full covariance matrix Markowitz model.

INSTRUCTIONS: Input data should be entered beginning in line 9900, in the following order:

1. the number of securities
2. the lending rate (decimal notation)
3. the borrowing rate (decimal notation)
4. the expected returns for each security
5. the full covariance matrix
(this should be listed row by row. Note that it is a square matrix $n \times n$, where $n = \#$ of securities).

SPECIAL CONSIDERATIONS: If a storage problem should result, delete lines 9000-9030 and run. MARKOW is restricted to 15 securities. To increase this number, change the DIM-statement 9050, and the equivalent values in lines 9051-9054:

G9 >2N + 2
E9 >N + 2
A9, R9, H9 >N

ACKNOWLEDGEMENTS: Francois Carlhian
Babson College

RUN

GET-\$MARKOW
LIS-9900
MARKOW

```

9900 DATA 9
9901 DATA .045,.065
9910 DATA 2.84022E-02,.110011,4.77284E-03,6.33756E-02,6.14846E-02,3.05807E-02
9920 DATA -7.12097E-03,-5.32422E-03,.260657
9930 RFM FXAMPLE COVARIANCE MATRIX FOLLOWS:
9940 DATA 2.88445E-02,9.04635E-03,1.31019E-02,1.70099E-02
9951 DATA 1.57015E-02,1.85585E-02,2.78296E-02,3.10865E-02
9952 DATA 1.14316E-02,9.04635E-03,6.75625E-03,4.64437E-04
9953 DATA 1.37025E-02,8.90057E-03,5.1941E-03,4.64437E-04
9954 DATA 9.64282E-03,4.30107E-04,2.05413E-03,.010148
9955 DATA 1.55908E-02,9.31176E-03,4.03761E-03,1.70099E-02
9956 DATA 1.37025E-02,4.30107E-04,2.86772E-02,1.55314E-02
9957 DATA 1.14319E-02,1.28415E-02,2.95581E-02,-4.5765E-03
9958 DATA 1.57015E-02,8.90057E-03,2.05413E-03,1.55314E-02
9959 DATA 1.88851E-02,4.27909E-03,9.07786E-03,2.20021E-02
9960 DATA 1.85585E-02,.099266,5.1941E-03,.010148
9961 DATA 1.14319E-02,4.27909E-03,1.63099E-02,.021356
9962 DATA 1.93458E-02,-5.6284E-03,2.78296E-02,6.43849E-03
9963 DATA 1.55908E-02,1.28415E-02,9.07786E-03,.021356
9964 DATA 3.04166E-02,2.70716E-02,2.8313E-03,3.10865E-02
9965 DATA 1.49714E-02,9.31176E-03,2.95581E-02,2.20021E-02
9966 DATA .093458,2.70716E-02,4.04682E-02,8.28133E-03
9967 DATA 1.14316E-02,9.78117E-04,4.03761E-03,-4.5765E-03
9968 DATA 1.99266E-02,-5.68284E-03,2.8313E-03,8.28133E-03
9969 DATA 6.43849E-03,1.49714E-02,9.78117E-04,1.31019E-02
9970 DATA 4.86656E-02
9999 END

```

RUN
MARKOW

* SECURITIES PORTFOLIOS USING MARKOW CHAINS *

```

AS INPUT WE HAVE: 9 SECURITIES
                   4.5 PERCENT AS THE LENDING RATE
                   6.5 PERCENT AS THE BORROWING RATE

```

PORTFOLIO NUMBER 1

```

EXP RETURN: .260657 STD DEV: .217214 ASS INT: .113302
SLOPE OF THE E-V CURVE IS: .640382

```

STOCK NO	PERCENT	R	H
9	100	1	0

PORTFOLIO NUMBER 2

```

EXP RETURN: .13959 STD DEV: 7.41758E-02 ASS INT: 1.71583
SLOPE OF THE E-V CURVE IS:-6.98121E-03

```

STOCK NO	PERCENT	R	H
2	80.3653	.794987	-1.24143
9	19.6347	.205013	1.24143

DONE

BUSINESS AND MANUFACTURING APPLICATIONS (700)

CONTRIBUTED PROGRAM **BASIC**

MCOST
36709

TITLE:

COMPARE AND EVALUATE UP TO 1000 MORTGAGE PAYMENT
PLANS SIMULTANEOUSLY

DESCRIPTION:

Permits the user to easily compare and evaluate up to 1000 mortgage payment plans simultaneously.

The program computes monthly mortgage payments for various principal amounts, at different interest rates, over varying periods. Sample input:

Enter the amounts? 22000,24000
Enter the rates (percent)? 7.5
Enter the years? 20,25

From the above input, 4 mortgage payment plans will be calculated and printed with supplementary comparison information.

INSTRUCTIONS:

RUN 9100 for instructions.

ACKNOWLEDGEMENTS:

Babson College
Babson Park, Massachusetts

RUN

'SMCOST' PERMITS THE USER TO EASILY COMPARE AND EVALUATE UP TO 1000 MORTGAGE PAYMENT PLANS SIMULTANEOUSLY.

THE PROGRAM COMPUTES MONTHLY MORTGAGE PAYMENTS FOR VARIOUS PRINCIPAL AMOUNTS, AT DIFFERENT INTEREST RATES OVER VARYING PERIODS.

ENTER THE AMOUNTS? 22000,24000

ENTER THE RATES (PERCENT)? 7.5

ENTER THE YEARS? 20,25

FROM THE ABOVE INPUT, 4 MORTGAGE PAYMENT PLANS WILL BE CALCULATED AND PRINTED WITH SUPPLEMENTARY COMPARISON INFORMATION.

ENTER THE AMOUNTS?22000,24000

ENTER THE RATES(PERCENT)?7.5

ENTER THE YEARS?20,25

INTEREST RATE	NUMBER OF YEARS	MONTHLY PAYMENT	TOTAL INTEREST	DECREASE MONTHLY PAYMENT	INCREASE TOTAL INTEREST
---------------	-----------------	-----------------	----------------	--------------------------	-------------------------

AMOUNT = 22000

7.5	20	177.23	20535.6		
7.5	25	162.58	26773.7	14.65	6238.07

AMOUNT = 24000

7.5	20	193.34	22402.5		
7.5	25	177.36	29207.7	15.98	6805.16

DONE

TITLE:

MAKE-BUY DECISION ANALYSIS

DESCRIPTION:

MKBUY calculates the present value of the cost saving incurred by making a product as opposed to buying it. It also prints a cash flow summary for each method for each year involved.

INSTRUCTIONS:

The following values are required as input:

1. the cost to buy one item FOB
2. the cost to manufacture one item including direct materials and labor but not overhead
3. the initial investment
4. the life of the investment
5. the salvage value of the investment
6. the annual fixed costs of the investment (supervision and maintenance)
7. corporate tax rate in percent
8. local tax rate on extra investment
9. cost of capital
10. estimate of yearly demand for the item under consideration.

**SPECIAL
CONSIDERATIONS:**

Life of the investment must be less than 25 years.

ACKNOWLEDGEMENTS:

RUN

GET-\$MKBUY
 RUN
 MKBUY

* MAKE-BUY ANALYSIS *

THIS PROGRAM CALCULATES THE PRESENT VALUE OF THE COST SAVING INCURRED BY MAKING A PRODUCT AS OPPOSED TO BUYING IT.

FIRST WE WOULD LIKE TO ASK YOU A FEW QUESTIONS...

WHAT IS THE NAME OF YOUR COMPANY?HEWLETT-PACKARD CO.

WHAT IS THE NAME OF THE COMPONENT YOU ARE CONSIDERING MAKING OR BUYING?.2 PENCIL

*** ENTER ALL COSTS IN DOLLARS ***

1. WHAT IS THE COST TO BUY A .2 PENCIL FOB YOUR PLANT?.05

2. WHAT IS THE COST TO MANUFACTURE A .2 PENCIL IN YOUR PLANT INCLUDING DIRECT MATERIALS AND LABOR BUT NOT OVERHEAD?.04

3. WHAT IS THE INITIAL INVESTMENT (COST OF THE EXTRA MACHINERY THAT WOULD BE NEEDED TO MANUFACTURE .2 PENCILS)?L-10000

4. WHAT IS THE LIFE OF THE INVESTMENT IN YEARS?5

5. WHAT IS THE SALVAGE VALUE OF THIS INVESTMENT?0
 (NOTE: SUM-OF-THE-YEARS-DIGITS METHOD WILL BE USED TO DEPRECIATE THE INVESTMENT.

6. WHAT ARE THE ANNUAL FIXED COSTS (SUCH AS SUPERVISION AND MAINTENANCE)INVOLVED IN YOUR MAKING .2 PENCILS?2500

7. WHAT IS YOUR CORPORATE TAX RATE IN PERCENT??25

8. WHAT IS THE LOCAL TAX RATE ON THE EXTRA INVESTMENT IN DOLLARS PER THOUSAND?55

9. WHAT IS YOUR COST OF CAPITAL IN PERCENT??12

10. WHAT IS YOUR ESTIMATE OF THE YEARLY DEMAND FOR .2 PENCILS ?10000

THE PRESENT VALUE OF THE COST TO MAKE IS 15208.2
 THE PRESENT VALUE OF THE COST TO BUY IS 1206.96

HEWLETT-PACKARD CO. SHOULD BUY .2 PENCILS AT A SAVINGS OF 14001.2 DOLLARS.

**** THE FLOWS ****

YEAR	IF BUY*****		IF MAKE*****		***NET***
	EXPENSE	CASH FLOW	EXPENSE	CASH FLOW	CASH FLOW
1	0	0	0	9533.33	-9533.33
2	500	375	6600	1616.67	-1241.67
3	500	375	5786.67	1673.33	-1298.33
4	500	375	5010	1757.5	-1382.5
5	500	375	4270	1869.17	-1494.17
6	500	375	3566.67	2008.33	-1633.33

WOULD YOU LIKE TO SEE THE EFFECT OF CHANGING A VARIABLE?
(YES OR NO)?YES
WHAT IS THE NUMBER OF THE QUESTION TO WHICH YOU WOULD LIKE
TO CHANGE YOUR ANSWER?10
WHAT IS THE NEW VALUE?50000

THE PRESENT VALUE OF THE COST TO MAKE IS 19070.5
THE PRESENT VALUE OF THE COST TO BUY IS 6034.78

HEWLETT-PACKARD CO. SHOULD BUY .2 PENCILS AT A SAVINGS OF 13035.7
DOLLARS.

MORE CHANGES?YES
SAME QUESTION?NO
WHAT IS THE NUMBER OF THE QUESTION TO WHICH YOU WOULD LIKE
TO CHANGE YOUR ANSWER?3
WHAT IS THE NEW VALUE?1000

THE PRESENT VALUE OF THE COST TO MAKE IS 20263.4
THE PRESENT VALUE OF THE COST TO BUY IS 6034.78

HEWLETT-PACKARD CO. SHOULD BUY .2 PENCILS AT A SAVINGS OF 14228.6
DOLLARS.

MORE CHANGES?NO

DONE

MORGAG
36094

TITLE: MORTGAGE ANALYSIS

DESCRIPTION: MORGAG will find the missing parameter of the following four, given the remaining three: the rate charged on a mortgage, the life, the amount borrowed, and the monthly payment. It will also print a summary, either monthly or yearly, indicating the amount of interest, amount of payment, and outstanding balance for each period.

INSTRUCTIONS: Provide input from the teletype as requested.

ACKNOWLEDGEMENTS: Frank Cada
Hewlett-Packard/Loveland Division

RUN

RUN

* MORTGAGE ANALYSIS *

IF YOU WANT TO FIND:
THE RATE, TYPE '1'
THE LIFE, TYPE '2'
THE AMOUNT BORROWED, TYPE '3'
THE MONTHLY PAYMENT, TYPE '4'
WHICH DO YOU WANT?1

MORTGAGE LIFE: YEARS, MONTHS?3,0
AMOUNT TO BE BORROWED?3000
AMOUNT OF ONE MONTHLY PAYMENT?94.01
SETTLEMENT DATE (MO, YEAR)?10, 1971
TABLE LENGTH (YEARS)?4
ANNUAL OR MONTHLY SUMMMARY(1OR0)?1

MORTGAGE TERMS

NOMINAL ANNUAL RATE= 8.00051 %
LIFE OF MORTGAGE = 3 YEARS, 0 MONTHS
AMOUNT BORROWED = \$ 3000
MONTHLY PAYMENT = \$ 94.01

MORTGAGE TABLE

Table with 4 columns: YEAR, INTEREST, PRINCIPAL REPAYMENT, ENDING PRINCIPAL OUTSTANDING. Rows for years 1971, 1972, 1973, 1974.

DONE
RUN

* MORTGAGE ANALYSIS *

IF YOU WANT TO FIND:
THE RATE, TYPE '1'
THE LIFE, TYPE '2'
THE AMOUNT BORROWED, TYPE '3'
THE MONTHLY PAYMENT, TYPE '4'
WHICH DO YOU WANT?2

NOMINAL ANNUAL RATE IN PERCENT?8
AMOUNT TO BE BORROWED?3000
AMOUNT OF ONE MONTHLY PAYMENT?94.01
SETTLEMENT DATE (MO, YEAR)?10, 1971

TABLE LENGTH (YEARS)?4

ANNUAL OR MONTHLY SUMMARY(10R0)?1

MORTGAGE TERMS

NOMINAL ANNUAL RATE= 8 %
 LIFE OF MORTGAGE = 3 YEARS, 1 MONTHS
 AMOUNT BORROWED = \$ 3000
 MONTHLY PAYMENT = \$ 94.01

THE MORTGAGE LIFE HAS BEEN ROUNDED UP TO NEAREST MONTH

MORTGAGE TABLE

YEAR	INTEREST	PRINCIPAL REPAYMENT	ENDING PRINCIPAL OUTSTANDING
1971	39.51	148.51	2851.49
1972	194.39	933.73	1917.76
1973	116.88	1011.24	906.521
1974	33.57	906.521	0

DONE
 RUN

* MORTGAGE ANALYSIS *

IF YOU WANT TO FIND:

THE RATE, TYPE '1'

THE LIFE, TYPE '2'

THE AMOUNT BORROWED, TYPE '3'

THE MONTHLY PAYMENT, TYPE '4'

WHICH DO YOU WANT?3

NOMINAL ANNUAL RATE IN PERCENT?8.00051

MORTGAGE LIFE: YEARS, MONTHS?3,0

AMOUNT OF ONE MONTHLY PAYMENT?94.01

SETTLEMENT DATE (MO, YEAR)?10, 1971

TABLE LENGTH (YEARS)?4

ANNUAL OR MONTHLY SUMMARY(10R0)?1

MORTGAGE TERMS

NOMINAL ANNUAL RATE= 8.00051 %
 LIFE OF MORTGAGE = 3 YEARS, 0 MONTHS
 AMOUNT BORROWED = \$ 3000
 MONTHLY PAYMENT = \$ 94.01

MORTGAGE TABLE

YEAR	INTEREST	PRINCIPAL REPAYMENT	ENDING PRINCIPAL OUTSTANDING
1971	39.51	148.51	2851.49
1972	194.39	933.73	1917.76
1973	116.89	1011.23	906.531
1974	33.57	906.531	0

DONE

RUN

* MORTGAGE ANALYSIS *

IF YOU WANT TO FIND:
THE RATE, TYPE '1'
THE LIFE, TYPE '2'
THE AMOUNT BORROWED, TYPE '3'
THE MONTHLY PAYMENT, TYPE '4'
WHICH DO YOU WANT?4

NOMINAL ANNUAL RATE IN PERCENT?8.00051
MORTGAGE LIFE: YEARS, MONTHS?3,0
AMOUNT TO BE BORROWED?3000
SETTLEMENT DATE (MO, YEAR)?10, 1971
TABLE LENGTH (YEARS)?4
ANNUAL OR MONTHLY SUMMARY(10R0)?0

MORTGAGE TERMS

NOMINAL ANNUAL RATE= 8.00051 %
LIFE OF MORTGAGE = 3 YEARS, 0 MONTHS
AMOUNT BORROWED = \$ 3000
MONTHLY PAYMENT = \$ 94.0097

MORTGAGE TABLE

MONTH	BEGINNING PRINCIPAL OUTSTANDING	INTEREST	PRINCIPAL REPAYMENT
FOR THE CALENDAR YEAR 1971			
11	3000	20	74.0097
12	2925.99	19.51	74.4998
PRINCIPLE REPAYD DURING 1971		148.51	
INTEREST PAID DURING 1971			39.51
PRINCIPLE OUTSTANDING AT YEAR END = 2851.49			

-----,--

FOR THE CALENDAR YEAR 1972			
1	2851.49	19.01	74.9998
2	2776.49	18.51	75.4998
3	2700.99	18.01	75.9998
4	2624.99	17.5	76.5097
5	2548.48	16.99	77.0197
6	2471.46	16.48	77.5298
7	2393.93	15.96	78.0498
8	2315.88	15.44	78.5697
9	2237.31	14.92	79.0898
10	2158.22	14.39	79.6198
11	2078.6	13.86	80.1497
12	1998.45	13.32	80.6898

PRINCIPLE REPAID DURING 1972 933.727
INTEREST PAID DURING 1972 194.39
PRINCIPLE OUTSTANDING AT YEAR END = 1917.76

-----,--

FOR THE CALENDAR YEAR 1973			
1	1917.76	12.79	81.2198
2	1836.54	12.24	81.7697
3	1754.78	11.7	82.3098
4	1672.47	11.15	82.8598
5	1589.61	10.6	83.4097
6	1506.2	10.04	83.9698
7	1422.23	9.48	84.5298
8	1337.7	8.92	85.0898
9	1252.61	8.35	85.6597
10	1166.95	7.78	86.2298
11	1080.72	7.21	86.7997
12	993.917	6.63	87.3797

PRINCIPLE REPAID DURING 1973 1011.23
INTEREST PAID DURING 1973 116.89
PRINCIPLE OUTSTANDING AT YEAR END = 906.538

-----,--

FOR THE CALENDAR YEAR 1974			
1	906.538	6.04	87.9698
2	818.568	5.46	88.5497
3	730.018	4.87	89.1398
4	640.878	4.27	89.7397
5	551.139	3.67	90.3398
6	460.799	3.07	90.9397
7	369.859	2.47	91.5397
8	278.319	1.86	92.1497
9	186.17	1.24	92.7697
10	93.4	.62	93.3898
11	1.02081E-02	0	1.02081E-02

PRINCIPLE REPAID DURING 1974 906.538
INTEREST PAID DURING 1974 33.57
PRINCIPLE OUTSTANDING AT YEAR END = 0

DONE

CONTRIBUTED PROGRAM **BASIC**REP
36177

TITLE: DATA CENTER INVENTORY REPORT GENERATOR

DESCRIPTION: This package includes two programs REPort and INput which together allow the user to generate sorted listings of information in a data file. The sample RUN enclosed uses a data file of computer equipment on consignment to the Atlanta Data Center. The data file is created and maintained by INput. Each item in the file occupies one record on a fixed head disc. The maximum number of items is currently 180 but the program could be modified to the limits dictated by the system hardware (552 on 2000A, unlimited on 2000B or 2000C). Sorted listings are available for model numbers, status, location, date received, and sales discipline. The program uses string sorting (pair exchange).

INSTRUCTIONS: DATA CENTER INVENTORY REPORT GENERATOR (REP)

DATA CENTER INVENTORY MASTER DATA INPUT (IN)

DATA FILE (DUMPED BY "FILDUM")

1. Four files are involved in this package C1, C2, CSORT1, and CSORT2.
2. If data is not on system RUN FILREA, answer "1" to how many files and input data tape.
3. If data is on system GET and RUN "REP" or "IN" (see sample attached).

SPECIAL
CONSIDERATIONS:

Data file consists of the following information in order;

<u>VARIABLE NAME</u>	<u>TYPE</u>	<u>FIELD LENGTH</u>	<u>FUNCTION</u>
O	NUMERIC	10	ITEM # (ASSIGNED BY IN)
M\$	STRING	9	MODEL #
S\$	STRING	10	SERIAL #
U\$	STRING	10	STATUS
L\$	STRING	4	LOCATION CODE
P\$	STRING	5	LIST PRICE
R\$	STRING	8	DATE RECEIVED
H\$	STRING	8	DATE SHIPPED
B\$	STRING	3	MANUFACTURING DIV CODE
D\$	STRING	8	SALES DISCIPLINE
C\$	STRING	30	COMMENTS

ACKNOWLEDGEMENTS: Phil R. Carter
Hewlett-Packard/Southern Sales Region

RUN

GET-REP
 RUN
 REP

-----DATA CENTER INVENTORY-----
 REPORT GENERATOR PROGRAM

PLEASE SELECT A REPORT OPTION
 TO LIST FOR 1 MODEL # TYPE (1)-----
 TO LIST FOR 1 STATUS TYPE(2)-----
 TO LIST FOR 1 OFFICE TYPE (3)-----
 TO LIST BY DATE RECEIVED TYPE (4)-----
 TO LIST FOR 1 SALES DISCIPLINE TYPE (5)-
 -----?1

MODEL # (1 TO 10 CHARACTERS)-----?2100A
 STANDARD LIST IS BY SERIAL #. TO CHANGE THIS TYPE (NO)
 OTHERWISE (YES)?YES
 FOR SHORT FORM PRINTOUT TYPE (1) OTHERWISE (0)--?0

ITEM #	MODEL #	SERIAL #	STATUS	LOC	PRICE	RCDT	SHDT	MFDV
16	2100A	2	SOLD	ATL	10750	02/10/71	NA	22
**SALES DISCIPLINE	DP	NEW						
17	2100A	3	FOR SALE	DAL	10750	03/10/71	NA	22
**SALES DISCIPLINE	SYS	NEW						
18	2100A	4	RENTED	NOLA	10750	04/10/71	NA	22
**SALES DISCIPLINE	DP	U S STEEL						
15	2100A	9	FOR SALE	ATL	10750	11/10/71	NA	22
**SALES DISCIPLINE	DP	NEW						

 43000

DO YOU WANT ANOTHER MODEL # (YES OR NO)?YES
 MODEL # (1 TO 10 CHARACTERS)-----?2100A

STANDARD LIST IS BY SERIAL #. TO CHANGE THIS TYPE (NO)
 OTHERWISE (YES)?YES
 FOR SHORT FORM PRINTOUT TYPE (1) OTHERWISE (0)--?1

ITEM #	MODEL #	SERIAL #	STATUS	LOC	PRICE	RCDT	SHDT	MFDV
16	2100A	2	SOLD	ATL	10750	02/10/71	NA	22
17	2100A	3	FOR SALE	DAL	10750	03/10/71	NA	22
18	2100A	4	RENTED	NOLA	10750	04/10/71	NA	22
15	2100A	9	FOR SALE	ATL	10750	11/10/71	NA	22

 43000

DO YOU WANT ANOTHER MODEL # (YES OR NO)?NO
 DO YOU WANT ANOTHER REPORT (YES OR NO)---?YES
 REPORT # (1 TO 5)-----?2

STATUS DESIRED (USE ONE OF LIST)

- FACT. LOAN
- IN REPAIR
- RENTED
- SOLD
- OBS
- 1 WK DEMO
- 2 WK DEMO
- 3 WK DEMO
- FOR SALE

-----?SOLD

STANDARD LIST IS FOR 1 MODEL#

FOR ALL MODEL #'S TYPE 'ALL'--

FOR 1 MODEL # TYPE (1 TO 10 CHARACTERS)--

-----?AL0-L

FOR SHORT FORM PRINTOUT TYPE (1) OTHERWISE (0)--?1

ITEM #	MODEL #	SERIAL #	STATUS	LOC	PRICE	RCDT	SHDT	MFDV
12	12597A-002	NSN	SOLD	ATL	600	13/07/70	NA	22
16	2100A	2	SOLD	ATL	10750	02/10/71	NA	22

11350

DO YOU WANT ANOTHER STATUS (YES OR NO)---?YES---NO

DO YOU WANT ANOTHER REPORT (YES OR NO)---?YES
REPORT # (1 TO 5)-----?3

OFFICE NAME (USE STANDARD OFFICE CODE)---?DAL

STANDARD LIST IS FOR 1 MODEL#

FOR ALL MODEL #'S TYPE 'ALL'--

FOR 1 MODEL # TYPE (1 TO 10 CHARACTERS)--

-----?ALL

FOR SHORT FORM PRINTOUT TYPE (1) OTHERWISE (0)--?1

ITEM #	MODEL #	SERIAL #	STATUS	LOC	PRICE	RCDT	SHDT	MFDV
14	12597A-005	NSN	FOR SALE	DAL	600	21/07/71	NA	22
17	2100A	3	FOR SALE	DAL	10750	03/10/71	NA	22

11350

DO YOU WANT ANOTHER OFFICE (OFFICE NAME OR NO)--?NO

DO YOU WANT ANOTHER REPORT (YES OR NO)---?YEP
REPORT # (1 TO 5)-----?4

STANDARD LIST IS FOR 1 MODEL

TYPE MODEL # (1 TO 10 CHARACTERS)--?2100A

FOR SHORT FORM PRINTOUT TYPE (1) OTHERWISE (0)--?1

ITEM #	MODEL #	SERIAL #	STATUS	LOC	PRICE	RCDT	SHDT	MFDV
16	2100A	2	SOLD	ATL	10750	02/10/71	NA	22
17	2100A	3	FOR SALE	DAL	10750	03/10/71	NA	22
18	2100A	4	RENTED	NOLA	10750	04/10/71	NA	22
15	2100A	9	FOR SALE	ATL	10750	11/10/71	NA	22

43000

DO YOU WANT ANOTHER MODEL (YES OR NO)---?NO
DO YOU WANT ANOTHER REPORT (YES OR NO)---?YES
REPORT # (1 TO 5)-----?5

ENTER SALES DISCIPLINE (1 TO 8 CHARACTERS)---?SYS
STANDARD LIST IS FOR 1 MODEL#
FOR ALL MODEL #'S TYPE 'ALL'--
FOR 1 MODEL # TYPE (1 TO 10 CHARACTERS)--
-----?ALL
FOR SHORT FORM PRINTOUT TYPE (1) OTHERWISE (0)--?1

ITEM #	MODEL #	SERIAL #	STATUS	LOC	PRICE	RCDT	SHDT	MFDV
14	12597A-005	NSN	FOR SALE	DAL	600	21/07/71	NA	22
17	2100A	3	FOR SALE	DAL	10750	03/10/71	NA	22
19	2114B	13	OBS	ORL	10500	03/03/70	NA	22
20	2114B	13	OBS	ORL	10500	03/03/70	NA	22

32350

DO YOU WANT ANOTHER SALES DISCIPLINE(YES OR NO)--?NO
DO YOU WANT ANOTHER REPORT (YES OR NO)---?NO

DONE

TITLE:

SALES COMMISSION REPORT

DESCRIPTION:

Dependent upon a number of input conditions, SALES will print a monthly planning table for a salesman, with his base salary, incentive dollars, and prospective billing totals.

INSTRUCTIONS:

Self-explanatory

note only: "INITIAL REVENUE" means the initial sales price of a unit item that this salesman sells.

"BILLING" is total amount of sales for the salesman.

**SPECIAL
CONSIDERATIONS:**

None

ACKNOWLEDGEMENTS:

RUN

GET-**SALES**
RUN
SALES

* SALES COMMISSION PLANNING *

ENTER THE BASE ANNUAL SALARY, COMMISSION %, & MONTHLY QUOTA?5000,.20,10

ENTER EXPECTED NUMBER OF NEW ACCOUNTS PER MONTH?1

ENTER EXPECTED INITIAL REVENUE & RATE OF GROWTH?100,.10

WHAT IS THE BEGINNING MONTH OF THE ANALYSIS [1-12]?1

DO YOU WANT AN [ANNUAL] OR [MONTHLY] PRINTOUT?MONTHLY

BASE SALARY = \$ 5000
MONTHLY QUOTA = 10
BASED ON 1 NEW ACCOUNTS PER MONTH WITH AN INITIAL REVENUE
OF \$ 100 AND AN AVERAGE GROWTH OF 10 % PER MONTH, YOU CAN EXPECT:

MO NO.	BASE \$	INCENTIVE \$	TOTAL \$	MONTHLY BILLING	TOTAL BILLING
1	416.667	18	434.667	100	100
2	416.667	40	456.667	210	310
3	416.667	64.2	480.867	331	641
4	416.667	90.82	507.487	464.1	1105.1
5	416.667	120.102	536.769	610.51	1715.61
6	416.667	152.312	568.979	771.561	2487.17
7	416.667	187.743	604.41	948.717	3435.89
8	416.667	226.718	643.384	1143.59	4579.48
9	416.667	269.589	686.256	1357.95	5937.42
10	416.667	316.748	733.415	1593.74	7531.17
11	416.667	368.623	785.29	1853.12	9384.28
12	416.667	425.686	842.352	2138.43	11522.7

YEARLY TOTALS:

	BASE	INCENTIVE	TOTAL
PAYROLL =	5000	2280.54	7280.54

MONTHLY REVENUE AT END OF CALENDAR YEAR IS \$ 2138.43

TOTAL BILLINGS \$ 11522.7

TOTAL PAYROLL AS A PERCENT OF SALES: 63.1843

DONE

TITLE:

COMPOUND INTEREST

SAVING
36708**DESCRIPTION:**

This program calculates the amount of money that would accumulate after N years at an annual interest rate.

INSTRUCTIONS:

Variable are denoted as follows:

N = Period of years
R = Annual interest rate
T = Times compounded per year
P = Initial amount
D = Amount added at the beginning of each year

Note: That P and D are given in dollars
That N and T must be integers
That R is given as a percentage

ACKNOWLEDGEMENTS:

Babson College
Babson Park, Massachusetts

RUN

RUN
SAVING

THIS PROGRAM CALCULATES THE AMOUNT OF MONEY THAT
WOULD ACCUMULATE AFTER N YEARS AT AN ANNUAL INTEREST RATE
VARIABLES ARE DENOTED AS FOLLOWS

N = PERIOD OF YEARS

R = ANNUAL INTEREST RATE

T = TIMES COMPOUNDED PER-YEAR

P = INITIAL AMOUNT

D = AMOUNT ADDED AT THE BEGINNING OF EACH YEAR

NOTE* THAT P AND D ARE GIVEN IN DOLLARS

THAT N AND T MUST BE INTEGERS

THAT R IS GIVEN AS A PERCENTAGE

WHAT ARE P(\$),D(\$),N(INT),T(INT),R(%)

?1000,150,7,2,8

AFTER 7 YEARS, 1000 DOLLARS INVESTED AT 8
PERCENT COMPOUNDED 2 TIMES PER YEAR, WITH THE
ADDITION OF 150 DOLLARS PER YEAR, YIELDS A TOTAL
OF 2926.67 DOLLARS.

WRITE YES(1) TO CONTINUE OR NO (2)

?2

DONE

CONTRIBUTED PROGRAM **BASIC**STKINC
36096

TITLE:

STOCK MERGER INCENTIVE PROGRAM

DESCRIPTION:

STKINC prints a table for stock incentive estimates, including prospective prices and gains, for the consolidated earnings of two companies considering merging.

INSTRUCTIONS:

STKINC requires the use of a data file. This file is used only while the program is running, and it is sufficient to open the file directly before running STKINC, and then to kill it immediately after the program completion. The OPEN statement should read:

~~OPEN~~^{OPEN}-STKFLE, 25

Input information required includes internal growth rates and current before-tax earnings for both companies, an estimated external growth rate after merging, a price/earnings ratio, the number of outstanding shares of stock, both common and qualified, after merging, and expected growth rate of the number of shares.

The program is presently initialized for a base year of 1969.

To update to base year Y, enter:

```
9445 PRINT TAB(24); Y;TAB(36); Y+1; TAB(48); Y+2; TAB(60);  
9446 PRINT Y + 3  
9680 PRINT TAB(24); Y + 4; TAB(36); Y + 5; TAB(48); Y + 6  
9840 PRINT Y + X;  
9910 LET Y9 = Y + 1
```

ACKNOWLEDGEMENTS:

RUN

GET-~~S~~STKINC
~~OPEN~~-STKFLE,25
 RUN

STKINC
 * STOCK INCENTIVE PROGRAM (MERGER) *

THIS PROGRAM WILL PRINT A TABLE FOR STOCK INCENTIVE ESTIMATES, INCLUDING PROSPECTIVE PRICES AND GAINS, FOR A COMPANY CONSIDERING MERGING.

WHAT IS YOUR PRICE/EARNING RATIO? (ANSWER MUST BE > 1)?50

WHAT IS YOUR INTERNAL GROWTH RATE?10

WHAT IS YOUR COMPANY'S PRESENT BEFORE TAX EARNINGS?50000

WHAT IS THE INTERNAL GROWTH RATE OF THE COMPANY WITH WHICH YOU ARE CONSIDERING MERGING?12

WHAT IS THIS COMPANY'S PRESENT BEFORE TAX EARNINGS?65000

WHAT DO YOU EXPECT YOUR EXTERNAL GROWTH RATE TO BE AFTER MERGING?15

WHAT DO YOU EXPECT THE TOTAL NUMBER OF OUTSTANDING SHARES TO BE AFTER MERGING?100000

WHAT DO YOU EXPECT THE ANNUAL PERCENTAGE INCREASE IN THE NUMBER OF OUTSTANDING SHARES TO BE?5

	1969	1970	1971	1972
CO. A BT EARNINGS (INT. GROWTH % 10)	50000.	55000.	60500.	66550.
CO. B BT EARNINGS (INT. GROWTH % 12)	65000.	72800.	81536.	91320.4
CONSOLIDATED EARNINGS (NO EXTERNAL GROWTH)	115000.	127800.	142036.	157870.
EXT. GROWTH % 15		146970.	163341.	181551.
EARNINGS PER SHARE		1.4697	1.55563	1.64672
PRICE OF STOCK		73.485	77.7816	82.336
	1973	1974	1975	
CO. A BT EARNINGS (INT. GROWTH % 10)	73205.	80525.5	88578.	
CO. B BT EARNINGS (INT. GROWTH % 12)	102279.	114552.	128299.	
CONSOLIDATED EARNINGS (NO EXTERNAL GROWTH)	175484.	195078.	216877.	
EXT. GROWTH % 15	201806.	224339.	249408.	
EARNINGS PER SHARE	1.74328	1.84565	1.95418	
PRICE OF STOCK	87.164	92.2823	97.7089	

NOW PLEASE ENTER AN EARNOUT RATE?20

PLEASE ENTER THE NUMBER OF OUTSTANDING 'QUALIFIED' SHARES YOU EXPECT TO HAVE FOR EACH YEAR, AND THEIR PRICE:

1970 ?1000,100
 1971 ?1200,110

1972 ?1400,120
 1973 ?1500,130
 1974 ?1500,130
 1975 ?1500,130

YEAR	EARNOUT SHARES	QUALIFIED SHARES	PURCHASE PRICE	PROJECTED PRICE STOCK	GAIN
1970	19813.6	1000	100	73.485	1.42949E+06
1971	20965.4	1200	110	77.7816	3.13319E+06
1972	22182.4	1400	120	82.336	5.13125E+06
1973	23468.1	1500	130	87.164	7.46928E+06
1974		1500	130	92.2823	1.02104E+07
1975		1500	130	97.7089	1.33882E+07

DONE

TITLE:

STOCK RETURNS REPORT

DESCRIPTION:

STKRTN computes a matrix of returns for an investment in a stock. It then computes an average return for a purchase at the beginning of a year, selling at each of the following years' ends, and computes an average return for all possible holding periods. It also computes an average return, standard deviation, and coefficient of variance for different length holding periods.

INSTRUCTIONS:

Data can be entered from either the teletype as it becomes necessary, or internally with data-statements. The first question in the program will ask the user to indicate his choice. The following information is necessary if the data-statement option is chosen.

Beginning in Line 9900:

N = # of years involved

Y1 = first year for which data will be entered

D_k, P_k = for each year, the dividend per share, followed by the closing stock price for that year

If $N > 25$ change dim statement in line 9205 accordingly.

ACKNOWLEDGEMENTS:

RUN

GET-\$STKRTN
 RUN
 STKRTN

* STOCK RETURNS *

DO YOU WISH TO ENTER YOUR DATA FROM THE TELETYPE, OR INTERNALLY
 USING DATA-STATEMENTS? ('T' FOR TELETYPE, 'D' OTHERWISE)?T

FOR HOW MANY YEARS DO YOU WISH TO ENTER PRICE AND DIVIDEND DATA, REMEM-
 BERING THE NEED FOR A BASE YEAR?? (MAX # OF YEARS IS 25)?6

WHAT IS THE FIRST YEAR FOR WHICH YOU WISH TO ENTER DATA?1969

ENTER THE DIVIDEND PER SHARE AND THE CLOSING STOCK PRICE, SEPERATED
 BY A COMMA, FOR EACH OF THE FOLLOWING YEARS.

DPS, CSP

YEAR 1969 ?5.00, 50
 YEAR 1970 ?5.10, 55
 YEAR 1971 ?5.25, 60
 YEAR 1972 ?5.50, 75
 YEAR 1973 ?6.00, 80
 YEAR 1974 ?5.75, 85

RETURNS ON INVESTMENTS

TO	1970	1971	1972	1973
FROM				
1969	.202	.1945	.23774	.21693
1970		.18636	.25847	.22286
1971			.34166	.24392
1972				.14666
TO	1974			
FROM				
1969	.20248			
1970	.20263			
1971	.20905			
1972	.14072			
1973	.13437			

 AVERAGE RETURN FROM 1969 = .21073
 AVERAGE RETURN FROM 1970 = .21758
 AVERAGE RETURN FROM 1971 = .264877
 AVERAGE RETURN FROM 1972 = .14369
 AVERAGE RETURN FROM 1973 = .13437
 AVERAGE RETURN FOR ALL
 POSSIBLE HOLDING PERIODS = .209357

		AVERAGE RETURN	STANDARD DEVIATION	COEFF. VARIATION
FOR ALL 1	YR HOLDING PERIODS:	.20221	7.40077E-02	.365994
FOR ALL 2	YR HOLDING PERIODS:	.209402	4.62019E-02	.220637
FOR ALL 3	YR HOLDING PERIODS:	.223217	1.17153E-02	
5.24841E-02				
FOR ALL 4	YR HOLDING PERIODS:	.20978	7.14995E-03	
3.40831E-02				
FOR ALL 5	YR HOLDING PERIODS:	.20248	0	0
FOR ALL POSSIBLE HOLDING PERIODS:		.209357	5.16289E-02	.246607

DONE

STKSMO
36099**TITLE:**

EXPONENTIAL SMOOTHING AS A STOCK GUIDE

DESCRIPTION:

STKSMO uses exponential smoothing on past price data to provide a guide for the timing of buy and sell orders of a given stock.

INSTRUCTIONS:

STKSMO is designed to keep an internal record of the price history of a given stock. The first time it is used, the input data is smoothed exponentially to provide a list of price forecasts. At the completion of this first run the user is asked whether he will wish to use the results of this run at a future time. If he so chooses, he should copy the lines that are then provided, and re-save the program, perhaps under a new name for clarity. Then, the next time the program is run, the initial trends have already been determined, and any new data can be accepted, and acted upon more reliably. After this second and all subsequent runs, a message will be provided for each new period describing the buy or sell action which ought to be taken.

The data for the first run should simply be the actual price of the given stock for any N number of consecutive periods.

**SPECIAL
CONSIDERATIONS:**

100 periods of data per run is the maximum. Otherwise alter the dim-statements in lines 9025 and 9030.

ACKNOWLEDGEMENTS:

RUN

GET-\$STKSMO
 RUN
 STKSMO

* EXPONENTIAL SMOOTHING AS A STOCK GUIDE *

THIS PROGRAM USES EXPONENTIAL SMOOTHING OF PAST PRICE DATA TO PROVIDE
 A GUIDE FOR THE TIMING OF BUY AND SELL ORDERS.

TO ENTER THE DATA FOR THE STOCK YOU ARE CONSIDERING, TYPE THE DATA
 BEGINNING IN LINE 9900. NO MORE THAN 100 PERIODS MAY BE CONSIDERED.
 THEN TYPE: '9035 LET Q=1'
 'RUN'

DONE
 9900 DATA 100,102,104,105,106,106,107,108,109,110,111,112
 9035 LET Q=1
 RUN
 STKSMO

* EXPONENTIAL SMOOTHING AS A STOCK GUIDE *

FOR HOW MANY PERIODS DID YOU ENTER DATA?12

ENTER A SMOOTHING COEFFICIENT BETWEEN 0.1 AND 0.9?.75

```
*****
PERIOD      ACTUAL      ESTIMATED      ESTIMATED      PREDICTED
            PRICE        PRICE          GROWTH         PRICE FOR
                                   NEXT PERIOD

1           100         100.           1.99997        102.
2           102         102.           1.99997        104.
3           104         104.           1.99997        106.
4           105         105.062        1.43747        106.5
5           106         106.031        1.15622        107.187
6           106         106.074        .488251        106.562
7           107         106.973        .734344        107.707
8           108         107.982        .899139        108.881
9           109         108.993        .966156        109.959
10          110         109.997        .989365        110.987
11          111         110.999        .99678         111.996
12          112         112.           .999069        112.999
*****
```

DO YOU WISH TO USE THIS PROGRAM AS A CONTINUING AID FOR THE TIMING OF
 BUY AND SELL DECISIONS ON THIS SAME STOCK AT SOME FUTURE TIME?YES

WHAT IS THE NAME OF THIS STOCK?HEWLETT-PACKARD COMMON
 WHAT TIME PERIOD HAVE YOU USED THUS FAR??(EX:MAY 1,1969 TO MAY 1,1970)
 ?JANUARY, 1968 TO DECEMBER, 1968

THEN ENTER THE FOLLOWING LINES BEFORE SIGNING OFF:

```
'9035 LET Q=2'
'9286 LET X(X9) = 111.667 '
'9287 LET Y(Y9) = 111.334 '
'9288 LET A = .75 '
'9280 LET A$ = 'HEWLETT-PACKARD COMMON' '
'9281 LET B$ = 'JANUARY, 1968 TO DECEMBER, 1968' '
'KILL-STKSMO'
'SAVE'
```

DONE

```
9035 LET Q=2
9286 LET X(X9) = 111.667
9287 LET Y(Y9) = 111.334
9288 LET A = .75
9280 LET A$ = "HEWLETT-PACKARD COMMON"
9281 LET B$ = "JANUARY, 1968 TO DECEMBER -, 1968"
KILL-STKSMO
SAVE
```

RUN
STKSMO

* EXPONENTIAL SMOOTHING AS A STOCK GUIDE *

THIS PROGRAM IS BEING USED TO PROVIDE A GUIDE TO THE TIMING OF BUY
AND SELL ORDERS ON HEWLETT-PACKARD COMMON.

IT IS BASED UPON DATA FROM THE PERIOD: JANUARY, 1968 TO DECEMBER, 1968.

FOR HOW MANY ADDITIONAL PERIODS FOLLOWING THE LAST MARKET DATA
SHOWN DO YOU WISH TO ENTER DATA? 12

WHAT IS THE PRICE FOR PERIOD 1 ?112
WHAT IS THE PRICE FOR PERIOD 2 ?113
WHAT IS THE PRICE FOR PERIOD 3 ?114
WHAT IS THE PRICE FOR PERIOD 4 ?113
WHAT IS THE PRICE FOR PERIOD 5 ?112
WHAT IS THE PRICE FOR PERIOD 6 ?113
WHAT IS THE PRICE FOR PERIOD 7 ?112
WHAT IS THE PRICE FOR PERIOD 8 ?114
WHAT IS THE PRICE FOR PERIOD 9 ?115
WHAT IS THE PRICE FOR PERIOD 10 ?116
WHAT IS THE PRICE FOR PERIOD 11 ?117
WHAT IS THE PRICE FOR PERIOD 12 ?118

WHAT PERCENTAGE DIFFERENCE (EXPRESSED AS A DECIMAL) BETWEEN THE PRE-
DICTED AND ACTUAL PRICE WOULD YOU LIKE TO USE AS A SCREENING RATE
FOR THE BUY AND SELL ORDERS? .02

```
*****
PERIOD          ACTUAL      ESTIMATED      ESTIMATED      PREDICTED
                  PRICE         PRICE          GROWTH         PRICE FOR
                                      NEXT PERIOD

1                112           112.062        .437073        112.5
2                113           112.969        .718597        113.687
3                114           113.98         .89447         114.875
4                113           113.117       -.160172       112.957
5                112           112.06         -.698502       111.361
6                113           112.898        .223251       113.121
7                112           112.07        -.407227       111.663
8                114           113.854        .907425       114.761
9                115           114.985        1.04169       116.027
10              116           116.002        1.02663       117.028
11              117           117.002        1.0107        118.012
12              118           118.001        1.00365       119.004
*****
```

IN PERIOD 1 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 2 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 3 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 4 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 5 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 6 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 7 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 8 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 9 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 10 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 11 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

IN PERIOD 12 THE PREDICTED PRICE VARIES FROM THE ACTUAL PRICE BY
LESS THAN 2 PERCENT, AND NO BUY OR SELL ORDER IS INDICATED.

DO YOU WISH TO USE THIS PROGRAM AS A CONTINUING AID FOR THE TIMING OF
BUY AND SELL DECISIONS ON THIS SAME STOCK AT SOME FUTURE TIME?NO

THEN ENTER '9035 LET Q=0', 'KILL-STKSMO', AND 'SAVE' BEFORE SIGNING OFF.

DONE

9035 LET Q=0

KILL-STKSMO
SAVE

CONTRIBUTED PROGRAM **BASIC**STKVAL
36100**TITLE:**

STOCK VALUE AND EVALUATION REPORT

DESCRIPTION:

STKVAL calculates a stock's value as determined by its growth rate over a period of years, and determines whether it is advisable to purchase the stock or not.

INSTRUCTIONS:

It is assumed that at some point in the stock's life its earning's growth rate will approach 5 percent, a conservative estimate of the currently expected growth rate of our economy.

Before this long-term growth rate is reached, there will be a period of non-normal growth. This non-normal growth period may contain many shorter periods of differing growth rates. For each of these shorter periods, you will be asked to supply the ending year of the period, and the growth rate you expect for the stock during this period.

It is important to note that when you have reached the end of what you consider the non-normal period, you must enter .05 as the expected growth rate. Any year greater than the beginning year will suffice.

For initialization, note remark at line 9765.

The data item in line 9790 is the value of the first period under consideration. It is here initialized to the year 1969. By changing this value one can initialize the program to any year, or, if monthly or semi-annual periods are being considered, to any period ID number.

**SPECIAL
CONSIDERATIONS:**

The program is limited to a 50 year life. To increase this life, change the dimensions in lines 9025 and 9030.

ACKNOWLEDGEMENTS:

RUN

GET-\$STKVAL
 RUN
 STKVAL

* STOCK VALUE & EVALUATION *

THIS PROGRAM DETERMINES WHETHER A CERTAIN STOCK OUGHT TO BE INVESTED IN, DEPENDING ON CERTAIN INPUT CONDITIONS. IT ALSO PROVIDES A LIST OF THE STOCK'S VALUE AND PRICE FOR EACH PERIOD.

WHAT IS THE CURRENT MARKET VALUE OF THE STOCK UNDER CONSIDERATION?100

WHAT IS THE STOCK'S CURRENT EARNINGS PER PERIOD?10

WHAT DO YOU EXPECT THE NORMALIZED EARNINGS FOR THE NEXT PERIOD TO BE?20

WHAT IS THE CURRENT MARKET CAPITALIZATION RATE?.12

AND WHAT IS THE PAYOUT RATIO?.33

NOW PLEASE ENTER THE ENDING YEAR AND THE GROWTH RATE YOU EXPECT FOR EACH OF THE NON-NORMAL GROWTH PERIODS BEFORE THE STOCK SETTLES TO A STEADY 5% RATE.

(REMEMBER THE LAST ENTRY MUST INDICATE THE ATTAINMENT OF THE 5% RATE).

BEGINNING YEAR	ENDING YEAR	GROWTH RATE
1970	?1970,	2.00
1971	?1971,	1.75
1972	?1972,	1.50
1973	?1974,	1.25
1975	?1975,	1.00
1976	?1980,	.50
1981	?1985,	.25
1986	?1990,	.10
1991	?1991,	.05

1969 VALUES FOLLOW:

PRICE : \$ 100
 EARNINGS : \$ 10
 P/E RATIO : 10

```

-----
:                INTRINSIC VALUE = 114146.                :
:                                                         :
:   FROM THE INFORMATION YOU HAVE SUPPLIED,              :
:   AND SINCE THE INTRINSIC VALUE IS EXACTLY              :
:   127736. PERCENT ABOVE THE PRESENT PRICE :
:   I AM SURE THAT THIS STOCK SHOULD BE                   :
:   PURCHASED AT THIS TIME.                               :
:                                                         :
-----
  
```

DO YOU WANT A LIST OF VALUES IN FUTURE YEARS?YES

YEAR	EARNINGS	GROWTH RATE	CAPITALIZER	VALUE (BEGINNING OF YEAR)
1970	20	2	5707.28	114146.
1971	60	1.75	2130.61	127836.
1972	165	1.5	867.619	143157.
1973	412.5	1.25	388.561	160281.
1974	928.125	1.25	193.27	179379.
1975	2088.28	1	96.0591	200598.
1976	4176.56	.5	53.6281	223981.
1977	6264.84	.5	39.8223	249481.
1978	9397.27	.5	29.514	277351.
1979	14095.9	.5	21.8171	307532.
1980	21143.8	.5	16.0701	339784.
1981	31715.8	.25	11.779	373581.

1982	39644.7	.25	10.29	407944.
1983	49555.9	.25	8.95584	443815.
1984	61944.9	.25	7.76044	480719.
1985	77431.1	.25	6.68935	517964.
1986	96788.9	.1	5.72966	554567.
1987	106468.	.1	5.53384	589175.
1988	117115.	.1	5.33445	624742.
1989	128826.	.1	5.13144	661063.
1990	141709.	.1	4.92474	697878.
1991	155879.	.05	4.71428	734860.

V/E RATIO = 11414.6

DONE

TRCK21
36174**TITLE:**

CALCULATE TRUCK FREIGHT RATES

DESCRIPTION:

This program calculates for truck movements the break point weights for a given commodity between any two points as published in any truck freight tariff. It then prints a table suitable for use by anyone involved in rating, preparing or checking truck freight shipments.

INSTRUCTIONS:

See line 60 to 120 of the program. The user should prepare a worksheet with the required data before using the program. The option of printing multiple copies of the results is provided as terminal cost to print additional copies may be equal to or less than other means of duplication.

ACKNOWLEDGEMENTS:

Jeff Johnson
Hewlett-Packard/Eastern Sales Region

RUN

RUN
TRCK21

DO YOU REQUIRE INSTRUCTIONS?NO
 FROM?EWR
 TO?PARAMUS, NEW JERSEY
 VIA?ACI DESIGNATED TRUCK
 FOR?PICKUP AND DELIVERY OF ANY COMMODITY
 ENTER EFFECTIVE DATE OF RATES?30JUL1
 ENTER MINIMUM CHARGE IN \$74.05
 HOW MANY RATE CLASSES IN THIS COMMODITY ARE THERE?6
 PLEASE ENTER DATA AS REQUIRED:
 RATE 1= \$71.80
 WEIGHT 1=?100
 RATE 2= \$71.70
 WEIGHT 2=?1000
 RATE 3= \$71.60
 WEIGHT 3=?2000
 RATE 4= \$71.15
 WEIGHT 4=?3000
 RATE 5= \$7.95
 WEIGHT 5=?5000
 RATE 6= \$7.75
 WEIGHT 6=?10000
 HOW MANY COPIES?1

FROM....EWR
 TO.....PARAMUS, NEW JERSEY
 VIA.....ACI DESIGNATED TRUCK
 FOR.....PICKUP AND DELIVERY OF ANY COMMODITY

ACT GROSS WT	CHARGEABLE WT	RATE/LB	CHARGES
-----	-----	-----	-----
1 TO 225	DECLARE AS MINIMUM		\$ 4.05
226 TO 944	ACTUAL	\$0.0180	AS EXTENDED
945 TO 1000	1000	\$0.0170	\$ 17.00
1001 TO 1882	ACTUAL	\$0.0170	AS EXTENDED
1883 TO 2000	2000	\$0.0160	\$ 32.00
2001 TO 2156	ACTUAL	\$0.0160	AS EXTENDED
2157 TO 3000	3000	\$0.0115	\$ 34.50
3001 TO 4130	ACTUAL	\$0.0115	AS EXTENDED
4131 TO 5000	5000	\$0.0095	\$ 47.50
5001 TO 7894	ACTUAL	\$0.0095	AS EXTENDED
7895 TO 10000	10000	\$0.0075	\$ 75.00
10001 TO	ACTUAL	\$0.0075	AS EXTENDED

EFFECTIVE DATE OF RATES..30JUL1

DO YOU HAVE MORE DATA?NO

DONE

TRUINT
36101

TITLE:

TRUE ANNUAL INTEREST RATE ANALYSIS

DESCRIPTION:

TRUINT calculates the true annual interest rate charged on an installment load.

INSTRUCTIONS:

Self-explanatory.

Four input values are required:

A = amount of loan (in dollars)

P = amount of each payment (in dollars)

N = total number of payments

K = number of payments per year

ACKNOWLEDGEMENTS:

RUN

GET-\$TRUINT
RUN
TRUINT

* TRUE ANNUAL INTEREST RATE *

THIS PROGRAM CALCULATES THE TRUE ANNUAL INTEREST RATE CHARGED ON AN
INSTALLMENT LOAN.

IF YOU NEED INSTRUCTIONS TYPE 1, OTHERWISE TYPE 0: ?1
TO USE THIS PROGRAM IT IS NECESSARY FOR YOU TO SUPPLY THE VALUES FOR
FOUR VARIABLES: A = AMOUNT OF LOAN (IN \$), P = AMOUNT OF EACH
PAYMENT (\$), N = THE TOTAL NUMBER OF PAYMENTS DUE, AND K = THE NUMBER
OF PAYMENTS DUE IN ONE YEAR.

WHAT ARE A,P,N,K ?10000,10,1500,52

THE TRUE ANNUAL INTEREST RATE = 3.03

ANOTHER CASE?? TYPE 'N' TO QUIT, 'Y' TO TRY AGAIN?Y
WHAT ARE A,P,N,K ?1000,100,11,11

THE TRUE ANNUAL INTEREST RATE = 17.85

ANOTHER CASE?? TYPE 'N' TO QUIT, 'Y' TO TRY AGAIN?N

DONE

TITLE: INVESTMENT STRATEGY ANALYSIS

DESCRIPTION: This program uses the Tektronix 4010 display to plot results for each of ten different investment strategies over a period of time selected by the user. The time-period can begin in any year between 1931 and 1967 (inclusive) and can end in any later year in the same range. The user specifies the beginning and ending years. The program then determines the annual returns obtained with each of the ten strategies for each year within the period. Four graphs are produced. The first shows the average annual returns for the ten strategies. The next shows the values of "beta" -- the slope of a regression line obtained by regressing the strategy's returns on those of the market as a whole. The third graph shows the geometric mean returns for the ten strategies. The final graph provides a scatter diagram relating the values of the average annual returns to those of beta for the ten strategies. A regression line is also fit to the data in the final graph.

Strategy 10 involves investment each year in the top 10% of the stocks ranked on the basis of market sensitivity during the previous 60 months. Strategy 9 uses the next 10%, etc. . Thus strategy 10 is intended to be a high-risk return strategy, while strategy 1 is intended to be a low risk-return strategy.

INSTRUCTIONS: INTRODUCTION

Within the last decade economists have investigated rather thoroughly the nature of a "perfect" or "efficient" market for securities. A widely used model dealing with uncertainty is that developed by Sharpe (6), Lintner (3), Mossin (5), and Fama (2), based on the pioneering contributions of Markowitz (4) and Tobin (8). Variously known as the "capital asset pricing model," "capital market theory," or the "market line theory," the approach deals with ex ante or predicted relationships. Briefly, it suggests that:

- 1) the appropriate measure of risk for a security or portfolio is the covariance of its rate of return with that of a portfolio composed of all risky assets, each held in proportion to its total value, and
- 2) the expected return of any security or portfolio will equal a constant plus some other constant times its risk.

(Instructions continued)

SPECIAL CONSIDERATIONS: For a detailed discussion of the Tektronix 4010 Display Terminal see the documentation for the "Subroutine display package for the Tektronix 4010 Terminal", VSUB, #36558. This documentation consists of (Technical Report No. 3) "Risk-Return Classes of New York Stock Exchange Common Stocks, 1931-1967" by William F. Sharpe and Guy M. Cooper (September, 1971). Permission to reprint has been granted by the authors.

ACKNOWLEDGEMENTS: Graduate School of Business
Standord University

Derivation of these results can be found in Sharpe (7).

While the model provides important insights into the nature of actual capital markets, it is of limited value for the selection of an investment strategy unless additional specifications are made concerning the stability and/or predictability of key measures.

A number of investigators have performed tests of such expanded capital asset pricing models. The original specifications are augmented with assumptions about the stability of key variables through time. The expanded models suggest (1) that measurement of values during some previous period can be used to implement strategies that will in fact differ with respect to both risk and expected return; (2) that high-risk, high-return strategies will return more on the average than low-risk, low-return strategies; and (3) that high-risk, high-return strategies will bring greater losses in bear markets (i.e., have more risk) than will low-risk, low-return strategies.

An extensive study of this type was performed by Black, Jensen and Scholes (1). They were concerned primarily with testing the validity of an expanded capital asset pricing model, and less directly with assessing the performance of alternative investment strategies. In this paper, the general approach of Black, Jensen and Scholes is followed with modifications designed to reduce its expense as a practical investment selection technique. Moreover, we report information particularly relevant to the selection of such a technique. Our focus is primarily on assessing alternative investment strategies; by and large, we bypass issues concerned with the adequacy of various expanded capital asset pricing models. 1/

Performance Measures

For any single period, a relevant measure of performance from the investor's point of view is return:

$$\text{return} \equiv \frac{\text{ending value} + \text{dividends} - \text{beginning value}}{\text{beginning value}}$$

For securities, return can be calculated on a per-share basis, with appropriate adjustments for stock dividends and stock splits.

A related measure is appreciation:

$$\text{appreciation} \equiv \frac{\text{ending value} - \text{beginning value}}{\text{beginning value}}$$

The other component of return is yield:

$$\text{yield} \equiv \frac{\text{dividends}}{\text{beginning value}}$$

Obviously:

$$\text{return} \equiv \text{appreciation} + \text{yield}$$

The data used in this study were taken from the CRISP (Center for Research in Security Prices) tapes developed at the University of Chicago. Monthly returns and appreciation figures for all New York Stock Exchange stocks over the period from January 1926 through June 1968 were utilized.

Performance over a number of periods can be measure by the average return. Let R_{pt} represent the return on a portfolio of stocks in time period t. The average return from period 1 through period T is:

$$\text{average return} = \frac{1}{T} \sum_{t=1}^T R_{pt}$$

(where Σ denotes summation)

An alternative measure of performance is the geometric instead of the arithmetic mean. The result indicates the constant return in each period that would have provided the same terminal value as the actual series of returns.

The value is:

$$\text{equivalent constant return} = \left[\prod_{t=1}^T (1 + R_{pt}) \right]^{\frac{1}{T}} - 1$$

(where Π denotes multiplication)

Risk can be measured in a great many ways. We focus on a measure that highlights the impact of swings in the market on the return from a security or portfolio. If there were no prospects of bear markets, there would be little risk in the common meaning of the term. Stocks are considered risky because they can go down. And typically, the more sensitive a security or portfolio is to swings in the market, the more it goes down in a bear market. To measure this, we use the slope of a regression line relating return on the portfolio to the return on a broadly-based portfolio used to represent "the market." Figure I provides an illustration.

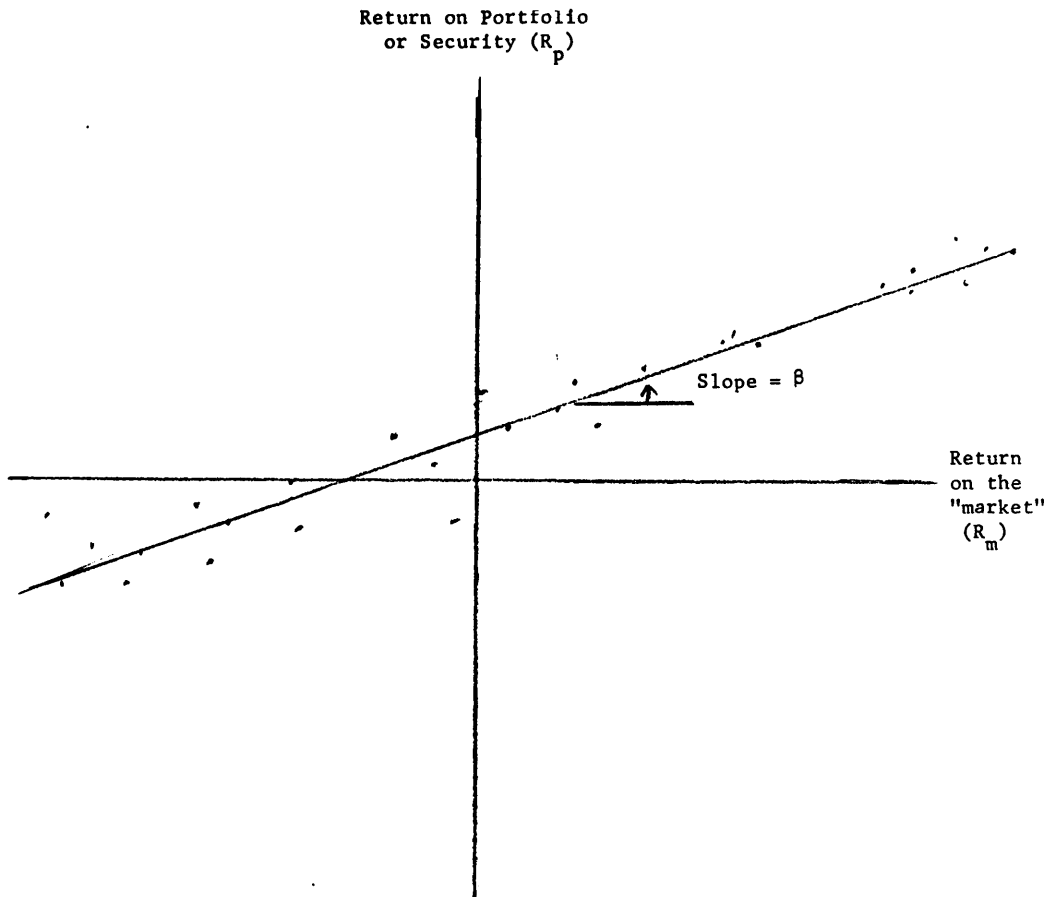


FIGURE I

We term the slope of such a line "beta." More formally: $\beta_p = \frac{\text{Cov}(R_p, R_m)}{\text{Var}(R_m)}$

$$\beta_p = \frac{\text{Cov}(R_p, R_m)}{\text{Var}(R_m)}$$

Where:

$$\begin{aligned} \text{Cov}(R_p, R_m) &= \text{covariance between } R_p \text{ and } R_m \\ &= \frac{1}{T} \left[\sum_{t=1}^T (R_{pt} - \bar{R}_p)(R_{mt} - \bar{R}_m) \right] \end{aligned}$$

$$\begin{aligned} \text{Var}(R_m) &= \text{variance of } R_m \\ &= \frac{1}{T} \left[\sum_{t=1}^T (R_{mt} - \bar{R}_m)^2 \right] \end{aligned}$$

\bar{R}_p = average return on portfolio p

\bar{R}_m = average return on the market portfolio

For purposes of this study, the Fisher market index included on the CRISP tape was used to measure R_m .

It is important to recognize that beta may not provide an adequate measure of the total risk of a portfolio. However, for well diversified portfolios, the majority of the variation in return is attributable to changes in the return on the market, and beta will thus provide a good measure of risk.

Risk-Return Classes

In an efficient market, one rarely gets something for nothing. If investors prefer high average returns to low average returns and prefer low risk to high risk, prices should adjust so that the best low risk strategy provides lower returns on the average than the best high risk strategy.

The average return of a portfolio is simply the weighted average of the average returns of its component securities, with the proportions of value used as weights. Moreover, the beta of a portfolio is a weighted average of the betas of its component securities, with the proportions of value used as weights. Finally, the beta of a well-diversified portfolio provides a good surrogate for its total risk, since almost all fluctuations in the portfolio's value will follow market swings.

A well-diversified portfolio with a high beta value will be risky. In an efficient market, it will also provide a high average return. A portfolio of this type may be constructed by choosing a large number of stocks with high beta values. Such a strategy should provide high returns on the average, but with substantial risk.

A well-diversified portfolio with a low beta value will have relatively little risk. In an efficient market, it will also provide a relatively low average return. A portfolio of this type may be constructed by choosing a large number of stocks with low beta values. Such a strategy should provide relatively low returns on the average, but with little risk.

In a period in which the market goes up, high-beta stocks will go up more than low-beta stocks. Unless dividend yields are strongly inversely related to beta values, average return and beta will thus be positively correlated over periods in which the market goes up. And since both history and expectations of risk-averse investors indicate that the market is more likely to go up than down, over long periods average return should be positively related to beta.

Stocks with high beta values should have high returns on the average; they may be said to be in a high risk-return class. On the other hand, stocks with low beta values should have low returns on the average; they may be said to be in a low risk-return class.

To use this relationship as a basis for an investment strategy, some means must be found to select stocks that will, in fact, have high beta values in the future. An obvious possibility involves the measurement of beta in the past, on the assumption that beta is reasonably stable over time. This procedure was utilized by Black, Jensen and Scholes and will be adopted here, with minor modifications.

Market Sensitivity

To measure performance it is important to use return -- i.e., appreciation plus dividend yield. However, most variation in return is due to changes in appreciation; dividend yield being relatively constant over time. This suggests that the value of beta would not change significantly if dividend yield were excluded. To avoid confusion, we continue to use the term "beta" for the slope of the regression line relating the appreciation on a portfolio or security to that of the market. Figure II provides an illustration.

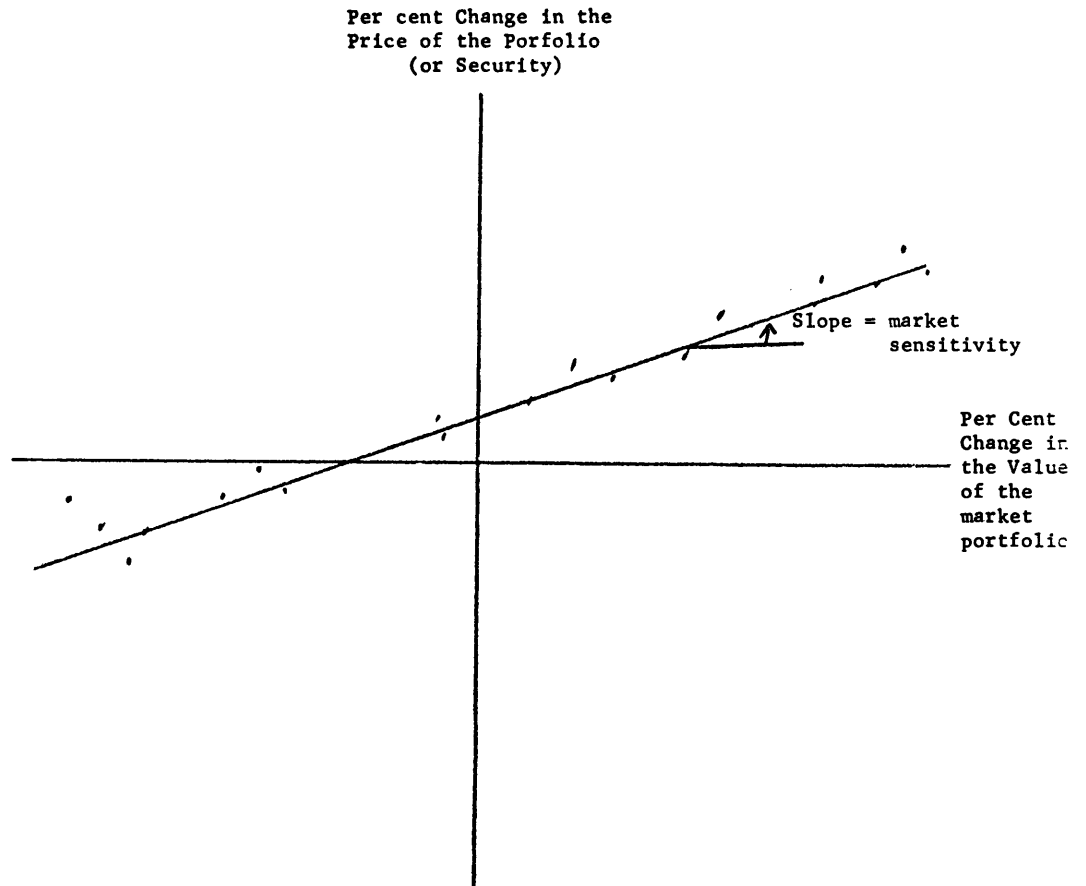


FIGURE II

To compare the two measures, the monthly returns and appreciation values for 1572 securities during the period from January 1960 through June 1968 were utilized. For each security the value of beta was calculated using returns; then the value of market sensitivity was calculated, using only price changes. The changes were very similar. If each of the 1572 pairs were plotted, the points would lie almost exactly along a 45-degree line through the axis, as illustrated in Figure III. The similarity of the two measures is clear from the results obtained when the values of beta were regressed on the values of market sensitivity. The regression equation was:

$$\text{Beta} = .004 + .997 * (\text{Market sensitivity})$$

$$\text{Coefficient of determination: } (R^2) = .996$$

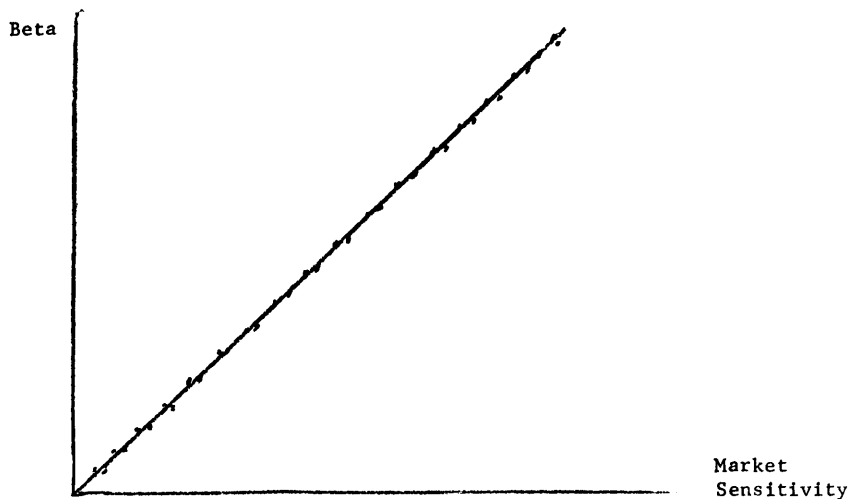


FIGURE III

This suggests that as a practical matter, market sensitivity may be used instead of beta when classifying securities into risk-return classes. Since dividend information may be difficult to collect and verify, this makes it possible to lower the cost of implementing strategies based on risk-return classes.

Portfolio Selection Strategies

We have determined the outcomes obtained from each of ten investment strategies during the 37-year period from 1931 through 1967. For each security listed on the New York Stock Exchange, market sensitivity was calculated, based on the monthly price changes for the 60 months prior to the beginning of the investment calendar year (a security would not be included if a full 60 months of data were not available). The number of securities for which market sensitivity was calculated ranged from 478 (in 1931) to 985 (in 1967).

After the market sensitivity values were calculated, the numerical values were ranked. Based on this ranking, securities were divided into deciles. The securities in the top decile (i.e., those with the highest market sensitivities) were considered to be in risk-return class 10 at the time of classification. The securities in the next decile were considered to be in risk-return class 9, etc. . The number of securities in a given risk-return class ranged from 47 (in 1931) to 99 (in 1967).

This procedure -- calculation of market sensitivities, ranking of securities, and assignment to risk-return classes -- was repeated for each of the possible investment years from 1931 through 1967.

Strategies are numbered from 10 to 1. Strategy 10 involves the purchase of equal dollar amounts of all stocks in risk-return class 10 at the beginning of each year. Every dividend received during the year is reinvested in the stock that pays it (at the beginning of the month following payment). On the first of the next year, stocks are bought and sold until the portfolio contains equal dollar amounts of all stocks in risk-return class 10 at that time. Rebalancing is thus required both to accommodate changes in the set of stocks in the specified risk-return class and to account for differential price changes.

To reduce the number of computations, the results have not been adjusted to account for transactions costs. However, these are relatively small and differ little among strategies since annual performance measures are being considered and rebalancing is done only once each year.

Performance

Figures IVa through IVd show the results obtained when each of the ten strategies was followed over the entire period studied (from 1931 through 1967). Figure IVa shows the average annual return for each strategy. On the average, strategy 10 provided a return of over 22 per cent per year, while strategy 1 provided less than 12 per cent. Although the values do not decrease uniformly, the general relationship is of the expected type -- portfolios composed of securities in lower risk-return classes tend to provide lower average return.

Figure IVb shows the actual values of beta for the ten strategies. Returns obtained with strategy 10 moved 42 per cent more than the market as a whole; on the other hand, returns obtained with strategy 1 moved only 58 per cent as much as the market as a whole. Again, the values do not decrease uniformly, but the general relationship is of the expected type -- portfolios composed of securities in lower risk-return classes tend to move less with swings in the market. 3/

Figure IVc shows the equivalent constant annual return for each of the ten strategies. Here the picture is far less clear. The investor concerned only with the very long run (in this case, 36 years) must take into account the impact of both risk and average return on his overall position. When returns vary, the geometric mean will always be smaller than the arithmetic mean, and the difference will typically be greater, the greater the variation. High risk-return classes typically offer a higher average return but also bring greater variability. The net effect over the very long term is thus relatively unpredictable. In this case, the best results would have been obtained with strategy 7. An investor who reinvested both capital and dividends every year while following strategy 7 would have accumulated as much wealth at the end of the period as if he had placed his money in a bank paying roughly 16 per cent interest per year, compounded annually. On the other hand, an investor following strategy 1 would have accumulated only as much wealth as if he had placed his funds in a bank paying roughly 10 per cent per annum, compounded annually.

Figure IVd summarizes the relationship between average return and the actual value of beta for each of the ten strategies during this period. As expected, the relationship is positive and quite significant (during this period the market rose on the average). The intercept is somewhat higher than the return on relatively safe investments during the period -- a result consistent with that of Black, Jensen and Scholes -- and the relationship appears to be approximately linear. 4/

Figures IVa, b, c, and d were produced using the Tektronix T4002 display and the Hewlett-Packard 2000C computer at the Stanford Graduate School of Business. Users of this system can obtain results for any other period between 1931 and 1967 by calling for program \$GRCC and running it. The program will give instructions, request the starting and ending year, and then provide the four graphs. By and large, the results will prove consistent with expectations. When the average market return is large, high risk-return classes tend to provide higher returns on the average than lower risk-return classes. Finally, the shorter the time-period studied, the less the results conform to expectations due to the influence of other factors.

Changes in Risk-Return Classes

The investor who holds a well-diversified portfolio need not be unduly concerned about the possibility that one or more of his stocks may move into a different risk-return class in the future. Some of the securities that were formerly in risk-return class 5 may move to class 6 (or 7, 8, 9 or 10), while some of the others may move to class 4 (or 3, 2, or 1). But the effect on the total portfolio may nonetheless be negligible, as securities moving to higher classes can be offset by those moving to lower classes. Putting it somewhat differently: it is easier to predict an average (i.e., the portfolio's beta) than the value of any single component (i.e., a given security's beta).

But changes in risk-return class membership are not unimportant. They give rise to transactions costs for the strategies described here. They are particularly relevant for those who do not (and perhaps cannot) hold well-diversified portfolios -- e.g., corporate officers. And they are important when risk-return class membership is used to estimate a firm's cost of capital.

To provide some evidence on such changes, the risk-return class of every security was determined for every year between 1931 and 1967 in which price and dividend data were available for the preceding 60 months. The risk-return class in each year was compared with first the class in the succeeding year, then the class five years hence. While the first comparison uses 48 months of common data, the second involves no overlap at all. Over 27,000 combinations were used for the first set of comparisons, and over 24,000 for the second.

Tables I and II summarize the results in transition matrices. For example, Table I shows that 74.2 per cent of the securities in risk-return class 10 in year t were still in risk-return class 10 in year $t + 1$. Table II shows that only 35.2 per cent remained in risk-return class 10 in year $t + 5$. 5/ Table III provides another summary, indicating the frequencies with which securities were in the same risk-return class or within one risk-return class one and five years later. As this Table shows, there is substantial stability over time, even at the level of individual securities. For portfolios, of course, the relationship would be considerably more stable.

Figure IVa. Average Annual Returns 1931 through 1967

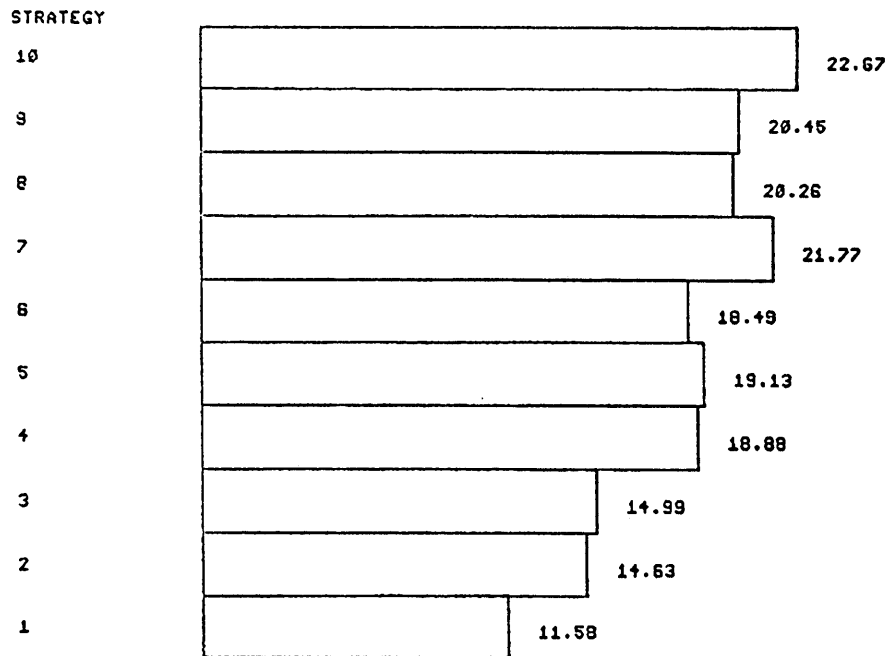


Figure IVb. Beta Values 1931 through 1967

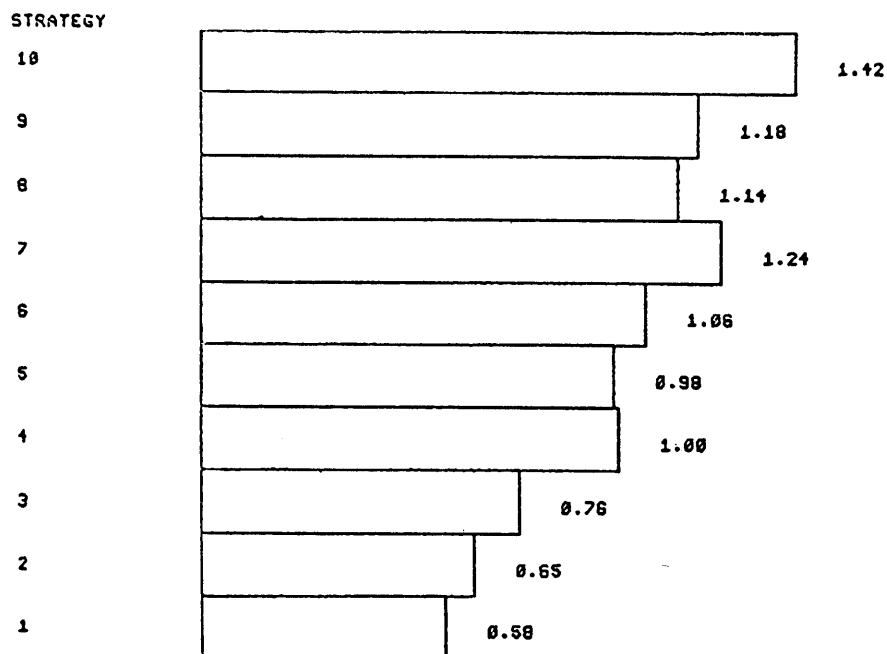


Figure IVc. Equivalent Constant Annual Returns 1931 through 1967

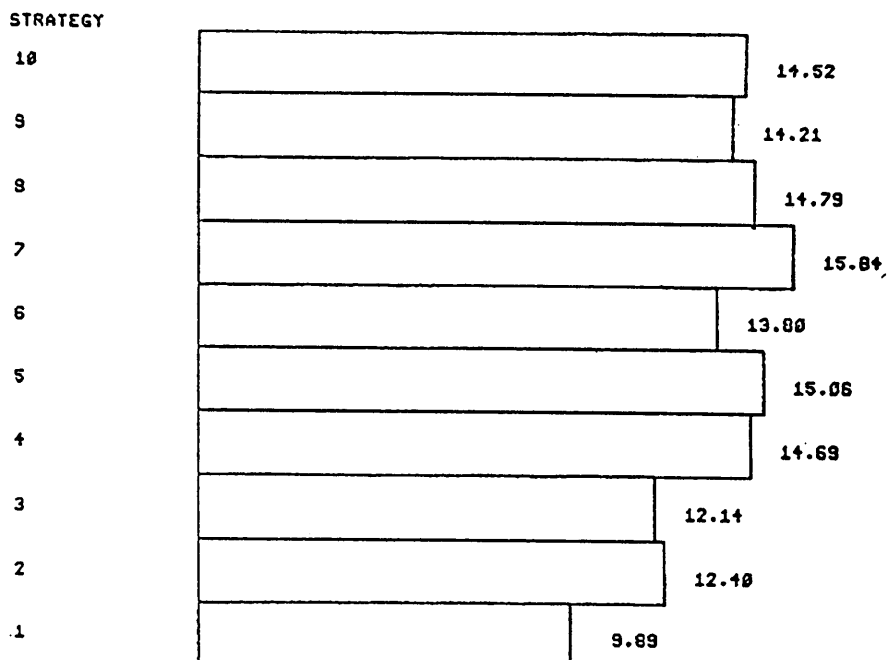
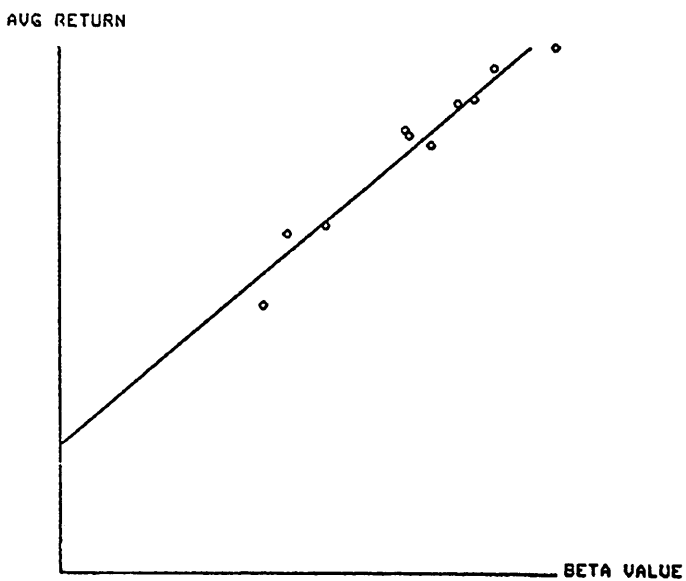


Figure IVd. Average Return Versus Beta 1931 through 1967



$$\text{AUG RETURN} = 5.53651 + 12.748550\text{BETA VALUE}$$

DONE

Security Data

Table IV shows the risk-return classes of all New York Stock Exchange stocks that could be assigned to a class on January 1, 1967. Table IVa includes securities in class 10, Table IVb, those in class 9, etc. . Within a risk-return class, securities are arranged alphabetically (with minor exceptions). Beside the name of each security is a list of symbols indicating its status in each year, beginning with 1931 and ending with 1967. The symbols have the following meanings:

- * insufficient data for the prior 60 months to allow classification
- 9 risk-return class 10
- 8 risk-return class 9
- 7 risk-return class 8
- 6 risk-return class 7
- 5 risk-return class 6
- 4 risk-return class 5
- 3 risk-return class 4
- 2 risk-return class 3
- 1 risk-return class 2
- 0 risk-return class 1

The performance of simple strategies based on risk-return class membership suggests the usefulness of data of the type shown in Table IV. The classifications can be used to test investment strategies that might have been adopted in 1967 or earlier. Moreover, they provide at least some information concerning current risk-return classes, if the stability shown in Tables II and III is at all applicable at present.

TABLE I
TRANSITION MATRIX
RISK-RETURN CLASS IN YEAR T
VERSUS
RISK-RETURN CLASS IN YEAR T + 1

Risk-Return class in year t	Risk-Return class in year t + 1									
	10	9	8	7	6	5	4	3	2	1
10	.7417	.1712	.0309	.0111	.0054	.0011	.0018	.0004	.0000	.0004
9	.1732	.4989	.2079	.0587	.0240	.0104	.0025	.0004	.0004	.0004
8	.0368	.2122	.4091	.2094	.0765	.0232	.0111	.0029	.0021	.0007
7	.0121	.0657	.2286	.3564	.1986	.0804	.0271	.0079	.0025	.0007
6	.0043	.0199	.0733	.2246	.3452	.2060	.0744	.0231	.0075	.0018
5	.0047	.0097	.0222	.0764	.2141	.3535	.2123	.0696	.0147	.0047
4	.0007	.0018	.0111	.0314	.0806	.2168	.3807	.2043	.0478	.0093
3	.0000	.0018	.0025	.0096	.0268	.0686	.2082	.4268	.2068	.0321
2	.0000	.0004	.0011	.0036	.0075	.0196	.0538	.2089	.5091	.1843
1	.0000	.0004	.0004	.0014	.0018	.0011	.0093	.0323	.1869	.7471

TABLE II
 TRANSITION MATRIX
 RISK-RETURN CLASS IN YEAR T
 VERSUS
 RISK-RETURN CLASS IN YEAR T + 5

Risk-Return class in year t	Risk-Return class in year t + 5									
	10	9	8	7	6	5	4	3	2	1
10	.3517	.1929	.1153	.0568	.0494	.0373	.0203	.0120	.0083	.0079
9	.2051	.1835	.1487	.1272	.0808	.0601	.0414	.0228	.0116	.0128
8	.1324	.1593	.1638	.1303	.1047	.0890	.0612	.0393	.0219	.0149
7	.0794	.1310	.1579	.1327	.1186	.1083	.0930	.0583	.0310	.0149
6	.0523	.0977	.1121	.1343	.1389	.1195	.1137	.0820	.0445	.0293
5	.0423	.0647	.0855	.1041	.1361	.1361	.1448	.1112	.0763	.0336
4	.0326	.0491	.0759	.0994	.1106	.1254	.1320	.1448	.1023	.0611
3	.0203	.0289	.0488	.0715	.0951	.1146	.1286	.1588	.1584	.1084
2	.0087	.0161	.0268	.0384	.0499	.0771	.1139	.1630	.2145	.2314
1	.0042	.0087	.0104	.0203	.0303	.0419	.0722	.1133	.2183	.4047

TABLE III

Risk-Return Class in Year T	Proportion in Same Risk-Return Class		Proportion Within One Risk-Return Class	
	In Year t + 1	In Year t + 5	In Year t + 1	In Year t + 5
10	.7417	.3517	.9129	.6927
9	.4989	.1835	.8800	.5373
8	.4091	.1638	.8307	.4534
7	.3564	.1327	.7836	.4092
6	.3452	.1389	.7758	.3927
5	.3535	.1361	.7799	.4170
4	.3807	.1320	.8018	.4022
3	.4268	.1588	.8418	.4458
2	.5091	.2145	.9023	.6089
1	.7471	.4047	.9340	.6230

Footnotes

1. This paper differs from that of Black, Jensen and Scholes (BJS) in a number of respects. The differences will be summarized here, although a full understanding may require a prior reading of the remainder of this paper. First, BJS require only 24 months of data to estimate a security's risk-return class (although they use up to 60 if available); we require 60 months. Second, BJS use beta to determine risk-return classes, while we use market sensitivity. Third, BJS measure performance in terms of monthly returns; we use annual values (both because an annual holding period seems more consistent with an annual review of risk-return classes and because annual rebalancing involves smaller transactions costs than monthly rebalancing of the portfolios). Finally, we report geometric means as well as arithmetic means for those interested in long-run performance and provide data concerning stability of risk-return classes for those interested in the characteristics of individual securities.
2. For a derivation of this relationship, see Sharpe (7).
3. In general, the value of beta describes the majority of the fluctuations in returns for these portfolios. The coefficients of determination for the regressions of portfolio return on market return were:

<u>Strategy</u>	<u>Coefficient of Determination</u>
10	.94
9	.94
8	.95
7	.95
6	.98
5	.98
4	.92
3	.94
2	.88
1	.87

4. This relationship can be derived from a model in which it is impossible to borrow without limit at the same rate of interest at which one can lend. If the portfolio used as a market surrogate is riskier than the optimal combination of risky securities for one who plans to lend part of his funds, the result follows directly as long as the market surrogate is on the efficient frontier. The true "market portfolio" (which includes all assets -- e.g., corporate bonds, real estate, etc.) may well be less risky than the typical index of New York Stock Exchange common stocks such as that used in this study. It is entirely possible that if a better surrogate for the market portfolio could be obtained, the relationship between average return and beta would intercept the average return axis very near the interest rate of safe investments.
5. The sum of the figures in a row in either Table I or Table II will be less than 1; the difference represents cases in which the security could not be classified in the later period due to lack of adequate data.

References

1. Black, Fischer, Michael C. Jensen, and Myron Scholes, "The Capital Asset Pricing Model: Some Empirical Tests," in Studies in the Theory of Capital Markets, M. C. Jensen, ed. (Praeger Publishing, forthcoming, 1971).
2. Fama, Eugene F., "Risk, Return and Equilibrium: Some Clarifying Comments," Journal of Finance, March 1968 (pp. 29-40).
3. Lintner, Joh, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," Review of Economics and Statistics, February 1965, pp. 13-37.
4. Markowitz, Harry, "Portfolio Selection," Journal of Finance, March, 1952, pp. 77-91
5. Mossin, Jan, "Equilibrium in a Capital Asset Market," Econometrica, October 1966, pp. 768-783.
6. Sharpe, William F., "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," Journal of Finance, September 1964, pp. 425-442.
7. Sharpe, William F., Portfolio Theory and Capital Markets, McGraw-Hill, 1970.
8. Tobin, James, "Liquidity Preference as Behavior Towards Risk," Review of Economic Studies, February 1958, pp. 65-86.