ten of which are applicable when inspection is non-destructive and the remaining twenty-one are applicable when inspection is destructive. The table for non-destructive inspection displays $c_m/c_s$ which is the ratio of manufacturing cost to inspection cost; $n$, the number of items to be sampled; $k$, the accepted number; $A(n, k)$, the probability of acceptance; and $c/c_m$, which is the ratio of effective cost to manufacturing cost. In the tables for destructive inspection, $A(n, k)$ is replaced by $A'(n, k)$, which is the expected number of accepted items per lot.

Plans for non-destructive inspection are given only for a nominal lot size of 10,000. Plans for destructive inspection are given for lot sizes of 10,000 and 20,000. For non-destructive inspection, the process average $p_0 = .01(.01).04$, the consumer's risk point $p_1 = .03(.01).07, .09$; at which the consumer's risks are .05 and .01. For destructive inspection $p_0 = .01$ and $.02$; $p_1 = .03(.01).06$, and consumer's risks are .05 and .01. The tables, however, do not include all possible combinations of the above listed parameter values.

A. C. COHEN, JR.

University of Georgia
Athens, Georgia

**53[K].**—N. L. JOHNSON, "Optimal sampling for quota fulfillment," *Biometrika*, v. 44, 1957, p. 518–523.

This article contains two tables to assist with the problem of obtaining a preset quota $m_i$ of individuals from each of $k$ strata by selecting first a sample $N$ of the whole population and then completing quotas by sampling from separate strata. Individual cost in the first case is $c$ and in the second $c_i$. Table I gives for $m_i = m$ optimal values of $N$ for $k = 2(1)10$; $mk \doteq 50, 100, 200, 500$; $d = c_i/c = 1.25, 1.5(.5)3.0$; $d' = c_i'/c = .9, .7, .25, 0$. Here $c_i'$ is the worth of first sample individuals in excess of quota. The tabulated values of $N$ are solutions of the equation $Pr(N_i < m) = (c - c_i')/(c_i - c_i)$.

Table 2 gives ratio of minimized cost to cost of choosing the whole sample by sampling restricted to each stratum. This quantity is

$$\frac{1}{d} + \left(1 - \frac{d'}{d}\right)\left(1 - \frac{1}{k}\right)^{N+1} \binom{N}{m} (k - 1)^{-m}$$

and is tabulated for $k = 2(1)5, 10$; $km \doteq 50, 100, 500$; $d = 1.5, 2.5, 3$; $d' = .5, .1, 0$.

W. J. DIXON

University of California
Los Angeles, California

**54[K].**—P. G. MOORE, "The two-sample $t$-test based on range," *Biometrika*, v. 44, 1957, p. 482–489.

This paper provides a sample statistic for unequal sample sizes for a two-sample $t$-test based on observed sample ranges instead of sums of squares. The statistic used by the author is simply

$$u = \frac{|\bar{x}_1 - \bar{x}_2|}{w_1 + w_2},$$

where $\bar{x}_1$ and $\bar{x}_2$ are the sample means, and $w_1$ and $w_2$ are the sample ranges. Since unequal sample sizes are now permitted, the mean range $(w_1 + w_2)/2$ proposed by Lord [1] in his original paper is no longer used. Moore shows that there is very little loss in power resulting from the use of the simple sum $w_1 + w_2$, rather than a weighted sum of sample ranges, although for the estimation of $\sigma$ separately, he gives a table of $f(n_1, n_2)$ and $d_{n_1} + fd_{n_2}$ to $3D$ for $n_1, n_2 = 2(1)20$ to estimate $\sigma$ from

$$g = \frac{w_1 + fw_2}{d_{n_1} + fd_{n_2}},$$

which minimizes the coefficient of variation of the range estimates of population standard deviation.

The main use of this paper is, of course, the tables of percentage points (10%, 5%, 2%, and 1% points) to $3D$ for the statistic $u$, above. The tables of percentage points were computed by making use of Patnaik's chi-approximation for the distribution of the range, which resulted in sufficient accuracy. The limits for sample sizes are $n_1, n_2 = 2(1)20$, which fulfills the most usual needs in practice. With this work of Moore, therefore, the practicing statistician has available a very quick and suitably efficient procedure for testing the hypothesis of equal means for two normal populations of equal variance.

F. E. Grubbs

Ballistic Research Laboratory
Aberdeen Proving Ground, Maryland

1. E. Lord, "The use of range in place of standard deviation in the $t$-test", *Biometrika*, v. 34, 1947, p. 41–67.

**55[K].**—National Bureau of Standards, *Tables of the Bivariate Normal Distribution Function and Related Functions*, Applied Mathematics Series, No. 50, 1959, xliii + 258 p., 27cm. U. S. Government Printing Office, Washington, D. C. Price $3.25.

These tables, compiled and edited by the National Bureau of Standards, provide values for the probability content $L(h, k, r)$ of an infinite rectangle with vertex at the cut-off point $(h, k)$ under a standardized and centered bivariate distribution with correlation coefficient $r$:

$$L(h, k, r) = \frac{1}{2\pi\sqrt{1 - r^2}} \int_h^\infty \int_k^\infty \exp\left[-\frac{1}{2}\left(x^2 + y^2 - 2rxy\right)/(1 - r^2)\right] dx\, dy$$

The range of tabulation is $h, k = 0(.1)4$, $r = 0(.05)0.95(.01)1$, the values of $L(h, k, r)$ being given to 6 decimal places. For negative correlations, the range of tabulation is $h, k = 0(.1)h_n, k_n$, $r = 0(.05)0.95(.01)1$, the values of $L(h, k, r)$ being given to 7 decimal places, where $L(h_n, k_n, -r) \leqq \frac{1}{2}.10^{-7}$ if $h_n$ and $k_n$ are both less than 4. The two tables of $L(h, k, r)$ for positive and negative $r$, respectively (Tables I and II in the text), may therefore be regarded as extensions of Karl Pearson's tables of the bivariate normal distribution in his celebrated *Tables for Statisticians and Biometricians*, Part II, since the range of parameters in the latter tables is $h, k = 0(.1)2.6$, $r = -1(.05)1$. In this connection, the authors of the