the foot of most of the tables there appears a symbolic statement of the maximum error arising from linear interpolation and the number of function values required in Lagrange's formula or in Aitken's method to interpolate to full tabular accuracy, as illustrated on p. x in the Introduction.

The 184 numerical tables appearing in this volume are too numerous to describe individually in a review, although their extensive range may be inferred from the listing of chapters given above. Approximately one-third of these tables have been extracted or abridged, with appropriate acknowledgment, from the numerous well-known tabular publications of the National Bureau of Standards, another third were taken from tables of the British Association for the Advancement of Science, the Harvard Computation Laboratory, H. T. Davis, L. M. Milne-Thomson, A. J. Thompson, C. E. Van Orstrand, and many others, and the remainder are the results of new computations.

The claim is made on p. ix that the maximum end-figure error is 0.6 unit in all tables of elementary functions in the Handbook, and is 1 unit (or in rare cases, 2 units) in tables of higher functions. This reviewer has carefully examined Table 1.1 (Mathematical Constants) and discovered several errors exceeding this limit. These corrections and others submitted by other users are presented in the appropriate section of this issue.

Despite such minor flaws, which are almost unavoidable in a work of this magnitude, the Handbook is a truly monumental reference work, which should be in the possession of all researchers and practitioners in the fields of numerical analysis and applied mathematics.

J. W. W.

2[D].—Norton Goodwin, *Seven Place Cosines, Sines, and Tangents for Every Tenth Microturn*, Society of Photographic Scientists and Engineers, Washington, D. C., 1964, 79 p. (unnumbered), 26 cm. Price $2.00.

According to the author, these tables were designed primarily to facilitate desk-calculator transformations of the coordinates of artificial earth satellites. However, as he states, they should also prove useful in space navigation and in electrical engineering, where cyclical coordinate changes are encountered.

The tables consist of sine $2\pi x$ and cos $2\pi x$ for $x = 0(0.00001)0.25000$ and tan $2\pi x$ for $x = 0(0.00001)0.12500$, all to 7D. The (linearly interpolable) values of the sine and cosine are arranged semiquadrantally, without differences, on facing pages, each containing 500 distinct entries, arranged in the conventional ten columns, supplemented by an eleventh, which gives the same tabular value in any row as the first column in the succeeding row, thereby facilitating the use of the tables in obtaining functional values for complementary arguments. Economy of space is attained by separation of the first two decimal digits and listing only the last five decimal digits in all the columns after the first. Change in the second decimal place occurring within a line is signalled by boldface numerals.

The author has communicated to this reviewer the information that these tables were computed on an IBM 7090 system at The Rand Corporation, using double-precision arithmetic to evaluate the functions by Taylor series prior to final rounding.

In the Preface to these tables we are referred to a comparable, unpublished table of the sine and cosine to 15D prepared by Bower [1], which is available in listed and punched-card form.

The present tables were photographically composed from digital-computer tape records. The typography was prepared by a commercial printer on a conventional photocomposition unit controlled by perforated paper tapes produced by a converter designed to process magnetic-tape records in a form suitable for general-purpose phototypesetting machines.

The resulting typography is uniformly excellent and the arrangement of the data is attractive. This compilation constitutes a valuable contribution to the limited existing literature [2] of trigonometric tables based on the decimal subdivision of the circle.

J. W. W.

1. E. C. Bower, *Natural Circular Functions for Decimals of a Circle*, ms., 1948. Listed and punched-card copies available at nominal cost from The Rand Corporation, Santa Monica, California. [For a review, see *MTAC*, v. 3, 1949, p. 425–426, UMT **77**.]

2. *MTAC*, v. 1, 1943, p. 40; also, A. Fletcher, J. C. P. Miller, L. Rosenhead & L. J. Comrie, *An Index of Mathematical Tables*, 2nd ed., Addison-Wesley Publishing Co., Reading, Mass., 1962, v. I, p. 177–178.

3[G, X].—Marvin Marcus & Henryk Minc, *A Survey of Matrix Theory and Matrix Inequalities*, Allyn and Bacon, Inc., 1964, xvi + 180 p., 24 cm. Price $9.75.

This book is a compendium of many important facts about matrices. Moreover, it starts out, as the authors state, "with the assumption that the reader has never seen a matrix before." It proceeds then, in a logical sequence and in condensed, systematic notation, to state definitions and theorems, the latter generally without proof. Since the purpose is evidently to condense as much material as possible in a short space, "certain proofs that can be found in any of a very considerable list of books have been left out."

It would be indicative of the extent of the coverage to say that if one needed to look up all of the missing proofs, he would have to consult all of a by no means inconsiderable list of books. This was, of course, not the expectation, but the instructor who considers adopting the book as a class text would be well advised to make sure that he can himself supply the proofs that are not readily available to him.

There are three chapters, the first, Survey of Matrix Theory, comprising slightly more than half of the book. Here one finds the expected topics: determinants, linear dependence, normal forms, etc. In addition, one finds somewhat nonstandard material such as permanent, compound and induced matrices, incidence matrices, property L, among others. The next chapter, Convexity and Matrices, develops such inequalities as those of Hölder, Minkowski, Weyl, Kantorovich, and also discusses the Perron-Frobenius theorem, and Birkhoff's theorem on doubly stochastic matrices. The final chapter, Localization of Characteristic Roots, deals almost exclusively with what the reviewer calls exclusion theorems, by contrast with inclusion (e.g., theorems of Temple, of D. H. Weinstein, and of Wielandt). Other topics briefly dealt with are the minimax theorems for Hermitian