The vigorously divergent

$$(976) \qquad \frac{1}{\epsilon}(1 - 2! + 3! - \cdots \infty) = \frac{0.4036526}{\epsilon}$$

is given without any tiresome commentary concerning convergence.

While a good handbook of infinite series is something much to be desired, it is doubtful whether the present book fully meets this need.

D. S.

58[K].—B. M. BENNETT & P. HSU, *Significance Tests in a* 2 × 2 *Contingency Table: Additional Extension of Finney-Latscha Tables*, March 1962. Deposited in UMT File. [See Review 9, *Math. Comp*, v. 15, 1961, p. 88–89; Review 20, *ibid.*, v. 16, 1962, p. 252–253.]

The authors present in these manuscript tables still another addition to the tables of Finney, first extended by Latscha. This latest extension covers the range $A = 31(1)45$, giving the exact test probabilities to four decimal places, as previously, and the significant values of b at the four levels presented in the Finney-Latscha tables and retained in the previous extensions thereto by the present authors.

J. W. W.

59[V].—PHILIP D. THOMPSON, *Numerical Weather Analysis and Prediction*, June 19, 1961. The Macmillan Co., New York, xiv + 170 p., 24 cm. Price $6.50.

In a rapidly developing field it never seems quite appropriate to freeze the state of knowledge in the form of a book. However, enough has evolved since the beginnings of numerical weather prediction to warrant a knowledgeable appraisal of the course of its development. Not only should such a book have a didactic objective but one would hope that the perspective be equally useful as a reference for active workers in the field. This would require the text to assess the road of experience well enough to define the problems and to indicate the avenues which are likely to yield a fruitful expansion of knowledge. Colonel Thompson's book represents a first such attempt. The fact that he has contributed materially to the evolution he sets out to document, taken together with his characteristically smooth expository style, amply qualify him for the task.

In Chapter 1, after a brief discussion of the inherent difficulties of observing and forecasting the atmosphere's evolutions, one finds a description of instrumental, aerological, and analysis techniques, and of the atmosphere's kinematical characteristics. The author then indicates the role of hydrodynamic laboratory models as a research tool and gives an historical development of numerical weather prediction: the antecedents heralding the Norwegian school and the contributions of Richardson, Rossby and the Princeton group.

Chapters 2 and 3 are given over to a summary of the hydrothermodynamic equations of meteorology, first in height coordinates and then in terms of pressure and of potential temperature. The transformation and interpretation of upper and lower boundary conditions are not given. Methods of central differencing and practical problems of numerical weather prediction, especially those engendered by the quasi-non-divergent character of the atmosphere, are then discussed. Chapters 4 and 5 first go into the properties of pure sound, gravitational, and Rossby waves by means of a perturbation analysis of the linear hydrodynamic equations, followed by an analysis of the corresponding finite difference equations with some discussion of their computational stability properties. As an introduction to the use of filtering approximations, the author analyzes in Chapter 6 the properties of mixed wave type solutions and their interaction in linear systems.

In Chapter 7 the author discusses physical systems in which the total kinetic energy is preserved by means of the equivalent barotropic approximation, giving some emphasis to the numerical solution of the corresponding non-linear equations. Chapter 8 lightly covers the question of mapping, examines the finite Fourier series method of Charney, Fjortoft, and von Neumann, and then goes on to discuss the application of relaxation techniques to elliptic difference equations.

Systems in which potential-kinetic energy conversions are admissible and the necessary vertical differencing structure are considered within a geostrophic framework in Chapter 9. Here only superficial mention is made of the approximations energetically consistent with the geostrophic constraint. Furthermore, the question of the consistent lateral boundary conditions for the vertical velocity and thermodynamic equations is not covered at all. In Chapter 10 Dr. Thompson analyzes the process of baroclinic instability, and the concomitant energy conversions and poleward heat transfer, and their role in the index cycle. However he does not take the opportunity to indicate how the barotropic kinetic energy of vortices is transformed to maintain the westerlies—the final link in the energy cycle.

The subject of Chapter 11 is the balance approximation as a filtering device. It could have been useful here to show its connection with the primitive barotropic equations. Also absent is mention of attempts to adapt balance techniques to baroclinic models. In Chapter 12 he takes up the question of establishing initial conditions for the primitive equations. He apparently holds the opinion that the balancing constraint must be applied periodically; however, this has not been borne out by experience. He considers the question of formulating boundary conditions for open boundaries as an unsolved problem.

Getting down to practical problems, the author discusses in some detail in Chapter 13 the question of operational utilization. In particular, he describes the organization of the Joint Numerical Weather Prediction Unit, methods of data processing and objective analysis. After drawing comparisons with routine conventional forecasting methods and skills, he then boldly makes an attempt to calculate the economic worth of a forecaster. Finally, he examines the impact of mechanization on the data processing chain.

Chapter 14 is given over to the question of unsolved problems. Here he points out the systematic errors in the zonal angular momentum which result from ignoring surface stresses. He then goes on to emphasize the importance of sources of kinetic energy through baroclinic instability but makes no mention of how the available zonal potential energy is maintained through radiative processes, which are probably of some significance within 48 hours. He makes some mention of how the quasi-stationary long waves may be excited geographically and of the uncertainties of the initial state on a forecast. Finally, he says something about the effects of truncation and round-off error. Chapter 15, entitled "The Outlook for the Future," is essentially a recapitulation of the 14 preceding chapters.

One's impression upon reading the book is that it is more an essay than a text or reference. A good many of its 170 pages are given over to the discussion of peripheral subjects which are treated much more exhaustively elsewhere and could more appropriately have been referred to. This reviewer would rather that the author had taken this space and perhaps more for greater thoroughness in discussing problems intimately germane to the development of dynamical prediction by numerical methods. A more complete discussion of computational instability of the various types that have already been encountered would have been extremely useful. A comprehensive account of mapping techniques for finite differences would be useful if found in one place. Very little attention is given to Green's function techniques and Fourier space, to the process of barotropic stability, to Lagrangian methods, to "staggered" finite difference methods yielding non-redundant solutions (such as that of Eliassen). The powerful methods and useful results of scale analysis are prominent in their omission. One would hope that in the absence of thoroughness Dr. Thompson would have given an exhaustive bibliography; however, his references are sometimes vague if not scanty (Phillips' significant contributions are virtually ignored) and those which are included often are given a superficial critique. Being the first of its kind, this book does fill a gap. However, this reviewer feels it to fall short of the needs, if not of the author's objectives.

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60[X].—W. F. FREIBERGER, Editor-in-chief, *International Dictionary of Applied Mathematics*, D. Van Nostrand Co., Inc., Princeton, N. J., 1960, 1173 p., 26 cm. Price $25.00.

At the outset it is perhaps appropriate to say a word concerning the title of this useful reference book. One might think that a book so named would confine itself to descriptions of those branches of *mathematics* which are applied to physics, engineering, etc., that is, to numerical analysis, vector analysis, statistics, etc. Instead a large number, or even most, of the entries here, e.g., Binary Stars, Polymer, Isotopes, Pfund Series, etc., are descriptions of those *phenomena* to which such mathematics may be applied. Of the 32 fields covered in this volume only 6 are applied mathematics in the strict sense, while Acoustical Engineering, Acoustics, Aerodynamics and Hydrodynamics, Astronomy, Atomic Structure, Automatic Control, Chemistry, Elasticity, Electromagnetic Theory, and 17 other fields are, rather, physical sciences to which mathematics is applied.

Each of the 32 fields had one or more authorities as a contributing editor. For example, that for Numerical Analysis was A. S. Householder. The 8000-plus entries are all listed alphabetically and not by field.

The many entries differ widely in their length and character. Those on modern physics, e.g., Relativity, Quantum Mechanics, S-Matrix, etc. are often fairly long and informative, but are weakened by a complete lack of references. The reader who wishes to learn more about Positronium or the Zeroth Law of Thermodynamics is given no assistance here. A number of the mathematical entries, on the other hand, are so brief that important qualifications and clarifications are omitted. Thus, in