Mathematical Association of America.—On September 2, 1947, at the concluding session of the summer meeting at Yale University, a symposium on computing machines was held, with lectures by HOWARD H. AIKEN of Harvard University and JOHN VON NEUMANN of the Institute for Advanced Study at Princeton University. Supplementing his lecture with slides, Dr. Aiken described the essential design features of the two electro-mechanical digital computing machines, Mark I and Mark II, which were built under his direction. He stated that the successful operation of the Mark I computer has proved the feasibility of big automatic calculators for large-scale computing, and that in the next few decades vast improvements may be expected in this field.

Dr. von Neumann, who is directing a research project at the Institute for Advanced Study for the construction of an improved electronic digital computing machine, spoke on some general aspects of the new high-speed computing field. In discussing the need for large-scale computing he stated that nearly all of the progress in solving the non-linear partial differential equations of aerodynamics so far has been brought about through the use of the wind tunnel, which may be regarded as a crude analogue calculator. He then spoke of the advantages of digital computers over analogue computers, explaining that the latter are completely inadequate to solve the difficult types of problems that digital computers could handle. He concluded with some speculations on the influence large-scale computers will have on future studies in pure mathematics, expressing his hope that the new machines will enable mathematicians to attack successfully the field of non-linear problems, where the classical methods of analysis, unaided by high-speed computing, have so far been unproductive.

Recent Developments in Mathematical Computing in France.—The Laboratoire de Calcul Mécanique, at Paris, is conducting a program of research in mathematical computing sponsored by the Centre National de la Recherche Scientifique (see *MTAC*, v. 2, p. 251). This project, which is under the direction of Dr. PIERRE LOUIS COUFFIGNAL, comprises two parts—one an investigation of computational methods, and the other the design and construction of an electronic digital computer. Although the design of the machine is not yet complete, certain guiding principles have been outlined, and the development of necessary components has been undertaken.

[1] A. ERDÉLYI & JOHN TODD, "Advanced instruction in practical mathematics," *Nature*, v. 158, Nov. 16, 1946, p. 690–692. Dr. Erdélyi is also now in this country, at California Institute of Technology, preparing papers of HARRY BATEMAN for possible publication. —EDITOR.

OTHER AIDS TO COMPUTATION

BIBLIOGRAPHY Z-II

1. GEORGES BAUDOUIN, "Principe d'une règle à calcul présentant une échelle logarithmique de grande longueur," Acad. d. Sci., Paris, *C.R.*, v. 224, Jan. 1947, p. 96–97.

Last paragraph: "Ainsi, avec une règle de dimensions restreintes, soit 20 cm. sur 4 cm., *on peut*, grâce au découpage de l'échelle logarithmique de 10 à 100 en dix parties superposées, *obtenir une précision environ dix fois plus grande qu'avec les règles ordinaires.*" See *Math. Rev.*, v. 8, 1947, p. 289, E. LUKACS.

2. The GLOBE-HILSENRATH *Azimuth Computer. Instructions for the use of the Globe-Hilsenrath Azimuth Computer.* A. M. Messer & Co., 18 40th St., Irvington, N. J. 1945. 12 p. 12.7 × 17.7 cm. Instrument and Instructions $8.75. Distributor for School and College trade: Yoder Instruments Co., East Palestine, Ohio.

This computer consists of a white vinylite sheet, 23.3 × 24 cm., carrying on each of its faces a printed grid, and a transparent plastic protractor with movable radial arm which can be attached in proper orientation to either side of the vinylite sheet. It is designed to be used in determining the azimuth of a celestial body from its local hour angle and declination and the latitude of the observer.

The grid on the face is intended to cover problems involving latitudes and declinations less than 45°, north or south. That on the back is for latitudes 40° to 60°, declinations 0° to 60°, north or south. Each grid consists of a set of confocal half-ellipses, to each of which corresponds a different degree of latitude and an orthogonal set of confocal hyperbolas, to each of which corresponds a local hour angle which is an integral multiple of four minutes. For local hour angles, 4 to 8 hours, and latitudes 20°S to 20°N, some of the curves are omitted. The declination scale is made up of the points where the latitude ellipses meet the line through their common center and normal to their major axes; for convenience's sake, however, this scale has been duplicated a short distance below and a red index line on the protractor allows one to set on the proper declination. The declinations of some of the more common navigation stars are marked on the declination scale, but because of the shortness of the declination scale, some, as Acrux, Rigil Centauri and Dubhe, often used by the navigator, ai e omitted.

To use the computer, one has only to mount the protractor on the proper side, set the protractor index on the declination of the celestial body, and turn the radial arm of the protractor until it passes through the intersection of the appropriate latitude ellipse and local-hour-angle hyperbola. One can then read Z_n, the azimuth of the celestial body directly on the protractor scale which is divided in degrees; one can estimate tenths of a degree if one wishes.

The most obvious criticism to be made of the computer is that the local hour angle is marked in hours and minutes instead of degrees and minutes of arc as is the custom today. Another weakness of the instrument is that there is no provision for the determination of azimuths for bodies of declination greater than 45° when the latitude is less than 45°; as a matter of fact, the screw which holds the protractor in place must be removed if one wishes to use a declination numerically greater than 27° with a latitude less than 45°.

As is the case with all graphical methods, (and this is just a mechanized nomogram), the accuracy to be obtained is limited. For ordinary navigation purposes, it is adequate.

The vinylite sheet carries a graphical presentation of the approximate declination of the sun and another of the approximate equation of time, allowing one to use the instrument to find the azimuth of the sun, even though an almanac is not at hand.

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EDITORIAL NOTE: The Azimuth Computer of JOSEPH HILSENRATH and SAMUEL GLOBE, of the U. S. Navy, was first put on the market in Dec. 1944, when it was reviewed in *Boat and Equipment News*, v. 7, p. 56. It was also reviewed in *The Rudder*, v. 61, May 1945, p. 42–43, and *Yachting*, v. 78, Nov. 1945, p. 71. On Oct. 6, 1946 it was patented (no. 2408776) and the printed description in *U. S. Specifications and Drawings* occupies 6 columns and 2 plates (a third plate having been canceled).

3. SAMUEL HERRICK, "Instrumental solutions in celestial navigation," *Navigation*, v. 1, no. 2, June 1946, p. 22–27.

Quotation: "This paper attempts to survey a selection of the mechanical devices already in existence and to suggest possible developments along the lines indicated by: (1) devices that give altitude and azimuth; (2) devices that give position; (3) devices that combine observation and reduction; (4) the need for increased accuracy." The illustrations are (a) The Hagner Position Finder and Sun Compass; (b) A universal instrument for projecting lines of position onto a chart; (c) The Kaster spherant; (d) An instrument for the determination of latitude and longitude from simultaneous observations of two stars. There is a bibliography of eight references.

4. I. ĬA. Akushskiĭ, "Numerical solution of the Dirichlet equation with the aid of perforated card machines," Akad. N., SSSR, (*Dok.*) *C.R.*, v. 52, 1946, p. 375–378. See *Math. Rev.*, v. 8, 1947, p. 288, P. W. Ketchum.

5. Neil R. Bartlett, "A punched-card technique for computing means, standard deviations, and the product-moment correlation coefficient and for listing scattergrams," *Science*, v. 104, 18 Oct. 1946, p. 374–375.

6. S. Bergman, "Construction of a complete set of solutions of linear partial differential equations in two variables by use of punch card machines," *Quart. Appl. Math.*, v. 4, 1946, p. 233–245.

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8. Paul Herget, "Numerical integration with punched cards," *Astron. Jn.*, v. 52, 1946, p. 115–117.

Development of ideas set forth by W. J. Eckert, *Astron. Jn.*, v. 44, 1935, p. 177–182, "The computation of special perturbations by the punched card method," regarding the use of punched cards for integration, in the solution of the equations of motion of the three- or *n*-body problem. See *Math. Rev.*, v. 8, 1947, p. 289, Z. Kopal.

9. G. Kind-Schaad, "Lösung von Eigenwertproblemen mittels Lochkartenmaschinen" [Solution of characteristic value (Eigenwert) problems by punched card machines], *Schweizer Archiv f. angew. Wissen. u. Technik*, v. 13, June 1947, p. 161–168.

10. Gilbert W. King, "Some applications of punched-card methods in research problems in chemical physics," *Jn. Chem. Educ.*, v. 24, Feb. 1947, p. 61–64.

11. H. W. Renner, "Solving simultaneous equations through the use of IBM electric punched card accounting machines," 6 p. + 2 plates, a personal paper procurable at IBM, Endicott, N. Y.

12. Wm. A. Reynolds, "A prepunched master deck for the computation of square roots on IBM electrical accounting equipment," *Psychometrika*, v. 11, 1946, p. 223–237 + 1 folding plate.

Quotation: "Such a deck is valuable in constructing mathematical tables which involve square roots or in obtaining standard deviations in connection with computing correlation coefficients."

13. P. A. Shaffer, Jr., Verner Schomaker & Linus Pauling, "The use of punched cards in molecular structure determinations, I. Crystal structure calculations," *Jn. Chem. Physics*, v. 14, Nov. 1946, p. 648–658.

14. P. A. Shaffer, Jr., Verner Schomaker, & Linus Pauling, "The use of punched cards in molecular structure determinations, II. Electron diffraction calculations," *Jn. Chem. Physics*, v. 14, Nov. 1946, p. 659–664.

15. Clifford E. Berry & J. C. Pemberton, "A twelve-equation computing instrument," *Instruments*, v. 19, 1946, p. 396–398.

See the article by Berry, Wilcox, Rock & Washburn, "A computer for solving linear simultaneous equations," reviewed by D. H. L., *MTAC*, v. 2, p. 222–223.

16. Îu. G. Tolstov, "Novyĭ elektricheskiĭ apparat dlîa harmonicheskogo analiza i sinteza" [A new electrical apparatus for harmonic analysis and synthesis], Akad. N., SSSR, *Izvestiîa*, *Otdelenie tekhnicheskikh N.*, Apr. 1946, no. 3, p. 389–400. See *Math. Rev.*, v. 8, 1947, p. 287, H. B. Curry.

17. I. S. Bruk, "A mechanical device for the approximate solution of the Poisson-Laplace equations," Akad. N., SSSR (*Dok.*) *C.R.*, v. 53, 1946, p. 311–312. See *Math. Rev.*, v. 8, 1947, p. 288, S. H. C.

18. I. S. Bruk, "A device for the solution of ordinary differential equations," Akad. N., SSSR (*Dok.*) *C.R.*, v. 53, 1946, p. 523–526. See *Math. Rev.*, v. 8, 1947, p. 288, S. H. C.

19. R. Fürth & R. W. Pringle, "A photo-electric Fourier transformer," *Phil. Mag.*, s. 7, v. 37, 1946, p. 1–13. See *Math. Rev.*, v. 8, 1947, p. 287–288, S. H. C. See also *MTAC*, v. 2, p. 89.

NOTES

80. Certain Gear-Ratio Tables.—We have previously referred to gear ratios in *MTAC*, v. 1, p. 21–23, 88, 92, 143, 324, 326–329, 430. In the tenth edition of their *Formulas in Gearing*, 1929, the Brown & Sharpe Mfg. Co. first published their 6D table, p. 239–243, Logarithm of Gear Ratios N/D, $N \leqslant 100$, $D \leqslant 100$, $\frac{24}{100} < N/D < \frac{100}{24}$. It was not until the eleventh edition, 1933, p. 227, that to the title of these tables is appended the footnote, "Wingquist's Tables (American Machinist)." This footnote is quoted by FMR, *Index*, p. 22. On appealing to Henry D. Sharpe, President of the Company, and Chancellor of Brown University, he kindly furnished the following details:

Erik Wingquist, in *American Machinist*, v. 43, 1915, p. 1080–1083, 1114–1118, published a 7D table of log N/D, for gear-ratios $\frac{30}{100} < N/D < \frac{100}{30}$. "Apparently we had used these tables in making hob-sheet calculations of the gearing for backing-off lathes. The tables, however, stopped at 30 teeth whereas we had to use change gears with as few as 24 teeth. When we decided to include a table of logarithms of gear ratios in the *Formulas*, it was also decided that the table should go down to 24:100. Accordingly our Mr. L. R. Mayo made the necessary revisions of Wingquist's tables to interpose and add all the new ratios involved with pinions having numbers of teeth between 24 and 30."

Hence the table in *Formulas*, by two authors, Wingquist & Mayo, is both an expansion and abridgment of Wingquist's table. Thus there is call for revision of the FMR entry in order accurately to present all that is here involved.

R. C. A.