30. J. H. ROBERTSON, "A simple machine capable of Fourier synthesis calculation," *Jn. Sci. Instruments*, v. 27, 1950, p. 276–278.

This machine is a Fourier synthesizer with a novel method of addition for the terms. The terms cause mirrors to rotate and, consequently, a beam of light successively reflected by all of them is displaced an amount approximately proportional to the sum of the rotations.

F. J. M.

31. M. L. UNGAR, "Probability paper," Permanent Records of Research and Development, Ministry of Supply, Shell Mex House, Strand, London WC 2, England (Sept. 1950).

This monograph describes with samples three types of probability graph paper used in the British Ordnance Factories. Type (a) is based on the normal distribution function and can be used to test whether a distribution is normal and if it is, the mean and standard deviation. Type (b) is used for skew frequency distributions and Type (c) for a Poisson distribution.

F. J. M.

32. V. VAND, "A mechanical x-ray structure-factor calculating machine," *Jn. Sci. Instruments*, v. 27, 1950, p. 257–261.

The machine described is a mechanical device for summing trigonometric series of the type developed by Kelvin. A method is described for varying the basic frequencies along a gradient in order to obtain the best fit to a given empirical curve. A new machine in which the summation process is by moments rather than by the Kelvin pulley method is being developed.

F. J. M.

33. J. F. WATERS, "Instrument for measuring the slope of graphs," *Jn. Sci. Instruments*, v. 28, 1951, p. 116.

34. E. H. WINKLER, "Principle and design of a new type Stieltjes integrator," *Rev. Sci. Instruments*, v. 22, 1951, p. 406–410.

The objective of this device is to evaluate

$$\int_{x_0}^{x_1} F(x)\, dH(x).$$

$F(x)$ and $H(x)$ are given as curves and a mechanical device plots the curve, given parametrically by $v = F(x)$, $u = H(x)$. The area under this curve corresponding to the given integral is then obtained by a planimeter. An electric follower is described which traces a curve drawn with conducting ink. The tracer is to remain on one side of the curve.

F. J. M.

NOTES

132. FURTHER STATISTICS ON THE DIGITS OF *e*.—An account of the calculation of the first 2500 digits of *e* on the ENIAC appears in *MTAC*,

v. 4, p. 11–15 and p. 109–111. In December, 1950 GEORGE REITWIESNER of the Ballistic Research Laboratories at Aberdeen furnished the Computing Service with a deck of punched cards bearing the remainders from the ENIAC calculation at 2520, 2538, 2556, 2574 and 2592 D. The remainders at 2520, 2538 and 2574 D were punched on new cards and the calculation was extended on the 602A. Originally the machine was wired to calculate 5D of quotient and 4D of new remainders. Later the process was speeded up to punch 12D of quotient and 4D of remainder. The job ran as a fill-in project for the 602A until the three runs had all passed 3000D. A new set of remainders, at 2556D, was then punched and the calculations were repeated on the 604. The wiring, to calculate 20 digits of quotient in one pass through the 604, as well as the entire calculation to check, was done by ORVILLE MARLOWE. Thus all digits from 2557 to 3002 were done four times. The remainders at 2945, 3005, 3010 and 3023D are available should anyone wish to extend the calculation.

The χ^2 analysis of the digits in each hundred (*MTAC*, v. 4, p. 110) may be extended as follows:

n	$A_n = \chi_n^2$	p_n
2600	2.04	.0092
2700	2.54	.0202
2800	2.53	.0199
2900	2.67	.0240
3000	2.95	.0339

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133. ON FINDING THE ELECTRONIC CYCLE CAPACITY OF THE IBM TYPE 604 COMPUTER.—Frequently, when programming problems on the IBM Type 604 Electronic Calculating Punch, it is convenient to know the capacity of the machine in electronic cycles. This is especially true when one is attempting to partition a long empirical formula so as to effect the solution with a minimum number of runs on the machine. The user of the machine does not ordinarily have access to the driving oscillator so as to be able to change the operating frequency. Furthermore, extended operation at other than the prescribed frequency may be detrimental to the machine. Hence, the scheme described herein was devised for finding the capacity of the machine at the frequency which has been set internally. According to the operating manual (p. 65), the capacity is 252 electronic cycles. This, however, will vary slightly from one machine to another and within a given machine over a period of time. The following is a method for determining the machine capacity in 5 to 10 minutes.

We start by key punching a card with all 9's in columns 1–12 and a 7 in column 13. The 521 is wired to read columns 1–8 into FS 3–4 and columns 9–13 into MQ, to emit O into FS2, and to stop in the case of an unfinished program. In each of the first four program steps ROFS3–4, MULT +. This will require (48)(4) = 192 cycles. On program step 5 ROFS2, RIMQ (1 cycle) and finally on program step 6 ROFS3–4, MULT + (5 cycles). The remaining programs are unwired, hence in the case of a 60 program step 604 we have 54 additional cycles or a grand total of 252 cycles. By varying the number emitted into FS2, the number of cycles in program step 6, and hence in the total, may be increased. By varying the number read into MQ from the card the number of cycles may be increased or decreased by multiples of 4. If the machine has fewer cycles the unfinished program will cause it to stop. Usually key punching 3 or 4 cards and moving one wire on the 521 control panel 2 or 3 times will determine the capacity of the machine to the nearest cycle.

If the user has a 20 or 40 program step 604 the programming must call for 40 or 20 electronic cycles less respectively. This can be accomplished by simply changing the number read into MQ.

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134. FRITZ EMDE.—Fritz Emde, professor emeritus of the Technische Hochschule, Stuttgart, died there on June 30, 1951; he would have been 78 years old on July 13. In *MTAC*, v. 3, we published (p. 397–398) some biographical notes, and (opp. p. 333) a portrait.

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135. RALPH ERNEST POWERS.—This amateur mathematician died on Jan. 31, 1952, at Puente, California. He would have been 77 years old on April 27. Mr. Powers was more responsible than any other man for the demonstration of the failure of Mersenne's conjecture. He proved that $2^{89} - 1$ and $2^{107} - 1$ were primes, and that several other Mersenne numbers were composite by long and laborious desk machine calculations. He was not aware of the discovery, the night before his death, of two new Mersenne primes (*MTAC*, v. 6, p. 61). Mr. Powers was born in Fountain, Colorado, and spent most of his life in Denver.

D. H. L.

QUERIES

41. A DEFINITE INTEGRAL.—Does the integral

$$\int_0^\infty u^{-1} \exp(-zu - u^{-2})\, du$$

have a generalized asymptotic form for large positive values of z, say $z > 10$? The integral is a solution of the differential equation

$$zy''' + 2y'' + 2y = 0.$$

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