The instruction included discussions of number systems, machine instruction methods, computational modes, subroutines and the subroutine concept, translation processes, general aids to programming, storage devices, input-output equipment, computer operation procedures, and computer reliability. The special program was under the direction of JOHN W. CARR. The instructional staff was composed of members of the Digital Computation Group. Special lecturers were N. R. SCOTT, builder and designer of the University of Michigan magnetic drum computer, and W. F. BAUER, Willow Run Research Center, mathematician and analyst, and specialist in digital simulation.

Wayne University Computation Laboratory.—A special summer course in computer applications and components was offered by Wayne University from August 10 to August 21, 1953, in an endeavor to meet partially the immediate need for trained personnel in the field of automatic computing machinery. The course was held to train people to prepare and program problems for automatic computers, to adapt electronic techniques to the problems in business and industry, and to apply new design ideas for more effective equipment. This course is a part of a comprehensive educational program in this field instituted by the University in cooperation with local industry.

Applicants could register for any one of three different groups, namely; business applications, engineering applications, and computer components. In the first group, three daily lectures were given on programming, selected accounting applications, and production scheduling. Actual sample payroll or inventory problems were coded and run on the computers. The members of the second group joined the lecturers on coding and programming in the first group in addition to hearing separate lectures on engineering applications. Members of the group on computer components attended lectures on magnetic drum and other memory systems, ferro-electric and ferro-magnetic materials, and transistors. This special course offered as lecturers and discussion leaders many prominent leaders in the field of computers and their applications. Two new computers were available to students in order that they might code problems in their own field of interest, and with the assistance of the laboratory staff that they might run them on the machines. One was a large scale digital computer with a 5000-word magnetic drum memory, built by the Burroughs Corporation, and the other was a digital differential analyzer type of machine furnished by the Bendix Aviation Corporation.

OTHER AIDS TO COMPUTATION

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The curvature of the edge of this ruler is varied by driving a wedge into a slot.

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A note on certain results of the National Bureau of Standards program for the development of fast acting clutches suitable for use in high speed computers.

1062. VALENTINE APPEL, "Companion nomographs for testing the significance of the difference between uncorrelated percentages," *Psychometrika*, v. 17, 1953, p. 325–330.

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1067. F. W. Billmeyer, "Nomographs for converting between Hunter color difference meter readings and I. C. I. color coordinates," Optical Soc. Amer., *Jn.*, v. 41, 1951, p. 860–861.

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1069. J. S. Campbell & D. F. Welch, "Graphical analysis of cloud chamber photographs," *Nucleonics*, v. 10, no. 12, 1952, p. 62–64.

The graphical transformation of orthographic drawings based on stereoscopic photographs is discussed.

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1071. W. C. Davidon, "Nomogram for computing register losses," *Nucleonics*, v. 10, no. 12, 1952, p. 76–77.

1072. P. A. Einstein, "Factors limiting the accuracy of electrolytic plotting tanks," *British Jn. Appl. Physics*, v. 2, 1951, p. 49–55.

An experimental investigation of tank errors due to polarization, mechanical misalignment and surface tension was made using special tanks. At low frequencies the impedance between two electrodes is non-linear but at higher frequencies, it becomes linear but not purely resistive, having a capacitative component. The reactive element is due to the surface impedance of the electrode, which may be minimized by a proper coating. When care is taken to eliminate known errors an accuracy of .2% is obtainable.

F. J. M.

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1074. H. Gulliksen & L. R. Tucker, "A mechanical model illustrating the scatter diagram with oblique test vectors," *Psychometrika*, v. 16, 1951, p. 233–236.

Model illustrates changes to oblique coordinate systems.

1075. F. I. Havlíček, "Nomogram for estimating the optimum aperture of optical systems," Optical Soc. Amer., *Jn.*, v. 41, 1951, p. 483–484.

1076. V. M. Hickson, "Photo elastic determination of free boundary stress on 'frozen stress' models by an oblique incidence method," *British Jn. Appl. Physics*, v. 2, 1951, p. 261–269.

"Frozen stress" models are obtained by taking a plastic model of a part, and heating and cooling it while subject to an analogous load. The permanent changes in the optical properties of the model which occur can be utilized to determine the principal stresses. This article reviews the literature and the basic theory is given in order to indicate the effect of experimental errors on the answers obtained. The actual experimental procedure is described in detail with a discussion of methods of minimizing errors. Accuracies of 4 to 6 per cent are obtainable for the maximum stresses present.

F. J. M.

1077. E. S. Hodge, "A gamma nomograph," Optical Soc. Amer., *Jn.*, v. 41, 1951, p. 731–732.

The nomograph is for calibrating spectroscopes.

1078. H. T. Jessop, "The scattered light method of exploration of stresses in two and three dimensional models," *British Jn. Appl. Physics*, v. 2, 1951, p. 249–260.

This is a general article describing the process of determining the stresses in a transparent model using the interference effects associated with the scattering of a very narrow beam of plane polarized light. An observer viewing the length of such a beam would observe interference fringes whose width indicates the stress present in the path of the beam. This situation is precisely analyzed and four types of problems involving two and three dimensions are given to which the method is applicable. A discussion of various materials for the model and a description of the optical system appear. Four examples are discussed. The maximum accuracy mentioned in these is three percent.

F. J. M.

1079. W. B. Miller, Jr., "Nomogram for estimating decay of I^{131} and P^{32}," *Nucleonics*, v. 9, no. 4, 1951, p. 58–59.

1080. P. MOON & D. E. SPENCER, "Slide rule for lighting calculations," Optical Soc. Amer., *Jn.*, v. 41, 1951, p. 98–103.

Two special slide rules and directions for their use are described.

1081. P. MOON & D. E. SPENCER, "Simplified interflection calculations," Franklin Inst., *Jn.*, v. 251, 1951, p. 215–230.

Certain problems in illumination which previously had been handled by tables are solved approximately by means of nomograms and graphs.

1082. S. C. REDSHAW, "A three dimensional electrical potential analyzer," *British Jn. Applied Physics*, v. 2, 1951, p. 291–295.

This analyzer consists of a resistance network. The network was woven of high resistance wire and nine tiers of 25 by 25 points were provided. The cubical lattice form is appropriate for flows perpendicular to a plane surface.

F. J. M.

1083. A. L. SCHOEN & R. H. DAVIS, "An alignment chart for computing the thicknesses of evaporated films," Optical Soc. Amer., *Jn.*, v. 41, 1951, p. 362–363.

1084. L. SIEGEL & E. E. CURETON, "Note on the computation of biserial correlations in item analysis," *Psychometrika*, v. 17, 1952, p. 41–43.

A method is described for the computation of biserial correlation with a large number of items using punched card equipment.

1085. A. P. SPEISER, "Rechengeräte mit linearen Potentiometern," *Zeit. für angew. Math. und Physik*, v. 3, 1952, p. 449–460.

The use of loaded potentiometers to represent functions of one or two variables is discussed.

1086. L. G. STANG & P. D. HANCE, "Nomogram for calculating fission product activities," *Nucleonics*, v. 10, no. 1, 1952, p. 48–49.

1087. RAJKO TOMOVICH, "A universal unit for the electrical differential analyzer," Franklin Inst., *Jn.*, v. 254, 1952, p. 143–151.

The unit mentioned in the title is a complicated combination of rotating switches which can successively switch fifty preset potentiometers into a circuit. This permits the representation of a function of one variable having fifty values. The device is driven by either a constant speed motor or by a servo mechanism if a function of a generated variable is desired.

F. J. M.

1088. W. WALCHER, "Graphische Methode zur näherungsweisen Bestimmung von Trägerbahnen in elektrostatischen Linsen unter Berücksichtigung des Raumladungseinflusses," *Zeit. für angew. Physik*, v. 3, 1951, p. 189–190.

1089. Louis G. Walters, "Hidden regenerative loops in electronic analog computers," I. R. E. (Professional Group on Electronic Computers), *Trans.*, v. EC-2, no. 2, 1953, p. 1–4.

The author considers the linear differential equations with constant coefficients that describe a simple electrical network. The characteristic polynomial of the system is of third degree. One formal method of derivation leads to a set of 2 second order equations whose leading matrix is singular. In coding this set for electronic analog computation, it is necessary that the gain of a loop consisting of 2 amplifiers be precisely 1. The fourth order system that results if the loop gain is $1 + \epsilon$ has an extraneous mode which diverges rapidly for positive ϵ and decays rapidly for negative ϵ. The author suggests recasting the equations to avoid the singular matrix or introducing a small negative value of ϵ in the loop.

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1090. Bruce B. Young, "Advanced time scale analog computer," Franklin Inst., *Jn.*, v. 253, 1952, p. 169–171.

A repeating type of differential analyzer for systems with constant coefficients. Results are displayed on an oscilloscope. Four non-linear elements are available. This device was mentioned also in an anonymous note in the same journal, v. 251, 1951, p. 488.

NOTES

154.—On a Computation of the Capacity of a Cube. The electrostatic capacity (transfinite diameter) of a two or three dimensional region is a domain functional to which considerable attention has been paid in the last generation. Although a number of independent approaches are known, the actual computation of the capacity for specific regions is attended by considerable numerical difficulty. The present note reports the result of a computation of the capacity of the unit cube which was recently carried out on SEAC and which employed the purely geometric definitions of Fekete[1] and Pólya & Szegö.[2]

Let M designate a three dimensional region and C its capacity. Then the following two formulas are due to Pólya & Szegö:[2]

$$C = \lim_{n\to\infty} \operatorname*{Max}_{P_i \epsilon M} \binom{n}{2} \Big/ \left[\sum_{i<j\leq n} \frac{1}{d(P_i,P_j)} \right], \tag{1}$$

$$C = \lim_{n\to\infty} \operatorname*{Min}_{(P_k)\epsilon M} \operatorname*{Max}_{P \epsilon M} \left\{ n \Big/ \sum_{k=1}^{n} \frac{1}{d(P,P_k)} \right\}, \tag{2}$$

where $d(P,Q)$ indicates the distance between P and Q.

Formula (2) was employed in the SEAC computation, and the maximizations and minimizations were accomplished by selecting P and P_k from a quasi-random sequence of points lying in the unit cube and monitoring the extreme values. A value $n = 8$ was used. Corresponding to a fixed selection