THE APRIL MEETING OF THE MISSOURI SECTION

The annual spring meeting of the Missouri Section of the Mathematical Association of America was held jointly with the Missouri Council of Teachers of Mathematics at the University of Kansas City, Kansas City, Missouri, on April 22, 1955. Professor Maria Castellani, Chairman of the Section, presided at the morning session, and Reverend W. C. Doyle, Rockhurst College, presided at the afternoon session.

There were 45 persons in attendance, including the following 30 members of the Association:

John J. Andrews, S. Louise Beasley, C. A. Bridger, Maria Castellani, John F. Daly, W. C. Doyle, D. H. Erkiletian, Jr., C. V. Fronabarger, J. D. Haggard, Nola L. A. Haynes, F. F. Helton, N. Q. Hubbard, G. H. Jamison, C. A. Johnson, L. O. Jones, P. S. Jones, C. E. Kelley, P. G. Kirmser, S. L. Levy, F. H. Lloyd, Marie A. Moore, O. J. Peterson, L. E. Pummill, Lois J. Roper, J. S. Rosen, Robert Schatten, W. R. Scott, R. G. Smith, W. A. Vezeau, Margaret F. Willerding.

At the business meeting the following officers were elected for the coming year: Chairman, Professor Francis Regan, St. Louis University; Vice-Chairman, Professor H. D. Brunk, University of Missouri; Local Secretary-Treasurer, Professor Marie A. Moore, Harris Teachers College. Professor Margaret F. Willerding, Harris Teachers College, retained her position of Association Secretary for a fourth year.

The following program was presented at the morning session:

1. *The significance and derivation of the formula*, by Mr. N. Q. Hubbard, Lincoln High School, Kansas City.

The study of the formula covers an extensive field in the branches of mathematics. The re-

search on this problem extends from the dates of 1857 to 1955. The significance and derivation of the formula, as it appears in print, covers an abundance of research work on this topic. The validity has been shown by various citations in this study by noted scholars in the field of mathematics whose authenticity has met the criteria in educational research. This study shows very plainly the aids, new methods of procedures, principles and modern avenues of approach to algebraic solution in secondary mathematics. The significance and derivation of the formula stands out as one of the basic concepts of junior and senior high school mathematics of today.

2. *A differential equation applicable to population problems*, by Mr. C. A. Bridger, Bureau of Vital Statistics, Jefferson City.

The differential equation $dP = f(P)F(t)dt$, where f and F are polynomials, is assumed. Examples for simple cases are developed. The Pearl-Reed logistic occurs when f is a quadratic and F is a constant. On the basis of information from previous decades, estimates by counties for Missouri are made for 1960. In over half of the counties, the exponential form of the solution of the equation is used.

3. *Birth, death, and waiting in line*, by Dr. Ernest Koenigsberg, Midwest Research Institute, Kansas City, introduced by the Secretary.

The problems of waiting in lines or queues can be introduced in terms of birth and death processes. A queue system is described by three characteristics: 1) a birth process or input mechanism; 2) a queue discipline (*e.g.*, "first come, first served"); 3) a death process or exit mechanism.

Several birth and death processes are described and formulated, and the "exponential holding time" queue system is formulated in terms of the rate of change of the number of units at the service station (*i.e.*, those waiting in line and those being served). The "constant holding time" queue system is also formulated in terms of the number of ways that a given number of units can be at the service station. Various other cases are discussed: queuing with priorities, queuing with special service, random queue disciplines, and now Poisson birth processes.

4. *Reorientation in economic theory: linear and non-linear programming*, by Professor E. Altschul, University of Kansas City, introduced by the Secretary.

Theory of Games by von Neumann and Morgenstern has initiated a new trend in developing analytical tools in economic theory and applied economics. Human actions geared toward optimization of various goals represent a maximum problem entirely different from that of physics. In a society each participant has to maximize a function without having control over all variables, being forced to meet actions of opponents.

Von Neumann and Morgenstern proved that economic problems are not those resembling maximum problems in physics, but problems of maximizing under constraint conditions, leading to the analysis of relative maxima as expressed by linear inequalities. The traditional approach of calculus must be replaced by matrix analysis. The new minimax approach opens a wide avenue for economic generalizations and development of flexible tools in solving practical problems of optimization in managerial decision.

5. *Some sign and rank tests in statistics*, by Professor W. A. Vezeau, St. Louis University.

A short discussion of basic concepts in statistics was presented as background. Then a historical development of sign and rank tests was given. Reasons for the use of such tests by mathematics teachers were presented with particular stress upon the introduction of such tests as special topics or projects in certain classes of mathematics. A number of practical problems were discussed using some of the sign and rank tests.

6. *Rational function approximations for the exponential function*, by Mr. Y. L. Luke, Midwest Research Institute, Kansas City, introduced by the Secretary.

Employing Chebyshev polynomials, simple rational function approximations for the exponential function in the complex domain are obtained. The technique follows that of C. Lanczos and is known as the τ-method for the solution of linear differential equations with rational coefficients. Some numerical examples are present. Results are useful for stability and response studies of time delay control systems.

7. *Infinite symmetric groups*, by Professor W. R. Scott, University of Kansas.

Let X and Y be infinite cardinal numbers. The infinite symmetric group $S(X, Y)$ is the group of $1-1$ transformations of a set of order X onto itself in which fewer than Y elements are moved. The alternating group $A(X)$ is the subgroup of finite even permutations in $S(X, Y)$. Any homomorphism of any $S(X, Y)$ or $A(X)$ on to an $S(X, Y)$ or $A(U)$ is an isomorphism and $X=U$, $Y=V$. Any factor group of $S(X, Y)$ contains a subgroup isomorphic to $S(X, Y)$ if $Y \neq \aleph_0$. If $2^Z < X$ (Z may be finite) and $Y \neq \aleph_0$, then neither $S(X, Y)$ nor $A(X)$ contains a subgroup of index $\leqq Z$.

8. *Phase plane solution of non-linear differential equations*, by Dr. S. L. Levy, Midwest Research Institute, Kansas City.

The ordinary electric bell's motion is analyzed in terms of an on-off servo-system. The analysis is completely graphic and is, furthermore, fully idealized so that it does not detract from the physical principles involved and the use of the phase-plane method. The response of a more realistic system is indicated. The result of the analysis shows a bell would not operate if it did not have "poor on-off control."

9. *The use of television in mathematics education*, by Professor P. S. Jones, University of Michigan. (By invitation).

There have been more than twenty-six television programs or series with mathematical content presented over stations in the United States. Most of these have been of a semi-popular "cultural" nature, designed to interest viewers in mathematics and to inform them about its role and importance. However, there have been several programs designed to teach particular mathematical topics (the slide rule, high school algebra, nomography, the teaching of arithmetic, measurement), and more programs sponsored by public schools showing the content and methods of teaching for public relations purposes.

Television offers opportunities for making individual skilled speakers or teachers and special equipment available to a large audience and hence can do much to increase interest in and appreciation of mathematics and to actually enrich the teaching of mathematics for school children as well as for adult viewers.

MARGARET F. WILLERDING, *Secretary*