PI MU EPSILON JOURNAL

THE OFFICIAL PUBLICATION OF

THE HONORARY MATHEMATICAL FRATERNITY

VOLUME 2 NUMBER 3

CONTENTS

FALL 1955

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ACKNOWLEDGEMENT

Since Miss Pepper and I have taken over respectively the posts of business manager and editor-in-chief of the Journal, we have come to realize the magnitude of the effort put forth by our predecessors. To Professor Howard C. Bennett and Professor Henry W. Farnham, who preceded Miss Pepper as business manager, and to Miss Ruth Stokes, who preceded me as editor-in-chief, the Pi Mu Epsilon Fraternity owes a great debt of gratitude for a difficult job well done.

Franz E. Hohn

NEW FRONTIERS FOR MATHEMATICIANS

Mina S. Rees
Hunter College

The American scene to-day presents important and exciting new vistas for students graduating from our colleges with a good background in mathematics, making demands for mathematically trained young people quite different from those presented even five years ago. In this paper some of these new frontiers for mathematicians will be discussed in an effort to give part of the background that should enable young mathematicians to choose wisely among the many paths they may take.

For those who are strongly attracted by pure mathematics, a life devoted to teaching and research will, of course, continue to hold the richest rewards; and the university will continue to be the center where the great advances in mathematics are made. But mathematics is always handmaiden as well as queen; and for those who are thinking of seeking careers in industry, the picture has changed. Until a few years ago, mathematics had only the same sort of general appeal for such young people as had virtually all subjects in the liberal arts curriculum unless actuarial work was the goal. To-day this picture is quite different. Now, college graduates with a major in mathematics have a choice of several interesting jobs in industry, and leading companies compete for their services. And those who go on for a Ph.D. find themselves, if they have suitable temperament and interest, in the novel position of being in as much demand as engineers and physicists.

What kinds of industries are bidding for the services of mathematicians, and what is the nature of the mathematics that is being used?

For a young A. B. the principal openings are still associated with the great computing centers that have grown up around the new electronic computers. Many of these jobs are actually involved with the preparation of problems for solution on the machines; but because the machines themselves can handle such interesting problems, our young mathematicians have much more exciting work than their predecessors a few decades ago who worked with desk machines. And there are interesting developments in the direction of using specially trained personnel on the sales forces of the great companies that have huge investments in these machines, and are developing them extensively for business uses. The thing to observe is that there are actually careers in the making. A first step, immediately after college, is to serve on the staff that operates the machines; a later forking of opportunities depends on the interest and further training of the young person, either on the sales force, or in an advanced scientific position, or in an administrative post. The types of problems handled, the constantly new points of view, the utterly unimagined developments that can be expected, make this a career worth considering.

There are interesting mathematical features of work with these machines. One is the exploitation of the representation of numbers in binary notation - in the engineering design of the machines and in much relevant mathematical analysis. Another is the iterative solution of linear equations. Much work has been done on the practical solution of linear equations in the last few years,[1] and there is much interesting new mathematics connected with the solution of these when there are many of them - at least ten, and preferably twenty-five, or a hundred. The problems involved in insuring that the answer actually has significant figures are non-trivial.^ Still another question that has been receiving attention is the numerical solution of differential equations by methods suitable for use with electronic computers.[3]

Linear programming is another aspect of recent mathematical work that is playing an increasingly large role in industrial developments, often in connection with operations research. The linear programming ideas offer an inviting introduction to some primitive concepts of convex sets, and of game theory. A good introduction to the background that motivated much of the early work in this field is the Leontieff article in the Scientific American, some time ago, on Input-Output Analysis.[4] This is a field in which there are increasingly many jobs for mathematicians, though they will usually need an advanced degree.

On operations research teams, a mathematician is a welcome participant, but again a considerable amount of advanced training is probably necessary. In all phases of applied mathematics it is in the construction of conceptual models that the applied mathematician often meets his greatest challenge; and it is here that the decisive contribution of the mathematician as a member of a team of scientists lies.

The operations research team, essentially as it is now used, was born during World War II. The groups formed in England at that time consisted of representatives of the physical sciences, mathematics, and applied statistics. Just before the war, the state of scientific analysis and of industry made the world ripe for the development of this new tool. There were three main features in this readiness. First, the social and industrial structure was rapidly becoming much more complicated. When changes were to be made, they often involved vast capital investments and no longer permitted the luxury of a trial and error solution of administrative problems. Second, scientific methods had begun to find their way into industrial management, with time-motion studies accepted by U. S. Steel and other great industries. Third, science had progressed to the point where it was not limited to controlled experiments but had developed some of the tools needed to study problems involving many variables that are related by complex interactions, in such a way that it is not possible to take one part away from the whole and consider its function entirely independently. The development of statistical methods of experimental design and analysis enabled giant strides to be made in biology and agriculture; and it is not too surprising that the methods of analysis that can resolve problems in the study of living biological organisms may also be used successfully in the study of living social organisms. The outbreak of World War II introduced a sharp stimulus towards the use of scientific methods to study some of the most pressing of military problems. There were many spectacular successes - improving the effectiveness of night fighters in the defense of Britain, adjusting the setting of depth charges to increase greatly the number of our successes against attacking submarines, advising on the patterns of bombing to be used in attacks against the enemy.

The examples can be multiplied. In some cases a clear mathematical theory can be developed; and the model of reality which it handles gives a close enough approximation to the problem studied, so that the results are usable. Often this is impossible, and an observational and statistical approach must be taken. Always a group of men, chosen from several disciplines, collaborate on the study. Their object is essentially practical - to provide the executive of a military service, or business, or industry with a prediction and comparison of the values, effectiveness, and costs of a set of proposed alternative courses of action involving man-machine systems. Since World War II, the use of this tool has greatly expanded. It has been used, for example, to study the lay-out of equipment in a heavy engineering shop at a place where a severe bottleneck occurred in production; to provide greatly improved timing and equipment in unloading iron ore at a port in Britain; to study many socalled "queuing" problems - patients waiting for doctors, the flow of customers out of super-markets, the stacking-up of airplanes; more broadly it has been used extensively in road traffic research, in studies of productivity and of accidents. In the recent book, "Operations Research for Management",[5] Horace Levinson has a chapter on *Experience* in *Commercial Operations Research* which is particularly useful as an introduction to some of these problems. The experiences cited use several relatively simple elementary concepts, but they use these concepts in a sophisticated manner that gives something of the quality of the problem without too greatly taxing the mathematical ingenuity of the reader. In particular Mr. Levinson studies a problem arising in a small mail-order house; he studies the effect of night openings at Bamberger's in Newark by a method subsequently extended to Macy's; he studies the effects of newspaper advertising on department store sales.

Operations research teams are making increasing demands on the supply of statisticians as well as of mathematicians. But we are simply unable to supply as many statisticians as are needed for a variety of positions in industry. On the less advanced level, there is the vast expansion of the use of quality control in industry. This subject is interestingly discussed in an article in the March, 1953, issue of Scientific American. A more advanced statistical training is needed for the expanding market for people equipped to provide technical advice involving the design of experiments. More and more the executives of great research laboratories, and those responsible for other extensive experimental establishments are being indoctrinated in the necessity of consulting the statistician before gathering data from experiments. A short time ago, at a dinner party in honor of a distinguished visiting British physician, the conversation drifted around to statistics. The distinguished visitor was telling about the biological aspects of some atomic work in Britain, and he said, "Of course, I knew that I had to get the statistician in before we planned the test, or we'd

probably run a very wasteful test, and we wouldn't be able to draw valid conclusions." He had been thoroughly indoctrinated, as have many of the leaders of our great research undertakings who have learned the value of consulting the statistician early. In a recent survey of the needs of all army research installations conducted by the Office of Ordnance Research, the two fields of mathematics in which the need for trained personnel was found to be most acute were numerical analysis and design of experiments. In the Navy, an extended program has been undertaken to provide advice in experimental design to Navy laboratories. In industry, some of the largest companies have recently expanded their effort in this direction.

Another field for the statistician where the demand exceeds the supply is in various versions of the survey. An estimate of the needs and wishes of people seems sometimes to be made just for fun, but it is a basic requirement for many decisions of business and government. Formerly, the dilemma was the necessity for a choice between a complete census of the population under study (often a very expensive operation) or the study of a small sample (a method that was liable to be hopelessly inaccurate before a proper theory of sampling had been worked out). Now we have an adequate theory available for the planning of sample surveys which insures that the sample is representative of the whole population and the probable limits of error are known. Even in the great pre-election poll failure of 1948, this was true. And at the time of the last population census in 1950, the Census Bureau organized a simultaneous sample survey to check the accuracy of the complete census. This may sound strange; but the vast amount of work involved in a complete census makes it necessary to use untrained, or at best ill-trained workers; and the incidence of inaccuracy in reporting is very great. In sample surveys, on the other hand, carefully trained workers can be used so that the results are often more reliable, in spite of the relatively small number of cases studied. As a result of the many uses of the survey in our society there is great variety in the careers open to young people who have acquired the kind of advanced training needed in this work.

In addition to the types of work described above, there continues to be a demand for young men and women trained in the more classical types of applied mathematics, such as continuum mechanics, elasticity, electromagnetics. The aircraft industry, in particular, has pressing needs for mathematicians as well as physicists and engineers; and there are many other industries that are bidding for young people with this type of training.

There is general agreement among those who are working in the fields of applications mentioned here, as well as in other fields where mathematics is finding a place, that the best preparation the young college graduate can bring to this work is a sound training in collegiate mathematics as well as understanding and experience with some other fields of learning such as the natural or the social sciences. Both breadth and depth are needed. Critically necessary, also, is an interest in working with people trained in other disciplines, and the willingness and ability to learn the language that non-mathematicians use and understand. For gifted mathematicians this is sometimes hard; but it is a ***sine qua non*** for success in the applications of mathematics.

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THE GREAT REDUCTION THEOREM

Alan J. Goldman
Gamma of New York

The theorem to be discussed is not new, its basic lemma having appeared, for instance, in Courant-Robbins' "What is Mathematics?" The lack of interest in it and comment on it is rather surprising, since one would certainly expect an enthusiastic reception to be accorded a result which yields Fermat's Last Theorem as an immediate consequence and provides instantaneous criteria for the convergence or divergence of infinite real series and the algebraic or transcendental nature of given real numbers. Even the restriction to the real domain is not essential, as will soon be evident. In view of the considerable simplifications effected in many branches of mathematics with its aid, I have taken the liberty of assigning it what seems an appropriate title.

The Great Reduction Theorem: If z is a real number, then $z = 0$.

Proof: Suppose we could show $1 = 0$. Then $z = 1 \cdot z = 0 \cdot z = 0$. Thus it ***suffices*** to prove $1 = 0$, but we can actually derive a much stronger result, as follows:

Lemma: If x is a non-negative integer and y is a non-negative integer, then $x = y$. (In particular, $1 = 0$.)

Proof: We proceed by mathematical induction on $M = \max(x,y)$. If $M = 0$, then clearly $x = y = 0$, so the theorem is true for this case. Suppose it is true for $M = n$, and we are given x and y such that $= n + 1$. Then obviously $\max(x-1, y-1) = M-1 = n$, so by the inductive hypothesis we have $x-1 = y-1$, and thus $x = y$. **Q. E. D.**

PROBLEM DEPARTMENT

Edited by
Leo **Moser,** University of Alberta

This department welcomes problems believed to be new and, as a rule, demanding no greater ability in problem solving than that of the average member of the Fraternity, but occasionally we shall publish problems that should challenge the ability of the advanced undergraduate and/or candidate for the Master's Degree. Solutions of these problems should be submitted on separate, signed sheets within five months after publication. Address all communications concerning problems to Leo **Moser,** Mathematics Department, University of Alberta, Edmonton, Alberta, Canada.

PROBLEMS FOR SOLUTION

78. Proposed *by* Fred Gross, Brooklyn College

Prove that if m, n, a, b, are fixed integers, with $m > n > 0$, then there exist integers x and y such that

$$2^{2^m}\cdot x + 2^{2^n}\cdot y = (a+\sqrt{x})(a-\sqrt{x}) + (b+\sqrt{y})(b-\sqrt{y}) .$$

79. Proposed *by* C. V. Trigg, Los Angeles City College

Find the bounding values of the ratio of the sides a and c of a triangle in order that the median to one side and the symmedian to the other side may be concurrent with the internal bisector of the included angle.

80. Proposed *by* H. Helfenstein, University of Alberta

Prove that the circumscribing circles of the four triangles determined by four planar lines of general position have a common point.

81. Proposed *by* Leon ***Bankoff,*** Los Angeles, California

Show that

$$1 + 1/2^2 + 1/3^2 + 1/4^2 + \ldots = 2(1 - 1/2^2 + 1/3^2 - 1/4^2 + \ldots) .$$

82. Proposed *by* C. W. Trier, Los Angeles City College

Show that by two continuous cuts the surface of a cube may be divided into two pieces which can be unfolded and assembled into a hollow square.

SOLUTIONS

6. Proposed *by* C. W. Trigg, Los Angeles City College

Starting with a straight edge, closed compasses, and two straight line segments, a and b, construct the harmonic mean of a and b in the least number of operations. Changing the opening of the compasses, drawing a circle or the arc of a circle, and drawing a straight line are each considered an operation.

Solution by Leon ***Bankoff,*** Los Angeles, California

A ten-step construction is given in the Pi Mu Epsilon Journal, April 1952, p. 226, and a nine-step construction appears in the issue of Nov. 1952, p. 277. It is possible to construct the harmonic mean in eight operations.

1) Draw a straight line **XY** conveniently extended.

2) Open compasses to a radius a. (Assume a > b.)

3) **On XY** choose an arbitrary point 0 as center and describe a circle of radius a, cutting XY in A and B.

4) Describe arc (A, a) cutting the circle (0) in C and D.

5) Change compass opening to radius b.

6) Describe arc **(B,** b) cutting (0) in E and F, and cutting AB in G.

7) Describe circle (G, b) cutting arc EGF in J and K.

8) Draw JD cutting AB in P. (J and D are on opposite sides of AB.) Then PB is the Harmonic Mean of a and b.

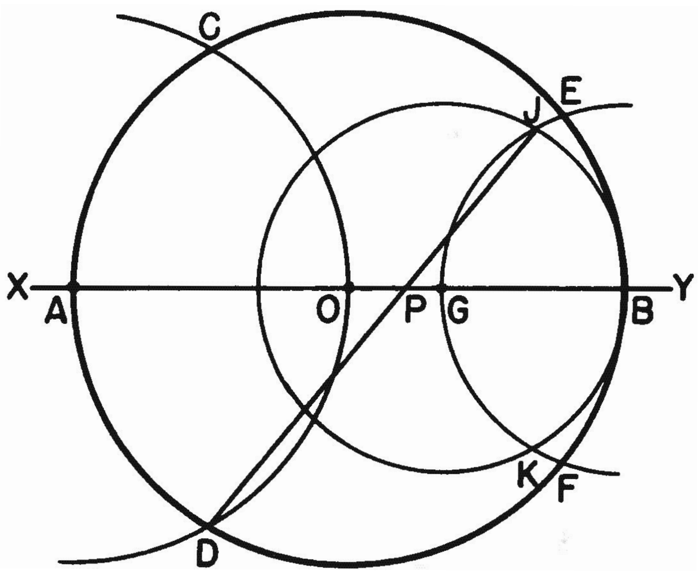
Proof: Triangles JPB and ADP are similar, since angles JBP and PAD are each equal to 60°. Hence

$$\frac{AB - PB}{PB} = \frac{AD}{JB}$$

$$\frac{AB}{PB} = \frac{AD}{JB} + 1 = \frac{AD + JB}{JB}$$

and

$$PB = \frac{AB \cdot JB}{AD + JB} = \frac{2ab}{a + b}$$



8. Proposed by R. T. Hood, University of Wisconsin

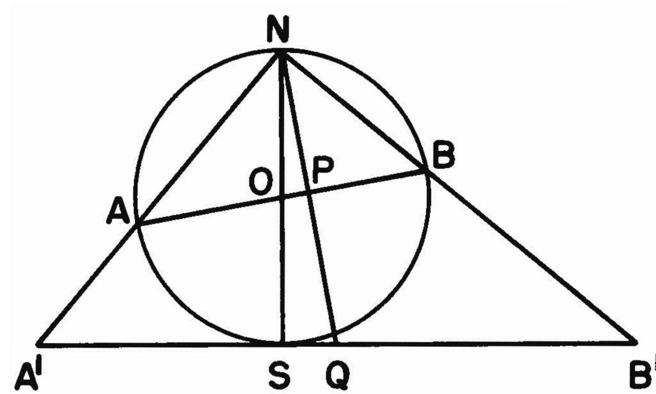
Consider the stereographic projection of a sphere onto a plane tangent to it at its south pole S, the center of projection being north pole N. Prove that every great circle on the sphere not passing through N is mapped into a circle whose center is on the line through N which is perpendicular to the plane of the great circle.

Solution by Leon Bankoff, Los Angeles, California

Let another sphere pass through any non-meridian great circle on the given sphere. By inversion with N as center and NS as radius, the given sphere is transformed into the tangent plane at S. The second sphere is inverted into a sphere whose intersection with the image plane is a circle inverse to the great circle chosen on the first sphere.

Let P be the foot of the perpendicular from N on the plane of the great circle and let NP cut the image plane in Q. Consider the plane through N, S and Q. This plane is perpendicular to the plane of the great circle and to the image plane and contains the point P, the center O of the given sphere, a diameter AB of the great circle, and the diameter $A'B'$ of the image circle. Of course, it also contains a meridian of the given sphere and the line of intersection with the image plane. (See accompanying figure of the plane section).

Now $\angle NA'B' = \angle NBA$ since each is measured by one-half arc AN. Similarly, $\angle A'B'N = \angle NAB$. By the similarity of triangles APN and $B'NA'$ we find that $\angle NA'B' = \angle A'NQ$, and by the similarity of triangles NPB and $B'NA'$ it follows that $\angle QNB' = \angle NB'Q$. Hence triangles $A'QN$ and NQB' are isosceles and $A'Q = NQ = QB'$. Since Q is the midpoint of diameter $A'B'$, it is the center of the circle mapped onto the image plane.



9. Proposed by the Problem Editor

If the bases of a prismatoid are equal in area, then so are the sections equidistant from the midsection.

Solution by J. Kiefer, *Cornell* University

It is well known (Solid Geometry, J. S. Frame, p. 131) that any convex prismatoid can be subdivided into prisms, wedges, and pyramids. From this it follows that any prismatoid is the result of additions and subtractions of prisms, wedges, and pyramids so that the area A of a principal section is a quadratic function of the distance x of the section from one base. Suppose $A(x) = ax^2 + bx + c$ and let the distance between bases be Id. Since $A(o) = A(2d)$ we obtain $d(4ad + 2b) = o$ and $4ad + 2b = o$. But now, $f(d+x) - f(d-x) = x(4ad + 2b) = o$ as required.

68. Proposed by Leon *Bankoff,* Los Angeles, California

An ellipse of maximum area is inscribed in a given triangle. Show that the area of the smallest quadrilateral circumscribing this ellipse is less than the geometric mean and greater than the harmonic mean of the areas of the ellipse and the triangle.

Solution by the Proposer

By projection, the configuration can be transformed into a circle inscribed in an equilateral triangle and circumscribed by a square, with relative areas invariant. The area of the circle is πr^2; that of the square is $4r^2$ and of the triangle $3r^2 \cdot \sqrt{3}$.

Since $$\sqrt{3\sqrt{3}\,\pi} > 4 > \frac{6\pi\sqrt{3}}{\pi + 3\sqrt{3}}$$

the proposition is proved.

69. Proposed by C. W. *Trigg,* Los Angeles City College

Two frictionless planes, inclined at angles of 10° and 30° to the horizontal, are joined at their tops, where an ideal

(frictionless, massless) pulley is placed. An ideal string parallel to the planes passes over the pulley. To the ends of the string are attached masses of 31-Kg. and 47-Kg., one mass resting on each plane. When the masses are released, the string will be under tension. To what angle must the inclination of the 10'-plane be changed in order that the tension in the string may be doubled?

Solution by the Proposer

In the general case of masses M_1 and M_2, tension T_1, and angles of inclination ϕ_1 and ϕ_2, when the masses are isolated and Newton's second law is applied,

$$M_2 g \sin\phi_2 - T_1 = M_2 a \text{ and } T_1 = M_1 g \sin\phi_1 = M_1 a .$$

When a is eliminated between these two equations, we have

$$T_1 = \frac{M_1 M_2 g(\sin\phi_1 + \sin\phi_2)}{M_1 + M_2} = K(\sin\phi_1 + \sin\phi_2). \text{ Here } K$$

is constant for any given pair of masses. Hence, if ϕ_1 and ϕ_2 are changed to θ_1 and θ_2 so that $T_2 = p\,T_1$, then

$$\sin\theta_1 + \sin\theta_2 = p(\sin\phi_1 + \sin\phi_2) \leq 2 .$$

In this particular problem, $\phi_1 = 10°$, $\phi_2 = \theta_2 = 30°$, and $p = 2$, so

$$\sin\theta_1 + \sin 30° = 2\sin 10° + 2\sin 30° .$$

$$\sin\theta_1 = 2(0.17365) + 0.50000 = 0.84730.$$

$$6 = 57°55'08'' .$$

The result is independent of the masses involved.

Also solved by Richard R. Boedeker.

70. Proposed by Pedro *Piza, San* Juan, Puerto *Rico*

Find eight distinct numbers $a_1, a_2, \ldots, a_8$ which satisfy

$$a_1^2 + a_2^2 + a_3^2 + a_4^2 = a_5^2 + a_6^2 + a_7^2 + a_8^2$$

and also, for arbitrary k, satisfy

$$(a_1 + k)^2 + (a_2 + k)^2 + (a_3 + k)^2 + (a_4 + k)^2 =$$

$$(a_5 + k)^2 + (a_6 + k)^2 + (a_7 + k)^2 + (a_8 + k)^2 .$$

Solution by the Proposer

The following is a solution involving the two parameters, a and b:

$$\begin{array}{ll} a_1 = a + b & a_5 = a + 2b \\ a_2 = a + 4b & a_6 = a + 3b \\ a_3 = a + 6b & a_7 = a + 5b \\ a_4 = a + 7b & a_8 = a + 8b \end{array}$$

Note that the eight numbers are, in some order, in arithmetical progression, and that the second relation of the problem follows from the linear relation:

$$a_1 + a_2 + a_3 + a_4 = a_5 + a_6 + a_7 + a_8 .$$

Also solved *by F.* Gross.

71. Proposed by A. J. *Goldman,* Princeton University

Let S be the set of $m \times n$ matrices with all mn entries distinct,

and let the matrix A be chosen at random from S. If entry a_{ij} of A is the least entry in the i-th row and the greatest entry in the *j*-th

and let the matrix A be chosen at random from S. If entry a_{ij} of A is the least entry in the i-th row and the greatest entry in the *j*-th

column, then the pair (i,j) is called a saddlepoint of A. (This concept is important in game theory.) Prove that A has at most one saddlepoint, and find the probability that A has a saddlepoint.

Solution by the Proposer

Suppose (p, q) and (r, s) were both saddlepoints of A. Then $a_{pq} \le a_{ps} \le a_{rs}$ and $a_{rs} \le a_{rq} \le a_{pq}$, so that $a_{pq} = a_{rs}$. Since the entries A are distinct, p = r and q = s; thus A has at most one saddlepoint.

To decide whether a specific entry a_{ij} of A is a saddlepoint, we examine the set of entries appearing in either the i^{th} row or the j^{th} column. These $m+n-1$ numbers can be ordered by magnitude in precisely $(m+n-1)!$ ways, and since A was chosen at random, all of these are equally likely. a_{ij} is a saddlepoint if and only if the ordering is such that the $m-1$ entries a_{kj} $(k \neq i)$ are less than a_{ij} and the n-1 entries a_{it} $(t \neq j)$ are greater than a_{ij}; there are $(m-1)!\ (n-1)!$ such orderings.

Finally, the probability that A has a saddlepoint is obtained by multiplying the probability that a specific entry be a saddlepoint by the total number mn of entries. The result is

$$mn(m-1)!\ (n-1)!\ /\ (m+n-1)! = m!\ n!\ (m+n-1)!$$

72. Proposed *by* Ken *U.* Summit, Adder *College*

Evaluate the following

$$\sum_{i=0}^{\infty} \frac{\sin i}{i!}$$

Solution by J. J. Dodd, Aurora, Illinois

Consider the identity

$$(1)\quad e^z = \sum_{i=0}^{m} z^i/i!$$

Let

$$(2)\quad z = r(\cos\theta + i\sin\theta)$$

Then

$$(3)\quad e^z = e^{r(\cos\theta + i\sin\theta)} = e^{r\cos\theta}(\cos(\sin\theta) + i\sin(\sin\theta)).$$

Using (3) and equating real and imaginary parts of (1) yields

$$(4)\quad \sum_{i=0}^{\infty} \frac{r^i\cos i\theta}{i!} = e^{r\cos\theta}(\cos(\sin\theta))$$

and

$$(5)\quad \sum_{i=0}^{\infty} \frac{r^i\sin i\theta}{i!} = e^{r\cos\theta}(\sin(\sin\theta))$$

Setting $r = \theta = 1$ in (5) gives

$$\sum_{i=0}^{\infty} \frac{\sin i}{i!} = e^{\cos 1}(\sin(\sin 1))$$

Also solved by P. L. ***Chessin***, J. *F.* Detlef, ***C.*** L. ***Gape***, and the proposer.

DEPARTMENT DEVOTED TO CHAPTER ACTIVITIES

Edited by
Houston T. Karnes, Louisiana State University

EDITOR'S NOTE. According to Article VI, Section 3 of the Constitution: "The Secretary shall keep account of all meetings and transactions of the chapter and, before the close of the academic year, shall send to the Secretary General and to the Director General, an annual report of the chapter activities including programs, results of elections, etc." The Secretary General now suggests that an additional copy of the annual report of each chapter be sent to the editor of this department of the Pi Mu *Epsilon* Journal. Besides the information listed above we are especially interested in learning what the chapters are doing by way of competitive examinations, medals, prizes and scholarships, news and notices concerning members, active and alumni. Please send reports to Associate Editor Houston T. **Karnes,** Department of Mathematics, Louisiana State University, Baton Rouge 3, La. These reports will be published in the chronological order in which they are received.

REPORTS OF THE CHAPTERS

Alpha of Michigan, Michigan State University

The Michigan Alpha chapter held eleven meetings during the year 1954-55. These included business meetings, program meetings, initiations, the annual winter banquet and the spring picnic.

The following papers were presented at the program meetings:

"A Problem in Investment" by Dr. H. E. ***Stelson***

"The Study of Mathematics" by Dr. J. *G.* Hocking

"Transcendental Numbers" by Mr. William L. Harkness

"Magic Squares" by Mr. Walter Turner

"Convex Functions of Higher Order" by Dr. Ralph James

Several chapter members attended a meeting of mathematics clubs from nearby universities at the University of Michigan, held in May, 1955.

At the winter banquet the speaker was Dr. J.W.T. Youngs of Indiana University. His subject was, "A Paradox".

The annual awards were presented to William Harkness, Walter Turner, Donald Lick, and Phillip Douglas by Dr. J. S. Frame, during the banquet.

Eighteen new members were initiated on May 3, 1955.

Officers for the year 1955-56 are President, William Harkness; Vice-president, Arthur Baker; Secretary, Elizabeth Armitage; Treasurer, Donald Lick.

Alpha of Louisiana, Louisiana State University

Due to certain conditions Louisiana Alpha was not as active this year as in the past. Organization was not effected until the second semester. Four business sessions were held in connection with the Freshman Honors Examination and initiation. On May 5 twenty-nine new members were initiated. Following the initiation a banquet was held in the Faculty Club. Dr. Houston T. Karnes was the banquet speaker.

The following annual awards were presented: Freshman Award (Based on an Honors Examination), Thomas H. Oswald, Natchez, Mississippi. Senior Award (Selected by the department on the basis of quantity of mathematics taken and the quality of work done), Weaver T. Brian, Shreveport, Louisiana.

The following served as officers during the year: President, Joanne Aycock; Vice-president; Melba LeRoy Harvey, Jr.; Secretary, Patricia Harrison; Treasurer, Cecilia Cimerman; Faculty Adviser and Corresponding Secretary, Dr. Houston T. Karnes.

Beta of New York, Hunter College

New York Beta held nine meetings during the year 1954-55. These included business sessions, program meetings, banquets and a tea.

The following topics were discussed at the program meetings:

"Some Paradoxes in Elementary Mathematics" conducted by student members ***Lorraine Nayer, Ethel Schwartz*** and ***Olga Shelley.***

"Spherical Trigonometry" conducted by student members ***Joel Greenburg, Elaine Kokines*** and ***Judith Rubinstein.***

"Complex Functions of *e* and Logarithms of Complex Variables" conducted by ***Carol Garber, Annette Quailer*** and ***Adelaide Rosenfeld.***

"The Three Distributive Operators, D, del, and E, and Their Inverses".

At the business meeting on November 1, 1954, an amendment was made to the chapter's constitution to include the office of Librarian.

On October 14, 1954, an initiation dinner was held in honor of the nine new initiates. The guest speaker for the occasion was Dr. Leo Zippin of Queens College. His subject was: "Reflections in Three-Space".

On March 17, 1955, an initiation tea was held in honor of the six new initiates for the spring semester.

A reunion banquet was held on May 7, 1955. This banquet was in celebration of the thirtieth anniversary of the installation of the New York Beta Chapter. These banquets are held every fifth year. Many alumnae return for the occasion. There was a total of 150 people present for the dinner. Professor E. R. Lorch of Columbia University gave the address.

Officers for 1954-55 were: Director, Professor Laura Guggenbuhl; Permanent Secretary, Professor Isabel McLaughlin; President, Elaine Kokines; Corresponding Secretary, Lorraine Nayer (first semester) and Judith Rubinstein (second semester); Recording Secretary, Arlene Steinkohl; Treasurer, Joel Greenburg; Librarian, Adelaide Rosenfeld.

Officers for 1955-56 are: President, Jill Marston; Corresponding Secretary, Louise Bargamian; Recording Secretary, Lena Seife; Treasurer, Joan Berks; Librarian, Theresa Landi.

Epsilon of Pennsylvania, Carnegie Institute of Technology

The Pennsylvania Epsilon chapter held three open lectures during the 1954-55 session. Special emphasis was placed on attracting freshmen and sophomores to these lectures. The following papers were presented:

"A Miniature Mathematics" by ***Dr. Marlow Sholander***

"Applications of Function Space to Quantum Mechanics" by ***Dr. Serge de Benedetti.***

"Mathematics Inspired by Digital Computers" by Dr. *J. E. Flanagan* of IBM.

On May **17,** the annual initiation banquet was held. Seventeen new members were initiated at this time.

Officers for **1955-56** are: Director, George Rybick; **Vice-**Director, Richard Major; Secretary, Judith **Hirschfield;** Treasurer, Theodore Hatch.

Alpha of Missouri, University of Missouri

The Missouri Alpha chapter held four meetings during the year **1954-55.** In November Dr. Herman Betz of the mathematics faculty spoke on "Infinity". Students from Stephens and Christian Colleges were guests. In December, nineteen new members were initiated. A short program and social hour followed. Mrs. Haynes, of the faculty, and a charter member of Missouri Alpha, gave a history of the chapter, and told about some of the early members and what they have achieved. Dr. **Burcham,** chairman of the department, introduced the members of the permanent staff, telling something of the background, training, and accomplishments of each. This was followed by the annual banquet. Seventy-one members and guests were in attendance. Dr. Herman Betz was master of ceremonies. Dr. Henry Bent, Dean of the Graduate School, was the principal speaker. Students took part in two skits, one of which was a dramatization of the Paul Bunyan story appearing in General College Mathematics by Ayres, Fry, and Jonah **(McGraw-Hill).** Another feature was the group singing of parodies (with a mathematical flavor) of some well known songs. Prizes of $25, **$15,** and $10 were awarded to Charles Hooper, Paul Klock, and Edwin Luallin, for first, second, and third rank, respectively, in the annual calculus competition sponsored by Pi Mu Epsilon.

Alpha of New York, Syracuse University

During the academic year **1954-55,** the New York Alpha chapter held five meetings. The following papers were presented:

"The Relativity of Physics and Mathematics" by Dr. Peter *Bergmann* of the Physics Department.

"Selected Topics of Boolean Algebra" by Dr. Kai Lai *Chung.*

"Information Theory" by Dr. Stanford *Goldman.*

"Elementary Theory of Games" by Dr. *Cyrus* Derman.

"Econometrics" by Dr. O. O. Pardee.

Twenty-six new members were initiated at the banquet held February 11, at which Dr. William **Hotchkiss** of the History Department was the guest speaker. He spoke on the "Evils of Mathematics".

A contribution of fifty dollars from the treasury was given to the Mathematics Library Committee for the purchase of new books.

Officers for the year **1955-56** were elected to be: Director, Robert Kurtz; Vice-Director, James Kennedy; Corresponding Secretary, Joan Walmsley; Recording Secretary, Shirley Samek; and Treasurer, Simon **Hellerstein.**

Gamma of Missouri, St. Louis University

Four meetings and a banquet were held by the Missouri Gamma chapter during **1954-55.** Each meeting concluded with a social hour. At the fourth meeting sixty-five new members were initiated. The guest speaker for this occasion was Professor George Polya, Professor Emeritus of Stanford University. Following the address a reception was held in honor of Professor Polya and the new initiates. The following papers were presented during the year:

"A Four-Dimensional Representation of a Complex Function" by Rev. Theodosius *Demen,* S.O. Cist.

"A New Field for Mathematics" by Dr. John Elder.

"Sign and Rank Tests in Statistics" by Dr. Waldo Vezeau.

"How to Solve It" by Professor George Polya, Professor Emeritus of Mathematics at Stanford University.

The annual banquet was the eighteenth for Missouri Gamma. Director Father **Martine Hanhauser,** O.F.M., was toastmaster. Among the honored guests were Professor Polya and Reverend Robert J. Henle, Dean of the Graduate School.

Dr. Waldo Vezeau was chairman of the **chapter's** Ninth Annual Prize Essay Contest. The junior award was won by Mr. Peter Buthewicz for his Essay on the "History and Development of High Speed Electronic Computers". The senior award went to Mr. William Baker for his solution of a statistical problem. The Garneau

Award of twenty-five dollars was presented to Miss Mary Jo Ann Herrmann, the highest ranking senior majoring in mathematics.

At the beginning of the year Sister M. Ferdinand Torline, C.S.J., was elected Vice-Director to succeed Mr. Jack Lange, and Sister M. Rose Rauen, O.S.B., was elected Secretary to succeed Miss Barbara Riley. Mr. William Perrault was elected Director for 1955-56 and Dr. Regan again accepted the position of Faculty Adviser and Permanent Secretary-Treasurer. The election of the other officers are to be held at the beginning of the new school year.

Alpha of Montana, Montana State University

The Montana Alpha chapter began the academic year of 1954-55 with the annual awarding of the entrance prizes to incoming freshmen, based on placement in a mathematics examination. The first prize of Twenty-five dollars was awarded to Audra Browman; second prize of Fifteen dollars to Ted Molten; and third prize of Ten dollars to Wally Donaldson and Stewart Nicholson, who had tied. The following papers were presented at meetings during the year:

"Famous Geometrical Problems" by *Professor T. G. Ostrom*

"Wythoff's Game" by *Professor William Myers*

"Topology" by *Professor J. Hashasaki*

"Fano's Configuration" by *Professor T. G. Ostrom*

"Foundations" by *Dr. F. Higman*

Three new members were initiated. At the annual banquet on May 3, 1955, the initiates were awarded certificates of membership.

The final activity of the year was a joint picnic with the Mathematics Club held at the home of Professor T. G. Ostrom.

Officers elected for 1955-56 are as follows: Director, Charles Gruhn; Vice-Director, William Lien; Secretary-Treasurer, Marilyn Pyle.

Alpha of North Carolina, Duke University

The North Carolina Alpha chapter held two program meetings and two initiations during 1954-55, one each semester. A total of twenty-five new members were initiated. The following papers were presented:

"Analogue Computers" by *Assistant Professor J. Frank Koenig*

"How to Make a Violin" by *Assistant Professor Emeritus Karl Bachman Patterson*

Officers elected for 1955-56 are as follows: Director, William A. Kumpf; Vice-Director, Robert B. Wilson; Secretary, Ellen Wallace; Treasurer, Theodore M. Parker, Jr.

Alpha of Nevada, University of Nevada

This is the first report of a new chapter, Nevada Alpha. Following a banquet in the Redwood Room of the Riverside Hotel in Reno on May 6, 1955, Dr. J. Sutherland Frame, acting director-general, installed the chapter. There were twenty-nine charter members. During the course of the evening Dr. Frame spoke on the history, meaning, and principles of Pi Mu Epsilon. Also, Dr. E. M. Beesley, chairman of the mathematics department at the University of Nevada, spoke on the background of the local Mathematics Honor Society, Nu Sigma Mu, which had been in existence for approximately two years. Dr. Sophia McDonald also spoke briefly to the new chapter. Following the installation ceremonies Mr. William Dennett, president of the local chapter, conducted initiation ceremonies for eleven new members. Guests included: Dr. J. Sutherland Frame, chairman of the mathematics department at Michigan State College; Mrs. Sophia McDonald of the University of California at Berkeley; and from the University of Nevada, Dr. E. Allan Davis, mathematics department; Mr. John Butler, Mackay School of Mines; and Dr. T. V. Fraser, Physics Department.

Earlier in the afternoon Dr. Frame addressed some eighty students and faculty members on "Elementary Notions in Relativity Theory".

Officers for the following year are: President, William Dennett; Vice-president, Ray Gore; Secretary-Treasurer, Doreen Spiller.

Alpha of Virginia, University of Richmond

The Virginia Alpha chapter held several business meetings, one initiation, two program meetings and a picnic during the 1954-55 year. Thirteen new members were initiated. The following papers were presented at the program meetings:

"Visual Aids in Teaching Mathematics", by *Miss Allene Archer*, Head of the Department of Mathematics, Thomas Jefferson High School, Richmond.

"A General Theory of Limits", by Professor E. J. McShane, University of Virginia.

Several student members, in company with faculty members, attended the meeting of the Maryland-District of Columbia-Virginia Section of the Mathematical Association of America held at Georgetown University.

The annual prize examinations for students in the elementary mathematics courses attracted almost one hundred entrants. The winners are as follows: Freshman Examination: First Prize of Ten dollars, Paul R. Vincent; Second Prize of Five dollars, Walter R. Grutchfield. Sophomore Examination: First Prize Ten dollars, Frances Gray; Second Prize Five dollars, Margaret Foster.

Officers for the year 1955 were: President, Ann Lindsay Pettit; Vice-president, J. F. Swanson; Secretary, Jacquelyn A. Mack; Treasurer, W. J. Guy; Director, Professor C. H. Wheeler, III; Permanent Secretary, Professor E. S. Grable.

Officers elected for the 1955-56 year were: President, Helen Crittenden; Vice-president, Philip A. Flournoy; Secretary, Jane Andersen; Treasurer, Raymond L. DeKozan.

The binary system is fun,
For with it strange things can be done.
A two, as you know,
Is a one and an 0,
And a five looks like one hundred one.

- William Keister

PRIZES OFFERED BY ACTUARIAL SOCIETIES

We are pleased to publish the following information concerning prizes offered to students making high grades on actuarial examinations. It was sent to us by Mr. William R. Battle, Assistant Actuary, Southwestern Life Insurance Company, Dallas, Texas, to whom further inquiries may be addressed.

We are always glad to receive and publish information of this kind which relates to the mathematical interests of a large group of our members.

"As you probably know, the life insurance business has expanded rapidly in this country during the last 15 years. There has been not only an increase in the volume of business conducted by the older companies but a rapid increase in the number of companies as well. In addition the types and complexity of coverages offered by these insurance companies have increased rapidly. There has also been a parallel growth in welfare and pension plans and in the social insurance and related governmental activities. All of this growth has created a great demand for qualified actuaries in the insurance business and related fields, a demand which will considerably exceed the supply for some years to come.

"It is our feeling that a good many capable young men and women who might find profitable and satisfying careers as actuaries do not give consideration to this profession simply because they have little or no knowledge of it. In many instances a student will first learn of the actuarial profession after he has definitely committed himself to another line of endeavor. Consequently, we are attempting to put before the undergraduate mathematics students of the southwest area a picture of the actuary with the thought that a number of them will undertake the course of examinations and ultimately become qualified actuaries.

"The official body of the actuarial profession is the Society of Actuaries. The Society serves both as a forum for the dissemination of information of interest and importance to actuaries and as the body that sets the standards for attaining the designation of actuary. At the present time one becomes a full member or Fellow of the Society by completing a course of eight examinations, and he may become an Associate member by completing the first five of the examinations.

"The first three examinations are the preliminary examinations and cover the following subjects:

Part 1 - Language Aptitude

Part 2 - Trigonometry, Coordinate Geometry, Algebra and Calculus

Part 3 - Finite Differences, Probability and Statistics.

Part 1 is a one hour examination, and the other two are three hours each with approximately 70 problems each. These examinations are given in May each year and are designed so that they may be passed by the mathematically talented student while he is still an undergraduate.

"In order to draw attention to these preliminary examinations and to induce undergraduate students in this area to sit for them the Actuaries Club of the Southwest will offer two prizes of $100 each in 1956. One prize will be for the best grade on Part 2 and one prize for the best grade on Part 3. The prizes will be restricted to undergraduate students of colleges and universities in Arkansas, Louisiana, New Mexico, Oklahoma and Texas. No student will be eligible for a prize unless he receives a grade of at least 7 (6 is passing), and one student may qualify for both prizes.

"Any student who is interested should contact his mathematics faculty. We will have furnished rather complete information about the actuarial profession, the details of the prizes and the procedure for enrolling for the examinations to each school in this area. I will welcome any inquiries addressed to me.

"In addition to the prizes which we are offering locally, the Society of Actuaries each year gives prizes totaling $1,000 for the nine best grades on Part 2 of the examinations among all undergraduate students in the United States and Canada. The first prize is $200 and the others are $100 each."

PI MU EPSILON ADDRESS LIST 1955

Alabama Alpha 5-1922	Dr. Herbert S. Thurston, Box 1453, University, Alabama.
Alabama Beta 54-1953	Prof. S. L. Thompson, Dept. of Math, Auburn, Alabama.
Arizona Alpha 40-1941	Dr. Deonisie Trifon, D. of M., Univ. of Arizona, Tucson, Arizona.
Arkansas Alpha 21-1931	Dr. Bernard H. Gundlach, D. of M., Univ. of Arkansas, Fayetteville, Ark.
California Alpha 12-1925	Prof. W. T. Puckett, D. of M., UCLA, Los Angeles 24, California.
California Beta 19-1930	Mrs. Sophia McDonald, D. of M., Univ. of California, Berkeley 9, Calif.
Colorado Alpha 33-1936 (Inactive)	Prof. Jack R. Britton, D. of M., Univ. of Colorado, Boulder, Colorado.
Colorado Beta 50-1950	Dr. Otho M. Rasmussen, D. of M., Univ. of Denver, Denver 10, Colorado.
Delaware Alpha 41-1941	Dr. E. Vernon Lewis, D. of M., Univ. of Delaware, Newark, Delaware.
D. C. Alpha 52-1951	Dr. George H. Butcher, 2641 Myrtle Ave NE, Washington, D.C. (HU).
Florida Alpha 51-1951	Mrs. Georgia Del Franco, D. of M., Univ. of Miami, Coral Gables, Florida.
Georgia Alpha 29-1934	W. S. Beckwith, 731 Cobb St., Athens, Georgia (U. of G.)
Illinois Alpha 7-1924	M. Evans Munroe, 360 Math Bldg. Univ. of Illinois, Urbana, Illinois.
Illinois Beta 42-1944	Dr. J.C.E. Dekker, Lunt 211, N.U. Campus, Evanston, Illinois.
Iowa Alpha 6-1923	Fred Wright, Beardshear 218, Iowa State College, Ames, Iowa.
Kansas Alpha 16-1928	Wealthy Babcock, 209 Strong Hall, Univ. of Kansas, Lawrence, Kansas.

Kansas Beta 31-1935	J. M. Marr, D. of M., Kansas State College, Manhattan, Kansas.
Kansas Gamma 49-1950	Prof. C. B. Read, Univ. of Wichita, Wichita 14, Kansas.
Kentucky Alpha 14-1927	Prof. H. H. Downing, D. of M., Univ. of Kentucky, Lexington, Kentucky.
Louisiana Alpha 38-1939	Prof. Houston T. Karnes, D. of M., Louisiana S. U., Baton Rouge, Louisiana.
Michigan Alpha 39-1940	Prof. J. S. Frame, D. of M., Michigan State College, East Lansing, Michigan.
Missouri Alpha 4-1922	Miss Mary Cummings, 212 Eng. Bldg., Univ. of Missouri, Columbia, Missouri.
Missouri Beta 11-1925	H. M. MacNeitle, D. of M., Washington Univ., St. Louis, Missouri.
Missouri Gamma 43-1945	Francis Regan, D. of M., St. Louis Univ., St. Louis, Missouri.
Montana Alpha 9-1925	Dr. Joseph Hashisahi, Montana St. Univ., Missoula, Montana.
Nebraska Alpha 15-1928	Prof. Edwin Halfar, 213 Burnett Hall, Univ. of Nebraska, Lincoln, Nebraska.
Nevada Alpha -1955	Prof. E. M. Beesley, Univ. of Nevada, Reno, Nevada.
New Hampshire Alpha 45-1948	Fredrick Cunningham, D. of M., Univ. of New Hampshire, Durham, N. H.
New Jersey Alpha 56-1954	Dr. Harold Grant, D. of M., Rutgers Univ., New Brunswick, New Jersey.
New York Alpha 1-1914	Nancy Cole, D. of M., Syracuse University, Syracuse 10, New York.
New York Beta 10-1925	Miss Isobel McLaughlin, D. of M., Hunter College, 695 Park Ave., N. Y. 21, N. Y.
New York Gamma 26-1933	Prof. Samuel Borofsky, Ch. D. of M. Brooklyn College, Bedford Ave. and Ave. A., Brooklyn 10, New York.
New York Delta 28-1933	Prof. John van Heijenoort, N. Y. U., 100 Wash. Squ. E., N. Y. 3, New York.

New York Epsilon 30-1935	Prof. Ruth M. Peters, D. of M., St. Lawrence Univ., Canton, New York.
New York Zeta 34-1937 (Inactive)	
New York Eta 53-1951	Paul J. Schillo, D. of M., Univ. of Buffalo, Buffalo 14, New York.
New York Theta 55-1953	Prof. H. Pollard, D. of M., Cornell Univ., Ithaca, New York.
North Carolina Alpha 24-1932	Prof. F. G. Dressel, 309 Frances St., Durham, North Carolina (Duke).
North Carolina Beta 46-1948	Dr. John W. Lasley, Jr., D. of M., Univ. of North Carolina, Chapel Hill, North Carolina.
Ohio Alpha 2-1919	Prof. Earl J. Mickle, Ohio Univ., Columbus 10, Ohio.
Ohio Beta 13-1927	Prof. Philip C. Stanger, D. of M., Ohio Wesleyan Univ., Delaware, Ohio.
Ohio Gamma 32-1936	Miss Violet Davis, 1914 Evansdale, Toledo 6, Ohio (U. of T.).
Ohio Delta 48-1949	Dr. Melvin Bloom, Upham Hall, Miami Univ., Oxford, Ohio.
Oklahoma Alpha 18-1929	Prof. Dora McFarland, D. of M., Univ. of Oklahoma, Norman, Oklahoma.
Oklahoma Beta 35-1938	Dr. R. B. Deal, D. of M., Oklahoma A and M, Stillwater, Oklahoma.
Oregon Alpha 22-1931	Dr. Robert L. San Soucie, D. of M., Univ. of Oregon, Eugene, Oregon.
Oregon Beta 36-1938	Prof. George A. Williams, D. of M., Oregon State College, Corvallis, Oregon.
Pennsylvania Alpha 3-1921	Miss Nina Schub, D. of M., Univ. of Pennsylvania, Philadelphia, Pennsylvania.
Pennsylvania Beta 8-1925	Prof. William I. Miller, 220 S. 3rd St., Lewisburg (Bucknell).
Pennsylvania Gamma 17-1929	Dr. Albert Wilansky, D. of M., Lehigh Univ., Bethlehem, Pennsylvania.

Pennsylvania Delta 20-1930	Prof. Orrin Frink, D. of M., Penn. State Univ., State College, Penn.
Pennsylvania Epsilon 44-1947	Dr. Marlow Sholander, D. of M., Carnegie Inst. of Tech., Pittsburg, Penn.
Virginia Alpha 47-1948	Prof. E. Sherman Grable, Box 45, Univ. of Richmond, Richmond, Virginia.
Washington Alpha 23-1931 (Inactive)	
Washington Beta 25-1932	Prof. Lee H. McFarlan, D. of M., Univ. of Washington, Seattle 5, Washington.
Wisconsin Alpha 27-1933	Dr. H. P. Pettit, D. of M., Marquette Univ., Milwaukee 3, Wisconsin.
Wisconsin Beta 37-1939	Pi Mu Epsilon, D. of M., Univ. of Wisconsin, Madison 6, Wisconsin.

"Proof" of the Remainder Theorem

$$\begin{array}{r|l} & \quad f \\ \hline x-r & f(x) \\ & \underline{f(x)-f(r)} \\ & \qquad f(r) \end{array}$$

NEW BUSINESS MANAGER

It is convenient for the editor-in-chief to select a business manager at his own school. Accordingly, Miss Echo *D. Pepper* of the Mathematics Department of the University of Illinois, has agreed to fill this post.

Miss Pepper is a native of the state of Washington. She attended schools in Seattle, Washington, where she took degrees of B.S. and M.S. in mathematics with physics as a minor. Her Ph.D. is from the University of Chicago where she wrote a thesis in the theory of numbers with the late L. E. Dickson and E. H. Moore. She has taught at the University of Illinois since 1928 except for the year 1945-46 when she taught at Seattle University.

Miss Pepper has received many honors. She was Senior Fellow at the University of Washington, Fellow at the University of Chicago, and is a member of Phi Beta Kappa, Sigma Xi, Sigma Delta Epsilon, and Pi Mu Epsilon. She is also a Fellow of the A.A.A.S. and once held a National Research Council Fellowship which permitted her to study at Oxford University in England.

Besides being interested in analysis and the theory of numbers, Miss Pepper is interested in mathematical puzzles and oddities, of which she has a fine collection. She is also deeply devoted to good teaching and is considered one of the outstanding teachers in the Mathematics Department at the University of Illinois.

Miss Pepper's teaching is enlivened by her rare sense of humor which endears her to her students and her friends alike. We are indeed fortunate to have so able and so inspirational a person as a member of the Journal staff.

NEWS AND NOTICES

National Meeting at Ann Arbor

The Pi Mu Epsilon Fraternity held its national meeting in conjunction with meetings of the Mathematical Association of America, the American Mathematical Society, and other organizations with mathematical interests at the University of Michigan, Ann Arbor, Michigan, August 30, 1955.

The meeting opened at noon with a luncheon at which delegates and officers were introduced. A meeting of the Council followed. Afternoon and evening sessions were devoted to presentation of the following student papers:

Walter W. Turner
Michigan State College
"Magic Squares"

Thomas James Head
University of Oklahoma
"Semigroups"

James T. Hinely, Jr.
University of Georgia
"Elliptical Wheels on an Inclined Plane"

Roy Lisker
University of Pennsylvania
"Modern Developments in Additive Number Theory"

Ronald Cleary
Syracuse University
"Reorderings of Sets"

John Stallings
University of Arkansas
"An Equation Concerning the Functional Exponent"

Chih Han Sah
University of Illinois
"Some Cayley Color Groups of Order Less than Fifteen"

Manning I. Rose
University of Kentucky
"On Extensions of Kasner's Circle"

We hope to publish some of these papers in future issues.

News of Alumni Members

The following items record honors attained by some of our members. The Fraternity is proud of their scientific accomplishments and we will be glad to publish more such items. – Ed.

Dr. Erwin F. Lowry (πME, Ohio State, 1923), who is Manager of the Engineering Laboratories, Sylvania Electric Products, Inc., Salem, Massachusetts, was awarded the 1954 Gold Medal of the Illuminating Engineering Society for "meritorious achievement conspicuously furthering the profession, art, or knowledge of illuminating engineering."

Army First Lieutenant David L. Weeks (πME, Oklahoma A and M) received a Commendation Ribbon for his performance of "a major role in completing a technical reevaluation and re-design of the I Corps wire communication system" in Korea.

Dr. Christopher E. Barthel, Jr. (πME, Louisiana State, 1932) assistant director of the Armour Research Foundation, Illinois Institute of Technology, was recently elected chairman of the National Electronics Conference, a national forum meeting annually in Chicago.

Edward C. Koch (πME, Syracuse) has been appointed manager of the Johns-Manville Market Survey Department. This department assists in plans for the market development of all Johns-Manville products and to study and analyze markets and methods of distribution, new business, new product lines, and other related problems.

Student Papers Desired

The editor of this *Journal* would be pleased to receive for consideration expository or original papers of high quality written by student members of the Fraternity. So fat as possible, we would like to make this a magazine *by* students as well as *for* students.

Back Issues for Sale

We have a large supply of back issues of the *Journal* on hand. We will be glad to sell these to members desiring a complete file at $3.00 for 12 issues, Vol. 1, Number 1, through Volume 2, Number 2. Short sets pro rata.

Sorry We're so Late

Because of the twin problems of learning the ropes and of squeezing time for editing out of an already crowded schedule, we've really turned the Fall Issue into a Winter Issue. We hope to have future issues out on time, however.

A New Department

From time to time, we would like to run a feature entitled ***Stories of Famous Mathematicians.*** Has any reader knowledge of unpublished amusing or otherwise interesting stories of outstanding mathematicians of this century? If so, send them in, and we'll publish all that we have room for, provided of course that they are not libelous.

Another thing we would like to receive is a supply of choice boners, humorous rhymes, etc., to use as space fillers at the ends of pages. However, don't send any copyrighted material without identifying it as such. The person submitting such material will of course be credited.

INITIATES

ACADEMIC YEARS 1953-4 (continued), 1954-5 (continued) and 1955-56

ALABAMA BETA, Alabama Polytechnic Institute

(February 8, 1955)

Joseph G. Anderson
Paul W. Bannon
Margaret Baskervill
Samuel C. Black, Jr.
Robert B. Bliss
Franklin L. Davis
Paul J. Driscoll
Douglas E. Fain
Martin Goldsworth
A. Reese Harvey
Andrew Kromis
Carl D. Lamb
Max Lane
James A. Lipham
Leonard McGarr
W. Russell Martin
Chester Miracle
Harold W. Morgan
Walter G. Shadt
Hugh A. Thompson
Don E. Watson
Wallace E. Wood

(May 10, 1955)

Carl Melvin Bennett
James H. Bowman
M. H. Bradley
J. P. Brandel
Edron L. Cato
Gordon E. Chriatiansen
Warner Thomas Clark
John Collins Cooper, Jr.
Billy Lee Culberson
James Thomas Fowler, Jr.
James W. Gasaway
Cecil C. Gregg
Elmer Gerald Griffiea
Gordon Harvey Griffith
Billy Myers Guthrie
Robert Gentry Haley
Raymond Earl Harper
Charles R. Henter
Donald A. Hickman
Edward H. Hooper
T. P. Huddleston, Jr.
Terrell M Jones
Stanford Nils Kemp
Mary Battle King
Roy H. Krotzer
Marion Lynn Laster
James Theo Mash
Kenneth L. McClelland
James L. McCorkle, Jr.
Albert T. McMain, Jr.
Joseph Monte
Albert Naughton
Lee Holloway Nichols
Andrew M Patterson, Jr.
Marlon Rayburn
Ava Ann Rogers
James Roundtree
Billy G. Smith
James W. Snider
Carl D. Strickland
Wilton Sturges, III
Byron E. Sturgis
Joae E. Tallet
Carlton Wayne Thomas
Carolyn Ward
Vernon B. Watwood, Jr.
Charles E. Whitsett, Jr.
Richard Leroy Yelverton

ARIZONA ALPHA, University of Arizona

(April 27, 1955)

Bryant Bannister
Eulis Gene Barman
William Patrick Bliss
Carl Luther Foiles
Jimmie L. Foster
Alma Anton Frederickson
Otto Hatcher
George S. Insalaco
Charles Earl Jones, Jr.
Donavon B. Lewis
Robert Harry MacLean
Mark Moore, Jr.
Harry Nicholson Shaver
Louis Davie Siegert
Humberto R. Solano
Carroll David Thatcher

ARKANSAS ALPHA, University of Arkansas

(November 11, 1954)

James Claebourne Barr
Henry Luke Bavni, Jr.
William Carrington Beggs
Frank Biggs
Harold R. Blevins
John B. Chapman
H. M. Brick Dumas
Gene Holloway
Jamea Morris Hubbard
James Herbert Kumpe
Howell Elijah Leming
Jamea Lamar Milner
William Edward Reck
Benjamin Edward Simpson
William Walker Trigg
Eugene Richard Wells

CALIFORNIA ALPHA, University of California

(January 8, 1955)

Robert E. Baker
Emanuel J. **Betinis**
Andrew **Bruckner**
Maxwell C. Gilliland
Eugene W. Greenstadt
Mildred M Moe (Mrs.)
Osborne K Moe
Alfred B. Nelson
Frank C. Reed
Burton **Rodin**
Gus Tricoles

(June 28, 1955)

Alfred W. **Adler**
Ralph E. **Behrends**
Paul Dong
Anton M Fleischman, Jr.
Keith L. Johnson
Geraldine **Karpel**
Donald P. Moore
Melvin Rosenfeld
Virginia Lee **Rosenthal**
Virginia **Thomas**
Robert B. Wheelock

CALIFORNIA BETA, University of California (Berkeley)

(January 5, 1955)

Gulbank Chakerian
Mansfield L. Clinnick
Calvin **Creston Elgot**
Yun-Tong Fung
Ronald Robert **Henley**
John Byers **Hutchins**
Allen Harold Reed
Mandakini Sane
Hans Konrad **Ury**
Vincent C. Williams

DISTRICT OF COLUMBIA ALPHA, Howard University

(April 15, 1955)

Melvin Eugene Jackson
Joseph Parker Johnson
Louise Irene Johnson
Gladys Lucille Richardson

GEORGIA ALPHA, University of Georgia

(May 11, 1955)

Charles Henry Fitts
A. Lee French, Jr.
John **Wilkinson** Hattrich
Helen Claire Raisty
Virgil W. Whitfield

(October 19, 1955)

Bryon O. Bohannon
Calvin Smith Brown
Ralph Wilson Eddy
Lois Francis Ginn
Jerry J. Gold
Robert Vance **Hendon**
Thomas Burke **Hodgson**
Sze-Tsen **Hu**
Joel James Knight
Marion Lawrence Miles
Patricia Louise Neese
William George **O'Quinn**
Elaine O. Robinson
Ronald Matthew **Rutledge**
Casimir **Emil** Sojka

ILLINOIS ALPHA, University of Illinois

(May 19, 1955)

Reuben W. Aboudi
Henry W. Babel
Parker H. Badger
W. Scott **Bartky**
Melford **R. Beamon**
Vytas B. **Gylys**
Frank J. Hahn
Harold E. Hall
Thomas S. **Hartwick**
E. Michael Henry
Costas Nikoletopoulas
John E. **Nylander**
Joyce A. **Picard**
Charles A. Plantz
Robert G. Polk

William C. Bennewitz
Yuan-Shih Chow
George T. Condo
Richard **E.** Coovert
John E. Crew
Dennis L. Cwik
Robert F. Daly
Marion E. Daus
George S. Dawkins
James W. Duncan
Ronald L. Easley
Harvey M **Endler**
Jerome M **Fishel**
Werner L. Frank
Marvin D. Girardeau
Richard **R.** Gold
Jack L. **Goldberg**
John B. **Hraba**
Carl **R. Kannewurf**
Beatrice J. **Katsulos**
Philip H. **Kier**
Joseph J. Lang
Donald E. **LeBrun**
Thomas C. Leonard
Marcia A. Leuchter
Harold R. Lewis, Jr.
Hsin-Lang Li
Jerry C. **McCall**
Gernot A. Metze
Allan S. Miller
Peter A. Minerva
Donald W. Moon
Harry W. **Muller**
James C. **Nelson**
Edward A. **Newburg**
Mathew J. Remec
Wayne A. **Rhoades**
Thomas L. Richardson
Seymour Samet
Alfred A. **Schilt**
Joel Selbin
James **H.** Shelly
Richard R. Shively
Richard C. **Sirrine**
Franklynn R. Sperberg
Louis S. Stahlman
Duane S. Steidinger
Donald W. Stilson
Sunt Techakumpuch
Toshio Tsuzuki
Richard P. Wishner
Julie C. Yang

ILLINOIS BETA, Northwestern University

(May, 1954)

Theodore **Ahlgren**
Carol Mae Bjork
George W. **Blomme**
William **Cowan**
Donald Danvers
Jean Fiedler
Joan Fiedler
Richard O. Garrigues
James N. Greene
Herbert Gross
Kenneth Hanson
Eugene D. **Haug**
Alan Kosmata
Jon Larson
Allen Newman
Elaine **Pavelka**
Gerald T. **Petersen**
Ralph Hchbock
Ernest W. **Stalder**
Vello Suigussaar
Charles K. Vilim
John Walton
Robert G. Watters
Kenneth Wiosner

ILLINOIS BETA, **Northwestern** University

(**May** 12, **1955)**

Rochelle Abend
Ethel June **Allard**
John Alvin Birmingham
Morris **Allen** Bode
Dawson Ezra Brewer
Robert Edwin Browning
Donald Allen **Celarier**
Ronald Keith Church
Sanford Charles Cohen
Roger W. Conner
Charles J. Cook
Melvin Douglas George
Winifred Guthrie
Margaret Mary **Hagerty**
Nicholas Joseph Kalman
Sheila Alice Kirk
Werner Erich Lemke
Roger Alan Nichols
Edwin James Nowak
Dolores June Pahnke
Sidney Charles Port
John Arthur **Pritzlaff**
Franz Schoennagel
John Dale Stauffer
Carl **Taibl**
Chi **Tien**
Robert Lorrie Toben
Ellen **E. Vogel**

IOWA ALPHA, Iowa State College

(April, **1955)**

R. C. **Amme**
Fred **Barson**
Robert **Belscamper**
Arden F. Boyd
Glenn A. **Branscom**
Robert K. **Brayton**
Dennis O. Brown
Frank E. Burton
Rudolph B. **Horst**
Margaret S. **Hussey**
Eric Hansen
John S. Hunter
Donald D. James
Mary Lou Jester
Mrs. Sharon **R.** Johnson
Charles A. Kingsbury
Richard Reid
Ivan Dale **Ruggles**
Lloyd M Schack
W. Douglas Sampson
Donald L. Schmidt
Lloyd Donald **Seela**
Gayle M Stock
John W. Stemple

N. Jean Brink
James H. Davis
Christ D. Dixon
Walter P. Thorn
Stig R. Erlander
James L. Gaylor
Albert R. Giisberg
Philip Goldberg
Janet Lee Hassell
David L. Hintermeister
Harry Knapp
Uno Kodres
Jeanette Lamoureaux
Diana M. Lichty
John Liittschwager
Jerold C. Mathews
Mrs. Sue Shaw McNamara
Loren R. McMurray
Leonard O. Moore
Donald R. Nielson
E. Gail Norris
Dale W. Thoe
Gordon Tollin
Ben O. Tweet
John C. Walker
Mrs. Joan E. Welch
Irwin H. Wentzein
Richard A. Wiggins
Albert W. Zechmann
Mrs. Joan Zirbel
Lois Anne Talcott

KANSAS ALPHA. University of Kansas

(Spring 1955)

Loren N. Argabright
Francis A. I. Bowers, Jr.
Robert B. Buckley
Hector Correa
Donald W. Drawbaugh
John A. Duggan
Willis H. Dukelow
Samir A. Khabbaz
George E. McCune
John Nels Olson
Alien J. Silvennan
Jay C. Williams
Peter W. Zehna

KANSAS BETA. Kansas State College

(Spring 1955)

John R. Buck
I-Dee Chang
Carol E. Clark
William G. Fateley
Hsienwen Hsu
Donald E. Jones
Robert D. Moorhead
Fred K. Rumford
Warren T. Sommer
Kiu Suk Sub
Vernie A. Swanson

KANSAS GAMMA, University of Wichita

(November 30,1954)

Don Richard Shields

(April 15,1955)

Charles Chouteau
John R. Durbin
Arthur D. Goering
Don D. Hufford
Lawrence Huntley
Phyllis Lester
Ronald Lee Shaffer
John Schweiter

MICHIGAN ALPHA, Michigan State University

(May 3, 1955)

Ronald E. Brown
John O. Cheney
Roger N. Crummer
Wayne D. Erickson
Albert N. Halter
Lloyd J. Hassencahl
Lenore Ho
James L. Hoose
James E. Kiefer
George L. Kreglow
George H. Larson
Wayne C. Liddle
Bonnie J. Lovejoy
Ronald R. Marston
Lester V. Ostrander
Nonna A. Perksen
Bill A. Stout
John Van Dyke

MISSOURI ALPHA, University of Missouri

(May 6, 1955)

Robert Angerer
Billy J. Attebery
John H. Endebrock
Daniel I. Herborn
Mrs. Aiko Hormann
Paul R. Kelly
Whitson Kirk
Paul W. Klock
Edwin D. Luallin
Milton D. Overholser
Joseph Palen
Haile D. Perry
Thomas E. Pierson
Dwight S. Reyburn
George A. Roupe
Byron W. Sherman
Charles M Warden
Shsf M Yunis

MISSOURI GAMMA, St. Louis University

(March 22, 1955)

Gene Braught
Joseph G. Kappel

MONTANA ALPHA, Montana State University

(February 9, 1955)

James H. Rowland
Thomas Walker

(April 6, 1955)

Ruth Marilyn Pyle

NEBRASKA ALPHA, University of Nebraska

(May 17, 1955)

Charles Julius Gibson
Earl Henry Heitbrink
Bruce Robert Lippke
Franklin Jed Sazama
Olgerts Stauers
Donald Lee Summers
Merlyn Duane Vandwbeek
Irven Frederick Wagner
Nils Donald Ylvisaker

NEVADA ALPHA, University of Nevada

(Spring 1955)

D. F. Abell
Ernest Andregg
Charles Bell
E. M Beesley
Ted Bradbury
Kenneth Bradshaw
James Bright
James Brune
William Bulkley
Dennis Burge
James Carlson
Jake Carpenter
D. K. Choy
Richard Coffill
William H. Colbert
David Connett
Alice Darrah
Maurice Demers
William Dennett
George Evans
Paul Fox
Roy Fujita
Gerald Galetti
Margaret Gerring
Ray Gore
Everett Harris
William Law
Olaf Leifson
George Maclean
Janice T. McEwin
Hans Mohr
Don Peterson
Ralph Powell
Juanita Peterson Rector
George Samsted
Doreen Spiller
Keith Stever
Charles Taylor
Frederick Wood

NEW HAMPSHIRE ALPHA, University of New Hampshire

(May 6, 1955)

Alton L. Amidon
Rodney W. Dunlap
Donald W. Fogg
Dorothy S. Fournier
Prescott Greene
Carl H. Love
Victor D. Azzi
James H. Trainor
Robert W. Goodrich
Bruce C. McQuarrie
Kenneth M. Simpson, Jr.

NEW JERSEY ALPHA, Rutgers University

(May 18, 1955)

Albert E. Babbit
Dr. Richard K. Brown
Charles R. Seliger
Robert K. Stump

LOUISIANA ALPHA, Louisiana State University

(May 5, 1955)

Albert J. Adoue
O. S. Andras
George W. Barineau, III
Barbara Bateman
Sylvan P. Bertrand
Carl A. Blumquist
Paul J. Ebert
Clarence M. Eidt
Francis J. Faresc
L. C. Hooper
Robert Theodore Johnson
Donald Keller
Lynn L. LeBlanc
Blaise A. Maniscalco
Denny Edgar Marshall
Sherry Kay McDowell
Robert J. Curso, Jr.
H. B. Payne
William P. Raborn
John David Radford
Oran A. Ritter, Jr.
Charles D. Russell
Charles J. Schexnayder
Andrew J. Shoup
Ali Ihsan Tangoren
Robert B. Tudor, Jr.
Richard W. White
Fred M. Whitmeyer
Alan Montgomery Warren

NEW YORK ALPHA, Syracuse University

(February 12, 1955)

Leita Adeson
Donald Borden
Barbara Cain
Conrad E. Campbell
James R. Capolongo
Eric H. Ellis
Brenda R. Fletcher
Gerald A. Carry
Elaine Greenburg
Arthur J. Heidrich
Douglas J. Ingalls
William J. Jones
Raphael Kaplan
Wayne C. Lee
Leonard Levy
Harold J. Locker
Throck Lowery
John Maksymiak
Frank Paoletti
William Peil
Virginia A. Peck
Louis Ragonese
Shirley Samek
Ludmila Syrtenke
Daniel L. Tauroney
Joan R. Walmsley

NEW YORK BETA, Hunter College

(October 14, 1954)

Louise Bargamian
Jill Msrston
Anne Morgenstem
Carol Schwartz
Lena Seife
Olga Skelley
Bertha Suhr
Louise Weiner
Elaine Yodice

(March 17, 1955)

Joan Berks
Rose D. Bianco
Carol Garber
Theresa Landi
Eleanor Plotkin
Annette Quailer

(October 26, 1955)

Adrienne Anderson
Elaine Burnstein
Alice Copland
Barbara Fruman
Rita Gutstein
Helen Josephides
Inga Liner
Renee Lipow
Gertrude Neuman
Susan Neumark
Janet Norman
Linda Scharf
Mary Seuba
Maria Tscheme
Marvette Wallace
Florence Wojtaszek

NEW YORK GAMMA, Brooklyn College
(April 15, 1955)

Paul Abramson
Arnold Cantor
Irwin Feifer
Jay Freier
Dorothy Geller
Mita Geltman
Helen Ginsberg
Alan Hoffman
Albert Huebner
Sondra Jaffe
Lawrence Mendelsohn
Arlene Reiss
Carmine Riccardelli
Barbara Sakitt

(May 27, 1955)

Lena Fishman
Rochelle Kleinberg

(November 18, 1955)

Howard Banilower
Raymond Cohen
Gerald Dorman
Joseph Eiss
Roy Frieden
Arnold Glick
Ruby Gold
Irving Katz
Fred Levine
Norman Levitin
Leonard Miller
Paul Rivot
Murray Schecter
Aaron Shapiro
Harry Sussman
Blossom Tepper
Ralph Warten

NEW YORK DELTA, New York University

Margery Maslan

NEW YORK EPSILON, St. Lawrence University

(October 12, 1954)

David J. Bennett
Cynthia A. Chambers
Frank A. Hankey
Eugene L. Larchar, Jr.
Gordon G. McGuire
William H. Plows
Philip H. Seaman

(March 8, 1955)

Westbrook Bates
Robert Joseph Brown

(November 1, 1955)

Dianne M DeLucia
John W. Heintz
M Patricia Herrick
Nancy Hoyt
William N. Sloan
Catherine M. Sterling

NEW YORK ETA, University of Buffalo

(April 27, 1955)

Alfred George Aswad
Joyce Marie Herbert
George Swartfigure

Lloyd Lewis Brassaw, Jr.
Daniel Thomas Gianturco
Richard T. J. Mahoney
Jon N. Mangnall
Gerald V. Schwartz
William J. Walbesser
Frederick R. White

NEW YORK THETA, Cornell University

(May 18, 1955)

Charles A. Berger
Lonnie Cross
Bob D'heedene
Sidnie Dresher
Manning Feinleib
Diane Finegold
Victor Gilinsky
Richard Isaac
Marc Kac
Stanley Kaplan
Benoit Lachapelle
Michael Lieber
Robert E. Lynch
John Mineka
Lawrence Mittag
Edward Norman
H. Pollard
J. Berkeley Rosser
Robert Norman Smith
Marilyn Taig
Stephen Wainger
J. Wolfowitz

NORTH CAROLINA ALPHA, Duke University

(December 14, 1954)

Richard Bilas
Simeon Cotton
Alfred L. Mowery
Theodore Parker
Joseph Robinson, Jr.
Sally Ann Simmons
Sylvia Moonyeen Walters

(May 12, 1955)

John Roy Beck
Charles Harper Carr
Marvin Mack Crutchfield
Lawrence D. Decker
Robert Schwaln Goudy
Lydia Ellen Hammaker
David M Hay
James M Hicks
Peter George Hoadley
Lynn Donald Ikenberry
Sidney George Lineker
Paul B. Parks
John David Peyton, Jr.
Edward Clarence Rogers
Parvin M Russell, Jr.
Philip Eugene Shaw
Frederick Gayle Sheppard
B. Earnhardt Troy, Jr.
Ellen Wallace
Walter Victor Weyhmann

OHIO ALPHA, Ohio State University

(May 27, 1955)

James Nelson Anno, Jr.
Jack Bacon
Betty Lou Bernhardt
Arthur J. Blackman
Hi Chang Chai
Jack K. Clifton
Ernest O. Doebelin
Lewis O. Donner
Wilbur France
Jack Friedgut
Fama Gerhart
Kenneth G. Hornung
Martin I. Jacobson
Raymond Hal Kelley
Carl C. Maneri
Arthur Alten McGee
William C. Nemitz
Kurt Rossman
Basant Lal Sharma
Francis M Sturms, Sr.
Foo-Heng Tse
Thomas A. Willke
Akihiko Yokosawa

OHIO GAMMA, University of Toledo

(March 24, 1955)

Carl J. Hudecek
Howard A. Leupp
Philip A. Long
Willis F. Long
Eldon D. Riehm

(Summer 1955)

Miss Judy Sparks

(October 24, 1955)

Harold E. Flesner
Lillian Inez Lewis

OREGON ALPHA, University of Oregon

(May 23, 1955)

Abdur R. Ansari
Richard E. Barlow
Douglas Basham
William Mearl Blake
Bruce Bloomfield
Mary E. Cary
Charles Chicks
Robert Ross Fossum
Loretta Anne Humphreys
Particia Inman
Yasuo Ishida
Henry R. Lind
Donald P. Marshall
Gordon V. Pefley, Jr.
Donald P. Peterson
Patricia Southworth
Kirkland B. Stewart
Stanley E. Williams

(September 29, 1955)

Janet Lee Schultz

OREGON BETA, Oregon State College

(November 11, 1954)

Zouhdi Derhalli
Chester W. Dyche
D. W. Glasgow
Roger W. Lindquist
Anthony E. Perpinias
Anthony G. Syriotis

(May 26, 1955)

John P. Barbour
Douglas Bennion
Robert E. Bowles
John D. Burroughs
Thomas L. Churchill
William A. Dieter
Edward D. Falk
Donald R. Hill
Wilbur V. Johnson
Alfred Lewis Leavitt
Albert Magnuson
Robert R. Magnuson
Arnold Manseth
Duane Robert Marr
Eugene E. Martin
Richard Newton
Sekyu Ohh
Alfred S. Olsen
Alvin R. Paden
Ronald F. Radke
Gary L. Sheldon
Ronald A. Shrock
John D. Sleeth
Pin-scng Tschang
Albert A. Van Duine
Earl F. Widney
Richard M Winn
Don A. Witcraft
John W. Wolfe
Wayne H. Yunker

PENNSYLVANIA EPSILON, Carnegie Institute of Technology

(Year 1954-1955)

Bernard Louis Bloch
Robert S. Engelmore
George Clarence Feth
Jan Lewis Hall
Theodore F. Hutch, Jr.
Evanna Mae Heidbreder
Judith B. Hirschfield
Dale Horelick
Webster E. Howard, Jr.
Herschel Edward Kanter
Richard Demarest Major
Thomas Braun Mattson
Cecil Lee Moore
Robert Eugene Odeh
Paul Louis Sieffert
David Zeheb
John Richard Zener

VIRGINIA ALPHA, University of Richmond

(February 15, 1954)

L. Henry Anderson
Thomas F. Armstrong
William J. Guy
Jacquelyn Ayre Mack
Ann Lindsay Pettit
Jean Olin Ruddle
John Frederick Swanson

(November 15, 1954)

Jane Anderson
Honor Patterson Braaten
Richard T. Burch
Solomon F. Cantor
Lucy Helen Crittenden
Raymond L. DeKozan
Velta Erdmanis
Philip A. Flournoy
Virginia Anne Hogge
Patricia McElroy
Robert N. Martin
Jane Saunders
Samuel R. Stone, HI

WASHINGTON BETA, University of Washington

(May 7, 1955)

Charles W. Austin
David Neil Berg
Phyllis Marie Berglund
Barbara Pauline Blair
Jack Garry Ceder
Colin Whitcomb Clark
William S. Eberly
Grant West Erwin, Jr.
Barbara June Ferguson
William Lee Foster
Robert A. Hall
John W. Hove
Edward T. Kobayashi
Shoschichi Kobayashi
John T. Lantz
Richard D. Mayer
Robert C. McCarty
Lawrence F. Moe
Janet M Myhre
Ronald Pyke
Arthur A. Sagle
James C. Schultz

WISCONSIN ALPHA. Marquette University

(May 14, 1955)

James Bonin
James Eckl
John H. Farrow
Rev. Lester J. Heider
Bruce Hein
Norman Krohn
James Lawrence Lewis
Lynn David Lewis
James Nordman
Karl Springer

WISCONSIN BETA, University of Wisconsin

(January 18, 1955)

Eugene Lang Albright
Homer Franklin Bechtell
Robert Allen Bonic
Elaine Cook
Richard Francis DeMar
John Andrew Fibiger
Evelyn E. Friedman
Sonia Evelyn Gibson
Thomas Ignatius Gilroy
Margaret Evelyn Martinson
Thomas LaRue McCoy
Charles Muckenfuss
Daniel Alfred Robinson
Keith Aylwin Rowe
David Brubaker Webster
Clarice Leora Wruck

(June 1, 1955)

Harold M Edwards, Jr.
Paul J. Friedman
Gerald W. Hedstrom
David H. Staley

WISCONSIN BETA, University of Wisconsin

(November 1955)

Gerald W. Altman
Gerald E. Bartholomew
Mrs. Patricia Bates
William J. Cable
William G. Collar
Richard C. Courter
Roland W. Dedekind, Jr.
Karel de Leeuw
William C. Lordan
Oscar Louik
Byron McAllister
J. Stuart McNair
Charles W. Nelson
Norman Nordeen
Ernest Paul Riedel
James N. Rogers
Robert J. Rolfe
Ronald H. Rosen
George J. Schick
Conrad M Siegel
Darold W. Silkwood

James E. Edwards
Lawrence Glasser
Richard G. Hetherington
John J. Hollemback
William J. Kammerer
Hiram Paley
H. Wescott Powell
Sampson G. Rice
Donald E. Richardson
Yvonne M Smith
Howard E. Thompson
Harold von Horn
Djimitri Wiggert
William Ziemcr