PI MU EPSILOX JOURNAL

THE OFFICIAL PUBLICATION OF

THE HONORARY MATHEMATICAL FRATERNITY

VOLUME 1 NUMBER 10

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APRIL 1954

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TEE OFFICIAL PUBLICATION
OF THE HONORARY MATHEMATICAL FRATERNITY

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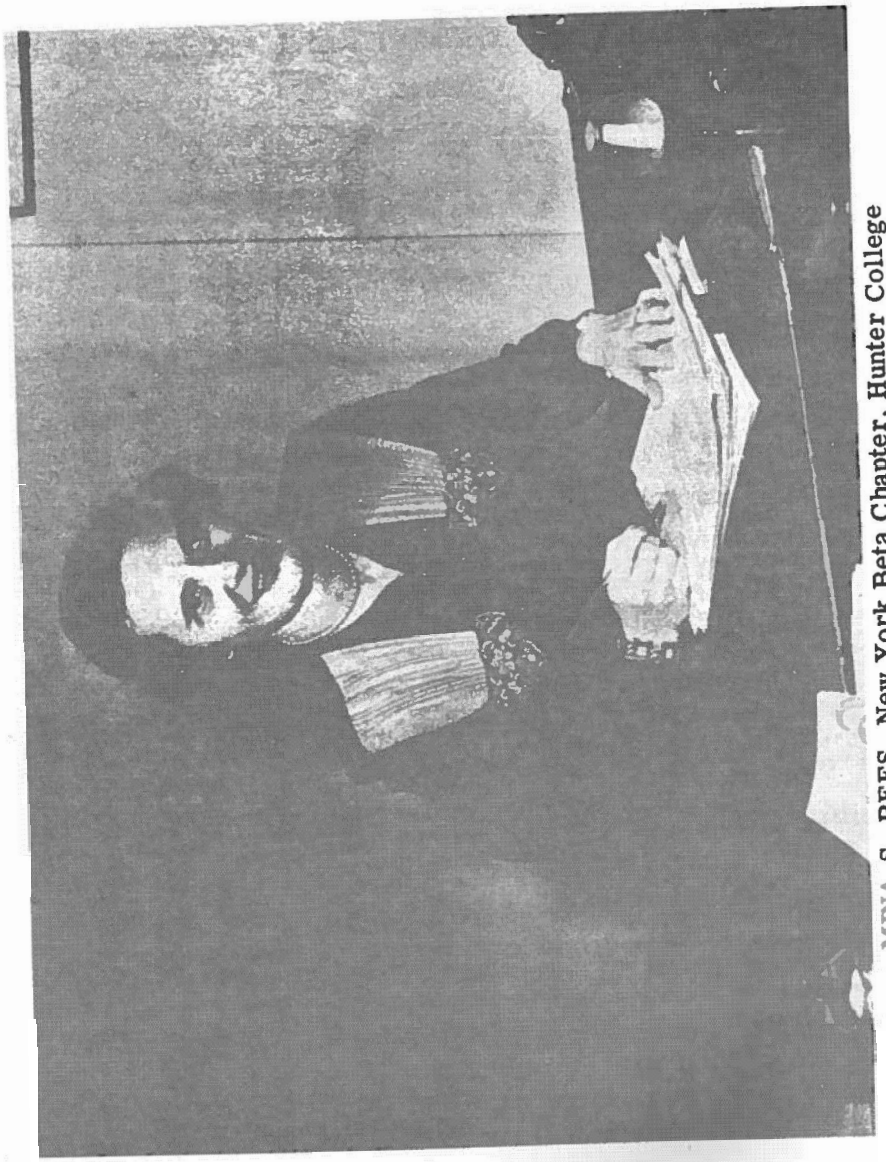

MINA S. REES, New York Beta Chapter, Hunter College
"OFFICIAL UNITED STATES NAVY PHOTOGRAPH"

MINA SPIEGEL REES

by
Mildred E. Taylor, Mary Baldwin College

Born in Cleveland, Ohio, a few years prior to World War I, Mina S. Rees, endowed with great mental and spiritual powers, was destined to render invaluable services to her country and to mathematics in particular, during World War II and the years that followed. Within a remarkably short time she had earned for herself both national and international recognition.

And now, crowned with a list of honors and success such as few scholars attain in a whole lifetime, after an absence of ten years from the campus of Hunter College, Mina Rees has returned to her Alma Mater to be Dean of the Faculty. She has more than fulfilled the promise that she showed as an undergraduate. As an undergraduate, she demonstrated exceptional ability and proficiency in mathematics; she easily qualified for membership and was initiated into the Pi Mu Epsilon Fraternity. Besides being an exceptional student she was interested in campus affairs. So, while being editor of the yearbook and president of the student council, she found time to do enough studying to earn a Phi Beta Kappa key and graduate ***summa cum laude***. She received an A.M. degree from Columbia University and a Ph.D. degree from The University of Chicago.

Even before receiving her doctor's degree she began her career as a highly trained mathematician when in 1926 she joined the faculty of Hunter College where she remained until the second year of the last war when she was granted a leave of absence to go to Washington to serve as Technical Aide and Executive Assistant to the Chief of the Applied Mathematics Panel, National Defense Research Committee, OSRD. In 1946, Dr. Rees was appointed Head of the Mathematics Branch of the Office of Naval Research. In 1949, she became Director of the Mathematical Sciences Division of the Office of Naval Research.

Science, honoring Mina Rees, published a resolution adopted by the Council of the Institute of Mathematical Statistics, excerpts from which follow:*

"Under Dr. Rees' leadership the Division of Mathematical Sciences of the Office of Naval Research gave whole hearted support to basic research, in particular to basic research in mathematical statistics and probability. The whole action was conducted with remarkable foresight and wisdom.. ..

"The postwar development of mathematical statistics in the United States owes a great deal to the farsighted policy of the Office of Naval Research ability administered by Dr. Rees. Mathematical statistics owes Mina Rees a public "well done," and extends its best wishes to her successor at the Office of Naval Research."

In 1953, Dr. Rees accepted an invitation to return to Hunter College as Dean of the Faculty.

Learned societies in which Mina Rees holds membership are: A.A.A.S. (Fellow), A.M.S., M.A.A., I.M.S., Philosophical Society of Washington, N. Y. Academy of Sciences, and Sigma Xi.

She has served in an advisory capacity for many of our scientific groups. We list here the chief of these:

Member, Council on Scientific Personnel, 1946
Member, UNESCO Panel on Applied Mathematics
Member, Committee on Conference in Applied Mathematics, International Congress of Mathematicians, 1950, Cambridge, Mass.
Member, Mathematics Policy Committee
Member-at-Large, Mathematics Division, National Research Council
Navy Member, Applied Mathematics Advisory Council, National Bureau of Standards, from time of Us founding until 1953

*See *SCIENCE,* vol. 118. no. 3065, Sept. 25, 1953, pp. 349-350.

Consultant, Committee to Evaluate the Operation and Functions of the National Bureau of Standards, 1953
Chairman of Section A(Mathematics), and Vice-President, A.A.A.S., 1954.
Member, Committee to Advise Director of National of National Bureau of Standards on mathematics program, 1954-1957.

Everything that Mina Rees has attempted has been done with distinction. As recognition for some of these services she has received the following honors: ***King's Medal for Service in the Cause of Freedom,*** given by Great Britain; and the ***President's Certificate of Merit*** from the United States. Last May when she was leaving Washington to return to Hunter College she was given the "OUTSTANDING PERFORMANCE RATING" for her work with ONR.* This citation reads in part:

"From the beginning of her career in the Office of Naval Research, Dr. Rees has foreseen more clearly than anyone else the impending expansion of the use of mathematical modes of thought and analysis in the Navy's theoretical and operational activities, as well as the directions in which this would take place.. ..

"As Deputy Science Director, Dr. Rees contributed significantly to the development of a corps of scientifically trained officers in the Navy by making an Advanced Science Program for Naval Officers, for which ONR is responsible, more attractive to properly qualified officers.

. . . . . .

...."At the same time her contacts with mathematicians, statisticians, and engineers have been such as to enable her to contribute significantly to the vitality of scientific activity in these fields; a fact which has earned her public recognition of the Institute of Mathematical Statistics and the American Mathematical Society."

*Excerpt from JUSTIFICATION FOR OUTSTANDING PERFORMANCE RATING, May, 1953.

Her most recent recognition has been made by the American Mathematical Society, and this is in the form of a resolution printed below, in this journal.

In addition. Dr. Rees is a much traveled young woman. Any list of foreign countries visited by her should include; England, France. Germany, Norway, Sweden, Denmark, Finland, Russia, Central America, Cuba, Italy, Portugal, Switzerland, and The Netherlands.

When any woman has been as busy as Dr. Rees in doing research, we are apt to think of her as being entirely absorbed in her work. She, however, like any normal young person has her hobbies for leisure hours, – painting and tennis. But she has always been interested in the people around her and the things that are happening to them and also to the world in which we live. She is alert to the meaning of events of our time. Dr. Rees has a quick wit, a ready humor and a most attractive smile.

Because Dr. Rees has done so much for mathematics and mathematicians. Pi Mu Epsilon is very proud to have her as a member and to pay this small tribute to her.

DEAN MINA S. REES

Honored by the American Mathematical Society

At a meeting of the Council of the American Mathematical Society, held in Levering Hall of The Johns Hopkins University, in Baltimore, Maryland, on December 29, 1953, the following resolution was adopted. It was read before the Society, by Secretary E. G. Begle, at the Business Meeting in Remsen Hall the next afternoon.

> "The Council of the American Mathematical Society here takes cognizance of the resignation this past September of Dr. Mina Rees as Head of the Mathematics Section of the Office of Naval Research. She has accepted a position as Dean of tho Faculty at Hunter College. We congratulate Hunter College on this wise selection and can only say that our heavy loss as mathematicians is tho gain of Hunter College.

> "The very striking and brilliant contributions made by pure (non-military, non-applied) science not least of these by mathematics, to the winning of World War 11 is well known. It was clearly seen by the government and those responsible for the armed services that a large scale fostering by the U. S. government of fundamental research, the basis of all research, was unavoidable. Only thus could we hope to hold our own in years to come, and incidentally build up a suitable reserve of talented men for emergencies. This was actually acted upon by the Navy who thus took the lead by some years with the creation of the Office of Naval Research, Needless to say as the purest of all sciences, mathematical research might well have lagged behind in such an undertaking. That nothing of the sort happened is beyond any doubt traceable to one person – Mina Rees. Under her guidance, basic research in general, and especially in mathematics, received the most intelligent and whole hearted support. No greater wisdom and foresight could have been displayed and the whole postwar development of mathematical research in the United States owes an immeasurable debt to the pioneer work of the Office of Naval Research and to the alert, vigorous and farsighted policy conducted by Miss Rees. The influence of these policies has been such that it vitally affected later developments: The activities of Air Force and Ordnance research, the National Science Foundation itself. It is well known that in these more recent organizations Mina Rees was constantly appealed to for counsel and guidance.
>
> "As Miss Rees leaves her task, the Council of the American Mathematical Society desires to express to her in the name of the whole mathematical community its warmest feelings of appreciation for her past performance and extends to her its best wishes for the future."

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METRIC EXTENSION*

Alan J. Goldmann,**
Gamma of New York, Brooklyn College

The problem we wish to discuss in this paper can be stated in general terms as follows: If a space K, in which a notion of "distance" has been defined, lies in a larger space S, then how can we extend the distance-concept of K to all of S? We shall show that under a special hypothesis concerning the relationship of K and S, the extension can be completed in one and only one way after it has been carried out "halfway," and that the method involved is a "natural" one.

First we make precise the way in which "distance" is to be defined. By a metric space is meant a set of elements called points, for all ordered pairs of which there is defined a real-valued metric or distance-function F such that:

M 1. $F(x,y) \geq 0$ for all choices of points x,y in the space.
M 2. $F(x,x) = 0$.
M 3. $F(z,x) \leq F(x,y) + F(y,z)$.

M1 and M2 are reasonable properties to demand of any candidate for the name of "distance"; M3 is called the "triangle" inequality, and reduces to the famous inequality of that name when F is the usual distance in the Euclidean plane.

A useful concept in a metric space is that of *convergence;* if p is a point and $p_1, p_2, \ldots = \{p_n\}$ a sequence of points in the space, we write $\{p_n\} \to p$ or $\lim p$ p if

*A paper presented before the Pi Mu E t rnity at the scientific session, Monday ev ber 1, during the National Meeting held Col- lege, East Lansing, Michigan, u mber 1, 1952.

**The Author of this paper legate to the National Meeting.

$\lim F(p_n, p) = 0$; this reduces the idea of convergence in a metric space to the (known) one of convergence in the system of real numbers.

It should be noted that the same space can be assigned many different metrics; for instance, in the Cartesian "r-s" plane, the distance from point $P(r_1, s_1)$ to point $Q(r_2, s_2)$ might be given by the familiar $\sqrt{(r_2-r_1)^2 + (s_2-s_1)^2}$ or by $|r_2-r_1| + |s_2-s_1|$. In either case M1, M2, M3 are satisfied; geometrically, use of the second metric instead of the first involves replacing the length of the hypotenuse of a right triangle by the sum of the lengths of its legs. These considerations show that the distance-function is not implicit in the mathematical space, but is an additional construct.

Both distance-functions given above for the Cartesian plane satisfy an additional condition:

M 4. $F(x,y) = 0$ only if $x = y$.

It is customary to impose this condition on a metric, in addition to M1, M2, M3; such a restriction is extremely desirable, in that without it, for instance, a sequence of points might converge to more than one limit point. M4 cannot be usefully introduced here, however, and at the end of the paper we shall explain why.

Lemma: If F satisfied M2 and M3, then $F(x,z) = F(z,x)$.

Proof. In M3, take $y = x$ and apply M2. The result is $F(z,x) \leq F(x,z)$. Then in M3 first interchange x and z, getting $F(x,z) \wedge F(z,y) + F(y,x)$, and then take $y = z$, obtaining $F(x,z) \leq F(z,x)$. The two inequalities imply the desired equality.

An obvious consequence is that in a metric space, the distance between two points does not depend on the order in which the points are considered. Any respectable "distance" should certainly have this property, and it will be used without explicit mention in the proofs of the theorems to come. This comment concludes the generalities on "distance."

The considerations of this paper were suggested by a rather specific situation which we proceed to describe.

Suppose we wish to measure the distance between points P and Q lying on the edge of a "ruler.' If the ruler bears a metric scale with subdivisions of all orders of fineness, then we might well adopt a procedure described sufficiently by the following particular case: Suppose the unit-cm. point which is the closest to P of those preceding P on the scale is the **1-cm.-point,** while the corresponding point for Q is the **3-cm.-point.** Then as a first approximation, $\overline{PQ} \simeq$ (3-1) = 2cm. Working with the **10^{-1}-cm.-points,** we might find **1.3cm.** nearest P and **3.6cm.** nearest Q, so that our next approximation would be $\overline{PQ} \simeq$ (3.6-1.3) = **2.3cm.** Continuing in similar manner, we might obtain as a sequence of points of scale-division (to be called scale-points) for P, {1, 1.3, 1.33, 1.333, **etc.**}, and perhaps the sequence [3, 3.6, 3.66, 3.666, etc.] for Q. Then the sequence of approximations for PQ is (2, 2.3, 2.33, 2.333, etc.) and we should conclude that $\overline{PQ}$ = 2 1/3 cm.

We now translate certain salient features of this situation into the language of our general problem. The set of all scale-points constitutes a space K on which a **distance-**measuring metric **F(x,y)** is already defined by the numbering of the scale, and this K is embedded in the space S consisting of all points on the ruler's edge. We assumed that we could approximate any given point P(or Q) of S by a sequence of points of K, $\{p_n\} \to P$; this state of affairs is described by saying that K **is *dens***e in S. But to say $\{p_n\} \to P$ is to say that the distance between p_n and P tends to zero, and so we must be able to measure such distances; although we cannot yet measure the distance between any two points of S, we must suppose that we can measure the distance between a point of K and a point of S. Such distances define an extension **G(x,y)** of **F(x,y).**

Before proceeding to the actual construction, we state the general problem in its final form. A metric space K, of distance-function **F(x,y),** lies in a larger space S. **F(x,y)** has already been extended somehow to a **G(x,y)** defined whenever one of **x,y** is in K; **G(x,y)** is nearly a metric for S, in that it satisfied Ml, M2, **M3,** but falls to be one since it is not defined for all point-pairs of S. K Is dense in S, in terms of G. and we wish to extend G(x,y), and thus **F(x,y),** to a metric H(x,y) for S.

The essential ideas of the method are indicated by the specific situation considered. Given points P and Q of S, we "approximate" each of them by a sequence of points in K, and consider the limit of the resulting'approximate distances." We show that this limit exists (Theorem 1), is independent of the choice of the approximating sequences (Theorem 2), and is really a metric (Theorem 3) which extends **G(x,y)** (Theorem 4). It is even the only extension of **G(x,y)** to **S(Theorem** 5 .

We begin with 2 trivial extension of **G(x,y),** by defining **G(x,x)** = O even when x is not in K. Now our Lemma applies to **G(x,y).** Note that G and **F** are equal when x and **y** are in K.

Theorem 1. Given P and Q in S, and sequences of points of K: $\{p_n\} \to P$ **and** $\{q_n\} \to Q$. Then **lim** $F(p_n,q_n)$ exists.

Proof:

$$F(p_n,q_n) = G(p_n,q_n) \leq G(q_n,q_m) + G(q_m,p_n)$$
$$\leq G(q_n,q_m) + G(p_m,p_n) + G(p_m,q_m),$$

$$F(p_m,q_m) = G(p_m,q_m) \leq G(q_m,q_n) + G(q_n,p_m)$$
$$\leq G(q_m,q_n) + G(p_m,p_n) + G(p_n,q_n).$$

Then

$$G(p_n,q_n) - G(p_m,q_m) \leq G(q_n,q_m) + G(p_m,p_n),$$

and

$$G(p_m,q_m) - G(p_n,q_n) \leq G(q_m,q_n) + G(p_m,p_n).$$

The left hand sides of the proceeding two inequalities are numerically the same and one is positive.

$$\text{So } |F(p_n,q_n) - F(p_m,q_m)| \leq G(q_m,q_n) + G(p_m,p_n)$$
$$\leq G(q_m,Q) + G(Q,q_n) + G(p_m,P) + G(P,p_n).$$

Since $\{p_n\} \to P$ and $\{q_n\} \to Q$, the last inequality implies that the sequence of approximate distances $F(p_n,q_n)$ Satisfied the Cauchy Convergence Criterion.

Suppose we wish to measure the distance between points P and Q lying on the edge of a "ruler." If the ruler bears a metric scale with subdivisions of all orders of fineness, then we might well adopt a procedure described sufficiently by the following particular case: Suppose the unit-cm. point which is the closest to P of those preceding P on the scale is the **1-cm.-point,** while the corresponding point for Q is the **3-cm.-point.** Then as a first approximation, $\overline{PQ}$ (3-1) = 2cm. Working with the **10^{-1}-cm.-points,** we might find **1.3cm.** nearest P and **3.6cm.** nearest Q, so that our next approximation would be $\overline{PQ} \simeq$ (3.6- **1.3**) = **2.3cm.** Continuing in similar manner, we might obtain as a sequence of points of scale-division (to be called scale-points) for P, **1** , 1.3, 1.33, 1.333, **etc.**, and perhaps the sequence {3, 3.6, 3.66, 3.666, **etc.**} for Q. Then the sequence of approximations for _ is {**2,** 2.3, 2.33, 2.333, **etc.**} and we should conclude that $\overline{PQ}$ = **2 1/3 cm.**

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Proof:

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$$\leq G(q_m,q_n) + G(p_m,p_n) + G(p_n,q_n) .$$

Then

$$G(p_n,q_n) - G(p_m,q_m) \leq G(q_n,q_m) + G(p_m,p_n),$$

and

$$G(p_m,q_m) - G(p_n,q_n) \leq G(q_m,q_n) + G(p_m,p_n) .$$

The left hand sides of the preceeding two inequalities are numerically the same and one is positive.

So $|F(p_n,q_n) - F(p_m,q_m)| \leq G(q_m,q_n) + G(p_m,p_n)$
$G(q_m,Q) + G(Q,q_n) +$
$G(p_m,P) + G(P,p_n) .$

Since $\{p_n\} \to P$ and $\{q_n\} \to Q$, the last inequality implies that the sequence of approximate distances $F(p_n,q_n)$ Satisfied the Cauchy Convergence Criterion.

Theorem 2. Given P and Q in S, and sequences of points of K: $\{p_n\} \to P$, $\{\bar{p}_n\} \to P$, $\{q_n\} \to Q$, $\{\bar{q}_n\} \to Q$. Then $\lim F(p_n,q_n) = \lim F(\bar{p}_n,\bar{q}_n)$.

Proof: The two limits exist by Theorem 1.

$$\begin{aligned} F(p_n,q_n) = G(p_n,q_n) &\leq G(q_n,\bar{p}_n) + G(\bar{p}_n,p_n) \\ &\leq G(q_n,\bar{q}_n) + G(\bar{q}_n,\bar{p}_n) + G(\bar{p}_n,p_n) \\ &\leq G(\bar{p}_n,\bar{q}_n) + G(q_n,Q) + G(Q,\bar{q}_n) + G(p_n,P) + G(P,\bar{p}_n), \end{aligned}$$

$$\begin{aligned} F(\bar{p}_n,\bar{q}_n) = G(\bar{p}_n,\bar{q}_n) &\leq G(\bar{q}_n,p_n) + G(p_n,\bar{p}_n) \\ &\leq G(p_n,q_n) + G(\bar{q}_n,q_n) + G(p_n,\bar{p}_n) \\ &\leq G(p_n,q_n) + G(q_n,Q) + G(Q,\bar{q}_n) + G(\bar{p}_n,P) + G(P,p_n), \end{aligned}$$

so

$$|F(p_n,q_n) - F(\bar{p}_n,\bar{q}_n)| \leq G(p_n,P) + G(\bar{p}_n,P) + G(q_n,Q) + G(\bar{q}_n,Q) \to 0.$$

Thus $\lim F(p_n,q_n) = \lim F(\bar{p}_n,\bar{q}_n)$.

Definition: Let P, Q be any points of S. Since K is dense in S, there exist sequences of points of K: $\{p_n\} \to P$ and $\{q_n\} \to Q$. Theorems 1 and 2 permit us to define our new **distance-function** by:

$$H(P,Q) = \lim F(p_n,q_n).$$

Theorem 3. $H(P,Q)$ *is* a metric.

Proof: *M 1:* $F(p_n,q_n) \geq 0$, so $H(P,Q) = \lim F(p_n,q_n) \geq 0$.

M2: Take $p_n = q_n$. Then $H(P,P) = \lim F(p_n,p_n) = 0$.

M 3: Since $F(r_n,p_n) \leq F(p_n,q_n) + F(q_n,r_n)$, we have $\lim F(r_n,p_n) \leq \lim F(p_n,q_n) + \lim F(q_n,r_n)$, or $H(R,P) \leq H(P,Q) + H(Q,R)$.

Theorem 4. $H(P,Q)$ is an extension of G.

Proof: Take any p in K and q_n in K, and any Q in S. Take $p_n = p$, and $\{q_n\} \to Q$. Then $G(p,Q) \leq G(Q,q_n) + G(q_n,p)$ and $G(p,q_n) \leq G(q_n,Q) + G(Q,p)$, so $0 \leq |G(p,Q) - G(p,q_n)| \leq G(q_n,Q) \to 0$.

Thus $G(p,Q) = \lim G(p,q_n) = \lim F(p,q_n) = H(p,Q)$.

Theorem 5. $H(P,Q)$ is the only possible extension of G to a metric for S.

Proof: Let J be another such extension of G. Then in particular it is an extension of F. Given any P,Q in S, we choose approximating sequences as usual. Then

$$J(P,Q) \leq J(P,p_n) + J(p_n,Q) \leq J(P,p_n) + J(p_n,q_n) + J(q_n,Q),$$

$$J(p_n,q_n) \leq J(p_n,P) + J(P,q_n) \leq J(P,p_n) + J(P,Q) + J(q_n,Q);$$

And

$$|J(P,Q) - J(p_n,q_n)| \leq |J(P,Q) - F(p_n,q_n)| \leq J(P,p_n) + J(q_n,Q) \to 0.$$

Thus $J(P,Q) = \lim F(p_n,q_n) = H(P,Q)$, and J coincides with H.

In order to justify our failure to restrict F by M4, we conclude by proving that such a restriction would be unprofitable, in that H might not obey M4 even if F did. To show this, the following example suffices: Let p be a fixed positive prime, and for any positive integer N define $V_p(N)$ as the exponent of the highest power of p dividing N. In the space S composed of the positive rationals m/n in lowest terms we choose as metric

$$H\left(\frac{m_1}{n_1},\frac{m_2}{n_2}\right) = |V_p(m_1n_1) - V_p(m_2n_2)|$$

clearly satisfying M1, M2, M3. Let K be the set of integers $1, p, p^2, p^3$, etc. Define F and G over their proper domains as equal to H. For any m/n, we have $G(m/n, p^{V_p(mn)}) = 0$, so that the sequence obtained by iterating $p^{V_p(mn)}$ is a sequence of points of K converging to m/n. Thus K is dense in S, and our previous discussion applies. Furthermore, F obeys M4, since for s, $t \geq 0$, we have $0 = F(p^s,p^t) = H(p^s,p^t) = |s-t|$ only if s = t and thus only if $p^s = p^t$. M4 fails for H, however, since $H(p,p^{-1}) = |1-1| = 0$. Thus in spite of all our efforts, S may turn out to be a rather queer metric space in which two distinct points can be zero-distant.

NOTE by R. C. A., 30 December 1953

It is a most extraordinary fact that during the past six years three thirteenth century manuscripts of Omar Khayyām's Rubāiyāt became available for scholars. Apparently they were originally in the library of a learned mullah, who died some years ago in Persia, and came to light when sold at auction. The oldest of these manuscripts, dated 1207, was acquired by the University of Cambridge in 1950. Its 252 quatrains are translated into 252 double quatrains by Professor A. J. Arberry in his ***Omar Khayyām. A New Version Based upon Recent Discoveries (1952).***

The New York manuscript, dated 1216, was discussed in some detail by Professor Arberry in Studies Presented to Vladimir Minorsky, London University, School of Oriental and South African Studies, ***Bulletin,*** v. 14, part 3, 1952, "Omar again," p. 413-419. In this manuscript are 247 quatrains. Still further items of interest with regard to the manuscript are in the illustrated auctioneer's catalogue of Parke-Bernet Galleries, New York, December 15, 1953, 16p.: ***The Second Earliest Known Manuscript of the Rubaiyat of Omar Khayyam. Sold by Order of the Present Owner.*** The manuscript was sold to a Philadelphia collector for $4,500.

The third manuscript, in the possession of the "noble and discriminating patron of oriental art and letters," Alfred Chester Beatty of Dublin, was published in a sumptuous volume (London, 1949) with the following title: ***THE RUBĀ'IYĀT OF OMAR KHAYYĀM, edited from a newly discovered manuscript dated*** 658 (1259 - 60) ***in the possession of A. Chester Beatty Esq., by A. J. Arberry, Sir Thomas Adams's Professor of Arabic in the University of Cambridge, with Comparative English Versions by Edward FitzGerald, E. H. Whinfield, and the Editor.*** This manuscript contains 172 quatrains. The New York manuscript contains all of these quatrains, and 245 of the 252 quatrains in the Cambridge manuscript.

For Swinburne's reaction, upon acquisition of his penny Copy of FitzGerald's 1859 masterpiece, see Lionel Stevenson, ***The Ordeal of George Meredith,*** New York, 1953, p. 113-114.

CORRIGENDA, VOLUME 1, NUMBER 9

R. C. Archibald, ***Notes*** on ***Omar Khayyām*** (1050–1122) *and* ***Recent Discoveries.***

p. 352, line 20, *for* **quatrians,** ***read*** quatrains
lines - 2-3, *for* 101 quotations, read 101 quatrains
p. 354, *for* $x^3+cx^3+bx = a$, ***read*** $x^3+cx^2+bx = a$
for $x^3+bx = cxta$, ***read*** $x^3+bx = cx^2+a$
footnote 7, lines 2 and 7, *for* **Woepeke,** ***read*** Woepcke
and in line –3 *for* Lucky, read Luckey
p. 357, line –13, *for* Lucky, ***read*** Luckey
line –2, *for* ***Beitrage, read Beiträge***
and *for* ***Chajjam, read Chajjām***
line **-1,** *for* ***Chajjam, read Chajjām***
for ***altesten Auszuge, read altesten Auszüge***
and *for* ***Chajjams, read Chajjāms***
p. 358, line I, *for* ***Ruba'ijjat, read Rubā'ijjāt***
line 10, *for* Khayyam, ***read*** **Khayyām**
line **-1,** *for* **nam,** ***read*** name
for Merciful, ***read*** Merciful
Plate, *for* **Khayyam,** ***read*** **Khayyām**

* * *

LETTER TO THE EDITOR

Dear Miss Stokes:

Thank you for remembering to send to me the interesting Pi Mu Epsilon Journal of November 1953, which contained the article by R. C. Archibald, "Notes on Omar **Khayyām** (1050 - 1122) and Recent Discoveries."

I am very much interested in any Omar material and am collecting quite a shelf of the subject. I was with my uncle, Dr. David Eugene Smith, when he was doing research for his book of **Rubāiyāt** of Omar **Khayyām.** He endeavored to get an Iranian student Interested in doing research in Iran when we were there in 1933.

Cortland, New York Helen E. **McAleer**
February 7, 1954.

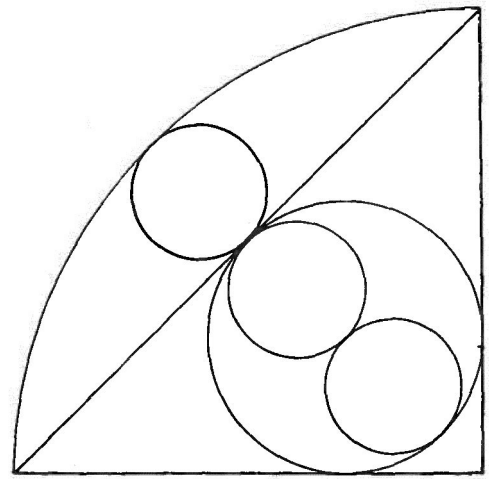
PROBLEM DEPARTMENT
Edited by
Leo Moser, University of Alberta

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

63. ***Proposed*** by ***Lean Bankoff, Los Angeles, California***

State and solve the problem suggested by the following diagram.



64. ***Proposed*** by Fred ***Gross, Brooklyn College***

Prove that

$$x^9 - 6x^7 + 9x^5 - 4x^3$$

is divisible by 27 for all positive integral values of x.

65. ***Proposed*** by ***Martin Schechter, Brooklyn, N. Y.***

Prove that every simple polygon which is not a triangle has at least one of its diagonals lying entirely inside of it.

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

If three circles with radii a, b, c, are externally tangent, there are two circles with radii r, R which touch the three circles. Show that

$$\frac{1}{r} - \frac{1}{R} = 2\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right)$$

and that

$$\frac{1}{r} + \frac{1}{R} = 4\sqrt{\frac{a+b+c}{abc}}$$

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

Find four numbers in arithmetical progression and three in geometrical progression such that the sum of the squares of the four is equal to the sum of the squares of the three.

SOLUTIONS

49. ***Proposed by C. S. Venkataraman, Trichur, India***

If $s = (a + b + c + d)/2$ and $S = abcd$, prove that

$$s^4 + (s-b-c)^4 + (s-c-d)^4 + (s-d-b)^4 - (s-a)^4 - (s-b)^4 - (s-c)^4 - (s-d)^4 = 12S.$$

Solution by the Proposer

Replacing s by its value we find that the right hand side is homogeneous of the fourth degree and vanishes when a = 0, b = 0, c = 0, d = 0. Hence it is equal to KS and K can readily be found to be 12 by taking a = b = c = d = 1.

Also solved by Louisa S. Grinstein, Buffalo, New York and C. W. Trigg, Los Angeles City College.

52. Proposed by R. T. Sharp, McGill University, Montreal

A set of n smooth dominoes 1" x 2" x $\frac{1}{4}$" is piled on a table, one horizontally placed domino in each layer. Find the largest distance that the top domino can be made to overhang the bottom one.

Solution by C. W. Trigg, Los Angeles City College

If a pile of (K - 1) rectangular parallelepipeds, each of length 2x, is placed on another horizontal parallelepiped and slid along until its center of gravity lies above the leading edge of the Kth parallelepiped, the center of gravity of the entire configuration lies a horizontal distance x/K from the leading edge of the Kth parallelepiped.

It follows that a columnar pile of the n dominoes, with x = 1", may be slid between two parallel vertical planes 1" apart so that the successive overhangs from the top down constitute the series,

$$1 + \frac{1}{2} + \frac{1}{3} + \ldots + \frac{1}{n-1},$$

thus forming a half-arch in equilibrium. Since the harmonic series is divergent, the sum of this series will increase with n and the overhang of the top domino over the bottom one may be made any desired amount.

In order that the ***entire*** top domino may overhang the bottom one, n must be at least 5, in which case the total overhang of the leading edge of the top domino is $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$ or approximately 2.0833". For n = 12, the total overhang is 3.0199".

If the pile be slid so that the diagonals of the dominoes lie in the same vertical plane and the centers of gravity of the various sub-piles from the top down lie over a corner of the leading edge of the supporting domino, then the total overhand will be $\sqrt{1^2 + (\frac{1}{2})^2}$ or $\frac{1}{2}\sqrt{5}$ times that of the first mentioned arrangement.

Also solved by A. E. Livingston, University of Washington, and the proposer.

53. Proposed by Lean Bankoff, Los Angeles, California

A rectangular slab of width w is moved horizontally from one corridor of width a into another at right angles to it, of width b. What is the maximum value of the length ℓ, of the slab, that will permit passage?

Solution by the Proposer

Let 9 denote the angle between the side ℓ and either wall of the corridor of width a. Referring to the diagram, it is evident that

$$\ell = a \csc 9 + b \sec 6 - w \tan \theta - w \cot \theta \qquad (1)$$

Then $\frac{d\ell}{d\theta} = -a \csc \theta \cot \theta + b \sec \theta \tan \theta - w \sec^2 \theta + w \csc^2 \theta.$

The minimum value of ℓ, found by equating the first derivative to zero, represents the maximum value of ℓ that will permit passage of the slab from one corridor to the other. Thus

$$b \sec 9 \tan 9 - a \csc 9 \cot 9 + w(\csc^2\theta - \sec^2\theta) = 0. \quad (2)$$

Now, if we let sin 9 = x, we get

$$\tan 9 = \frac{x}{\sqrt{1 - x^2}}; \quad \cot 6 = \frac{\sqrt{1 - x^2}}{x}; \quad \sec \theta = \frac{1}{\sqrt{1 - x^2}}; \quad \csc \theta = \frac{1}{x}.$$

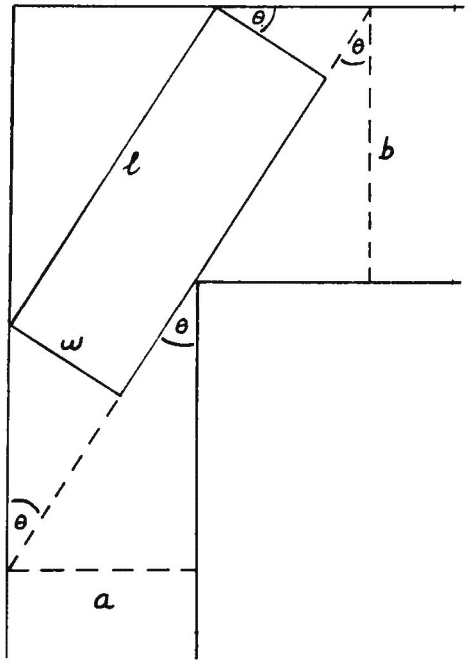
Substituting for 9 in (2), we get

$$\frac{bx}{1 - x^2} - \frac{a\sqrt{1 - x^2}}{x^2} + w\left(\frac{1}{x^2} - \frac{1}{1 - x^2}\right) = 0.$$

Simplifying and squaring, we obtain

$$x^6(a^2 + b^2 - 4wb\,x^5 + x^4(4w^2 - 3a^2)$$
$$+ 2wbx^3 - x^2(3a^2 - 4w^2) + w^2 - a^2 = 0. \qquad (3)$$

Since all the coefficients of the powers of x are given the sextic may be solved for x, yielding the value of sin θ for which ℓ is extreme. Substituting corresponding values for function of 9 in (1), we obtain the desired value of ℓ.



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

Unscramble each of the numbered words and phrases to obtain the names of twenty-nine mathematicians. It will be observed that the initials of the names, in order, read PI MU EPSILON JOURNAL, MATHEMATICS.

(1) REAP COIN; (2) AIM HIS CLUB; (3) MEN SNEER; (4) SPUN KEYS; (5) NINE TIES; (6) A PLOT; (7) NO

ALMS; (8) IN ZEBRA; (9) TALL HOPI; (10) THE COURD; (11) SHUN A COMIC; (12) I ADJOURN; (13) OO!! DOGS; (14) WONDER DUO; (15) RED CORE; (16) PANIER; (17) BAR A CHILD; (18) MEN IN LAND; (19) MORE IN CASH; (20) SAUL IN POOL; (21) FETCH, BY HEC; (22) CROP HIS PATE; (23) OX DUE US; (24) GNOME; (25) BALE; (26) CHERISH SUN TAN; (27) FLED IN; (28) CARTON; (29) SLIT RING.

Solution by Nathaniel Grossman, Aurora, Ill.

(1) POINCARE; (2) IAMBLICHUS; (3) MERSENNE; (4) USPENSKY; (5) EINSTEIN; (6) PLATO; (7) SALMON; (8) IBN EZRA; (9) L'HOPITAL; (10) OUGHTRED; (11) NICOMACHUS; (12) JOURDAIN; (13) OSGOOD; (14) UNDERWOOD; (15) RECORDE; (16) NAPIER; (17) ARCHIBALD; (18) LINDEMANN; (19) MASCHERONI; (20) APOLLONIUS; (21) TCHEBYCHEF; (22) HIPPOCRATES; (23) EUDOXUS; (24) MONGE; (25) ABEL; (26) TSCHIRNHAUSEN; (27) INFELD; (28) CANTOR OR CARNOT; (29) STIRLING.

Also solved by Leon Bankoff, Ruth Stokes and the proposer.

Bankoff points out that omitted from the list is the name of the editor of the problem section of the Pi Mu Epsilon Journal, which may be written: SORE MOLE; MORE SOLE; LOSE MORE; EEL ROOMS; OLE MORSE; ORE MOLES; etc.

59. *Proposed* by *P. Piza, San Juna, Puerto Rico*

Let

$$a = 1 + 2 + 3 + 4 + \ldots + n,$$
$$b = 1^3 + 2^3 + 3^3 + 4^3 + \ldots + n^3,$$
$$c = 1^5 + 2^5 + 3^5 + 4^5 + \ldots + n^5,$$
$$d = 1^7 + 2^7 + 3^7 + 4^7 + \ldots + n^7.$$

And let $t_n = n(n+1)/2$ be the n th triangular number.

Prove the following relation true for arbitrary n:

$$a + b + c + d = 2(t_n^4 + t_{t_n}).$$

Solution by Louisa S. Grinstein, Buffalo, New York

It is well known that

$$a = n(n+1)/2, \quad b = n^2(n+1)^2/4$$
$$c = n^2(n+1)^2(2n^2 + 2n - 1)/12$$
$$d = n^2(n+1)^2(3n^4 + 6n^3 - n^2 - 4n + 2)/24$$

Adding and regrouping we find

$$a + b + c + d = n^4(n+1)^4/8 + [n(n+1)/2]$$
$$[n(n+1)/2 + 1] = 2(t_n^4 + t_{t_n}).$$

Also solved by Fred Gross, Brooklyn College, Martin Schechter, Brooklyn, N. Y., C. W. Trigg, Los Angeles City College, and the Proposer. The solutions of Trigg and Gross were almost identical with the one given above while Piza used induction over n.

NATIONAL MEETING
OF THE PI MU EPSILON FRATERNITY
BALTIMORE, MARYLAND

Minutes of the Meeting, December 28, 1953

A national meeting of the Pi Mu Epsilon Fraternity was held in the south lounge of Levering Hall on the Homewood Campus of Johns Hopkins University, Baltimore, Maryland, on December 28, 1953.

An informal gathering of delegates was held from 10:00 a.m. to 12:00 during the meeting of the National Council. Luncheon at noon was followed by a business meeting which adjourned at 2:30 p.m. Then after a brief intermission about half of the group stayed on until 4:00 p.m. to hear something of the history of Pi Mu Epsilon and to participate in further exchange of ideas.

Twenty-two chapters were represented at the business meeting by the following delegates and members.

California Alpha	Sophia McDonald (Councilor General)
Delaware Alpha	L. Vernon Lewis
	G. C. Webber
D. C. Alpha	Arthur N. Thorpe
Georgia Alpha	T. Fort (Councilor General)
Illinois Alpha	Peter G. Braunfeld
	S. S. Cairns (Councilor General)
	Franz Hohn
Iowa Alpha	Gary H. Meisters
Kansas Alpha	Elliott Ward Cheney, Jr.
Kentucky Alpha	Joseph B. Cornelison
	J. A. Ward
Michigan Alpha	Delia Koo
	J. S. Frame (Secretary-Treas. General)
Missouri Alpha	John D. Bentley
Missouri Gamma	Gerald T. Dobrindt

New York Alpha	William Kopka
	Ruth Stokes (P.M.E. Journal Editor & C.G.)
New York Beta	June Zimany
	Ellen Praus
	Sandra Biderman
	J. H. Bushey
	Frances Goldman
North Carolina Beta	W. M. Whyburn (Vice-Director General)
Ohio Alpha	Phyllis Rubin
Ohio Delta	Frederick G. Werner
Oklahoma Alpha	John E. Hoffman
Oklahoma Beta	Yaroslaw Stachiw
Pennsylvania Beta	Ronald H. Broadhurst
	Bruce Cloud
Pennsylvania Gamma	Lawrence J. Wallen
	G. L. Raynor
Wisconsin Alpha	H. P. Pettit
Wisconsin Beta	S. Ashby Foote
	C. C. MacDuffee (Director General)

The minutes of the September 1952 meeting at East Lansing, Michigan, were read and approved.

Director General MacDuffee reported on the installation of the Alabama Beta chapter at Alabama Polytechnic Institute on April 21, 1953, and of the New York Theta chapter at Cornell on May 22,1953. The pending petition of Rutgers University has 17 favorable votes. If ti is approved, New Jersey Alpha will be the 56th chapter.

Secretary General Frame reported an increase in members of 1048 in the year 1953, bringing the total membership to 22,062. Then Treasurer General Frame gave a financial report indicating a balance in the treasury of $4901.13, from which travel expenses to the meeting are still to be paid.

Miss Ruth Stokes, in her report as Editor of the Pi Mu Epsilon Journal, indicated that volume 1 would close with number 10, and recommended that in the future eachvolume

should cover the period of service of one editor. She commended the work of the Associate Editors, Walker, McCoy, Frame, Moser, and Karnes. She presented the financial report and notes that the Journal has 297 paid subscribers in addition to initiates. She urged students to gain experience by writing expository articles for publication in the Journal, and to contribute by sending in problems and solutions.

The report of the nominating committee was presented, as given on the enclosed ballot (a copy of the ballot follows these minutes, p. 419). Since no candidate for business manager of the Journal had been found, the name of Paul Gilbert was suggested by Miss Stokes, but he has subsequently declined the nomination. The rest of the slate was approved without additions from the floor.

Two amendments were presented by the National Council and were approved by the meeting after discussion.

1. Moved by G. C. Webber of Delaware Alpha, seconded by Delia Koo of Michigan Alpha, and unanimously approved for referral to the chapters: To amend Article V, section 3 of the Constitution and By Laws of the Pi Mu Epsilon Fraternity by changing the date "April 1" to "July 1."

As explained In the agenda for the meeting, the months of April and May are the busiest months of the year for the preparation of certificates by the Secretary General; and not the easiest time for a new man to learn his job, and for transferring the files. It would also be difficult for a new Journal Editor to take over on April 1, just before the Spring issue is off the press.

2. Moved by H. P. Pettit of Wisconsin Alpha, seconded by Ashby Foote of Wisconsin Beta and approved for referral to the chapters: To amend Article IX to include the sentence "Each chapter of Pi Mu Epsilon shall select a permanent corresponding secretary (to whom official correspondence for the chapter shall be sent) who shall be a member of the mathematics department with the rank of instructor or higher at the institution where the chapter is located."

The purpose of this amendment is to keep a continuing and up-to-date mailing list of chapters for sending communications from the Secretary General, the Journal Editor, and other officers. Not infrequently when student officers leave their institutions they fail to report the names of their successors.

It was moved by June Zimany, New York Beta, and seconded by Ronald Broadhurst, Pennsylvania Beta, and supported by the convention that the following policy on travel reimbursement (similar to that of the Mathematical Association) be approved, subject to budgeting limitations: That the Director General, Secretary-Treasurer General, and Journal Editor be paid a sum up to first class rail fare plus pullman for one meeting a year, less travel expense available from other sources; that the Vice-Director General and other General Officers be paid travel expense on the basis of one-third the above rate, provided that the total reimbursement from all sources does not exceed first class fare; and that reimbursement for student delegates be decided each year on recommendation of the National Council.

The place and time of the next meeting was discussed, and it was suggested that the location be west of the Mississippi, but no action was taken.

Mr. John Hoffman described and distributed copies of the mathematical newsletter printed by the Oklahoma Alpha chapter.

There being no further business, the meeting was adjourned.

Respectfully submitted,

J. Sutherland Frame

J. Sutherland Frame
Secretary-Treasurer General

Just as the manuscript for the April issue of the Journal was going to press the editor received a copy of the ballot showing not only nominations for General Officers of Pi Mu

Epsilon who will take office on July 1, 1954, for a three-year term, but also showing the election results. So, instead of the ballot as originally printed, we give here the results of the election.

There were 31 ballots received by March 15, and the election was extremely close.

General Officers for Three-Year Term 1954-1957

Director General: S. S. Cairns, University of Illinois
Vice-Director General: J. S. Frame, Michigan State College
Secretary-Treasurer General: R. V. Andree, University of Oklahoma
Councilors General:
Wealthy Babcock, University of Kansas
R. F. Graesser, University of Arizona
Sophia L. McDonald, University of California, Berkeley
H. S. Thurston, University of Alabama
Editor of the Official Journal: Ruth W. Stokes, Syracuse University
Business Manager of the Official Journal: (Office not yet filled; so, by the constitution (p. 11), the present Business Manager Howard C. Bennett will continue to hold office until his successor has been elected and duly qualified. Mr. Bennett asked to be relieved of his duties.)

The chapters voted approval of the two amendments to the constitution (See statements of the amendments, as given in the minutes of the Baltimore meeting, above.)

REPORTS OF THE CHAPTERS

Edited by
Houston T. Karnes, Louisiana State University

(Send reports to Ruth W. Stokes, 15 Smith College, Syracuse University, Syracuse 10, New York.)

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 of meetings, 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 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. These annual reports will be published in the chronological order in which they are received.

Eta of New York, University of Buffalo

The following papers were presented at regular meetings of the New York Eta chapter during the 1952-1953 year:

"Pretty Patterns of Polygons or Regular Tesselations in Curved Spaces" by George W. Walker

"Celestial Mechanics" by Dr. William H. Davis of the Physics Department

"Fibonacci Numbers" by Rita Mochan

"An Area Expressed as a Limit" by Mary Harrington

"Semi-Complex Graphs" by Dr. Louis Kramer

"Mathematical Developments of Some Vibration Problems" by Robert C. Kroeger

"Measure" by Dr. Daniel Orloff of the Cornell Aeronautical Laboratory.

The meeting on December 16, 1952, was a dinner meeting. Mathematical games and recreation were enjoyed by the members.

The following were elected to serve as officers for the year 1953-54: Director, Richard Barnes; Vice-Director, Leonard

Darbee; Secretary, Joseph Siciliano; Treasurer, Thomas Harris; Faculty Advisor, Howard W. Baeumler.

Alpha of Alabama, University of Alabama

During the academic year 1952–1953, the Alabama Alpha chapter held five meetings. In addition, the chapter had a Christmas banquet and the annual spring picnic. The first meeting was held on October 16, when the director, Miss Betty Ellis,* presented a report on the Pi Mu Epsilon National Convention held during the summer. At subsequent meetings the following papers were presented:

"Photoelasticity" by Dr. William D. Jordan, Department of Engineering Mechanics

"A Problem in Potential Theory[D] by Dr. J. H. Hornback, Mathematics Department

"The Logical Design for an Automatic Digital Computer[D] by Dr. A. S. Householder of the Oak Ridge Laboratories

"Inverting a Matrix by the Monte Carlo Method[D] by Dr. Paul Hummel of the School of Commerce.

Eighteen new members were initiated during the year.

Officers elected for the year 1953–1954 were: Director, A. W. Yonda; Secretary, Betty Ellis; Treasurer, Roger Wicks; Faculty Advisor, Dr. Carl Seebeck; Social Chairman, Lou Ann Ray; Scholarship Chairman, Dr. J. H. Hornback.

Epsilon of New York, The St. Lawrence University

At the first meeting of the New York Epsilon chapter for the academic year of 1952–53, the following officers were elected: President, Heidi Genhart; Secretary, Hilda Budelman; Treasurer, George Van Wyck; Director, Dr. O. Kenneth Bates; Permanent Secretary, Dr. Ruth Peters.

Meetings were held monthly with the presentation of the following papers:

"Non-Euclidean Geometry[D] by Hilda Budelman

"Wartime Radar Equipment[D] by George Van Wyck

"The Actuarial Field[D] by Bernard Silkowitz

"The Poisson Distribution Curve[D] by Stuart Collins

"$e^{ix} = \cos x + i \sin x$[D] by Heidi Genhart

"The Steel Square[D] by William Dixon.

*Student delegate to the National Convention at Michigan State College, 1952.

On May 12 the annual picnic was held.

Officers for 1953–1954 are: President, Hilda Budelman; Secretary, Ellen Keenholts; Treasurer, Jack Kinney; Director, Dr. O. Kenneth Bates; Permanent Secretary, Dr. Ruth Peters.

Alpha of New York, Syracuse University

The New York Alpha chapter held six meetings during the year 1952–1953. The following papers were presented:

"Analogue Methods* by Dr. Otway Pardee

"Surfaces* by Dr. Erik Hemmingsen

"IBM Machines and the Computation Field[D] by Dr. Walter Murdock of the IBM Corporation

"Looking Between the Stars[D] by Dr. Kurt Sitte of the Physics Department

"Boolean Algebra[D] by George Mulfinger and "Duplex Numbers" by Frank Raymond

"Curves of Constant Width" by Dr. Walter Baum.

The annual initiation banquet, welcoming thirty-three new members, was held December 17. The guest speaker was Dr. W. A. Hurwitz of the Cornell University Mathematics Department. He spoke on "Trigonometry Without Geometry."

Officers elected for 1953–54 were: Director, Norbert Bischof; Vice-Director, Richard H. Brans; Corresponding Secretary, Joan Farber Johnson; Recording Secretary, Patricia Hansell; Treasurer, George Finkbeiner.

Alpha of Florida, University of Miami

During the academic year of 1952–1953, the Florida Alpha chapter held six meetings. The following papers were presented:

"Hypercomplex Numbers[D] by Dr. Harry S. Robertson

"Riemann Geometry and Relativity[D] by Dr. Mayme I. Logsdon

"Sub-tropical Topology[D] by Dr. Wayman L. Strother

"Directed Sets[D] by Dr. Herman Meyer

"Relation Theory and Multivalued Functions[D] by Dr. David Foulis

"Selected Mathematical Problems" by Dr. Elton J. Moulton.

The annual Christmas party was postponed until January 5. Entertainment was provided by members of the chapter after which refreshments were served.

Officers for 1952–1953 were: Director, Dr. Mayme I. Logsdon; Vice-Director, John Maecher; Secretary, Robert W. FitzGerald; Treasurer, David Foulis.

Officers for 1953-1954 are: Director, William Gaylor; Vice-Director, Walter Roop; Secretary, Edward Berger; Treasurer, Zwni Abboushi.

Beta of Illinois, Northwestern University

(Report of the activities of the chapter, Fall and Winter 1953-1954)

During the first two quarters of the academic year 1953-54, six meetings were held. At these meetings, six papers were presented, three by members of the faculty and three by student members of Pi Mu Epsilon. The papers were:

"Decision Problems" by Dr. James Dekker, chapter advisor
"Critical points" by Dr. George Springer
"The Mathematics of an Armament Race" by Dr. Ralph Boas
"Some Aspects of Set Theory" by Robert Rieger
"Simple Mechanical Computers" by Robert Fultyn
"The Random Walk Problem" by Jerome Green.

On March 4, the Illinois Beta chapter of Pi Mu Epsilon will have a mathematics demonstration and lecture, as part of the annual Open House held by the Northwestern Technological Institute.

On January 12, election of officers for the following year took place, these officers to hold office until the Winter quarter of the academic year 1954-55. The following officers were elected: President, Robert E. Briney; Vice-president & Treasurer, Robert Rieger; Secretary, Raymond Ettinger; and Corresponding Secretary, Dr. James Dekker.

Officers for the previous year, 1953, were: President, Miles V. Klein; Vice-president, Jerome Green; Treasurer, Robert Fultyn; and Secretary, Mary Lou Stanfield.

At the initiation banquet held in May, 1953, Dr. William Jenner spoke on "Prime Numbers." The next initiation will be held in May, 1954.

MEDALS, PRIZES AND SCHOLARSHIPS

On April 25, 1953, the New York Epsilon chapter sponsored a high school mathematics contest, now an annual event. The individual winner was Earl Dunn, a junior from Tupper Lake High School, Tupper Lake, N. Y. The highest scoring senior, William Bartlett from Potsdam High School, Potsdam, N. Y., was offered a $1,000 scholarship to St. Lawrence University, according to the rules of the contest.

The latter part of April, 1954, the Illinois Beta Chapter, Northwestern University, will hold its annual mathematics contest, a campus-wide competition with cash prizes.

The Eta of New York chapter, University of Buffalo, makes an annual award of dues for one year's membership in the Mathematical Association of America paid by the chapter for the winner. The award for the academic year 1952-1953 went to Mrs. Miriam Hayman Brown for outstanding achievement in mathematics.

At the November 12, 1952, meeting of the Kansas Gamma chapter, University of Wichita, announcement was made of two additions to the Pi Mu Epsilon Scholarship Fund: $200 by Mr. H. K. Sears in memory of Mrs. Sears; $100 by Mrs. E. B. Wedel in memory of Professor Wedel (former professor of mathematics at the University of Wichita).

NEWS ANT) NOTICES

PI MU EPSILON CELEBRATES ITS FORTIETH ANNIVERSARY

The first meeting of the Mathematical Fraternity, at Syracuse University, which was soon to become a national fraternity was held in the Hall of Languages, April 27,1914. At that meeting Dr. E. D. Roe, Jr., was unanimously elected Director of the Fraternity. In less than one month, that is, on May 20, 1914, the Pi Mu Epsilon Fraternity, as it was then called, was granted a charter by the State of New York. The fraternity was incorporated under the name: "Pi Mu Epsilon Fraternity, Inc." The Certificate of Incorporation was signed by P. C. J. De Angelis, Justice of Supreme Court, and on May 25, 1914, the certificate was placed on file in the Office of the Secretary of State, in Albany, New York. The fee for recording was $11.00.

As Number 10, Volume 1, of The Pi Mu *Epsilon Journal* goes to press, the editor has before her all of these precious documents, pertaining to the founding of the fraternity, kindly loaned by the present Secretary General.

We mention these matters at this time because May 20, 1954, will mark the fortieth anniversary of Pi Mu Epsilon, and we think it is fitting to pause and give some thought to the beginnings of our great national honorary mathematical fraternity.

"A chapter of Pi Mu Epsilon may be chartered only in an academic institution whose standards are excellent in all liberal arts departments and particularly so in mathematics," so says our present constitution. The fraternity has experienced steady growth both in strength of membership and number of chapters. By 1923, there were six chapters, and presiding over these six chapters was Dr. E. D. Roe, first Director General. These chapters are listed here in order of installation: at Syracuse University, Ohio State University, University of Pennsylvania, University of Missouri, University of Alabama and Iowa State College of .Agriculture and Mechanical Arts.

In forty years the number of chapters has reached fifty-six.

* * * *

A New Chapter

We are happy to announce that the chapters voted approval of the petition from the Mathematics Club of Rutgers University for

a chapter of Pi Mu Epsilon. So it looks as if New Jersey Alpha will soon be our fifty-sixth chapter. The installation ceremony probably will be on April 22, 1954, with Director General C. C. MacDuffee officiating.

* * * *

News Items Gleaned from Chapter Reports

In April, 1953, the Alpha of Alabama sent three delegates, Director Betty Ellis and two other members, to represent the chapter at the installation of the Beta of Alabama chapter at Alabama Polytechnic Institute.

On March 4, 1954, the Illinois Beta chapter of Pi Mu Epsilon featured a mathematics demonstration and lecture, as part of the annual Open House held by the Northwestern Technological Institute.

The New Hampshire Alpha chapter sponsors a program called the "Math-Aid" which functions every Monday evening and members assist other students having difficulty with mathematics in courses ranging from algebra to differential equations.

* * * *

News of Alumni Members

Army Home Town News Center,
Kansas City, Missouri
January 28, 1954

David L. Weeks of Oklahoma City, Okla., recently was promoted to first lieutenant in Korea, where he is wire officer with the signal section at I Corps headquarters. Before arriving overseas last October, Lieutenant Weeks was stationed at Camp Gordon, Ga. A graduate of Oklahoma A & M College where he was a member of Lambda Chi Alpha, Phi Kappa Phi, PI MU EPSILON and Phi Eta Sigma, the Oklahoma City officer entered the Army in July 1952. His parents, Mr. and Mrs. Leo E. Weeks, live at 1230 St. Charles Street.

(U.S. Army Photo)

Mr. Vincent Naramore (New York Alpha) has been appointed head of the Mathematics Department at St. Michael's College, Winooski, Vermont.

Dr. John W. Brace (New York Theta) took his Ph.D. degree at Cornell University, June 1953, and is now a member of the mathematics staff at the University of Maryland.

* * * *

Deaths

Professor E. B. Wedel, member of Pi Mu Epsilon (University of Oklahoma) and professor of mathematics at the University of Wichita, died in July, 1952.

Among the initiates for the Missouri Alpha chapter, University of Missouri, May 1,1953, there appeared the name of George F. Schwaebe (See vol. 1, no. 9, p. 390). Last Fall our Business Manager, Howard C. Bennett, received a letter from the parents bearing the news that their son had been killed in a Navy plane crash, July 17 (1953). We are sure the other members of Pi Mu Epsilon will be saddened by this news and will wish to join the Journal Staff in an expression of sympathy to the parents. Details of the plane crash are given in Mr. and Mrs. Schwaebe's letter to Professor Bennett, excerpts of which are printed below.

"We received a copy of the Pi Mu Epsilon Journal addressed to our son, George F. Schwaebe in which was enclosed the attached form to renew his subscription.

"It is with great sorrow that I write to tell you that George was killed in a Navy plane crash at Milton, Florida, July 17, with 39 other midshipmen while on their summer training tour.

"We do want you to know that George took great pride and joy in his association with Pi Mu Epsilon, and Mrs. Schwaebe, with the permission of the local chapter at Missouri University, in Columbia, has his Pi Mu Epsilon pin on a gold chain around her neck as her most valued memento of our only son. We hope that you also will approve of this.

"With our best wishes for your continued success in encouraging all young college people in attaining high proficiency in mathematics, we are...

(Signed) Mr. and Mrs. Geo. E. Schwaebe."

* * * *

Pi Mu Epsilon Doctorates

Among the persons receiving doctorates in mathematics in 1952 in the United States (and listed in the *Bulletin* of the American Mathematical Society, vol. 59, no. 3 [May, 1953], p. 286–296) the following sixty members of Pi Mu Epsilon received Ph.D's at the institution where they were initiated into Pi Mu Epsilon. They are listed below by chapter and initiation date.

California Alpha	J. J. Brandstatter	(June 7, 1946)
	R. M. Hayes	(Dec. 20, 1946)
	J. R. Jackson	(Jan. 6, 1950)
	E. E. Osborne	(May 29, 1947)
California Beta	T. A. Jeeves	(Sept. 25, 1943)
	W. L. Parker	(April 27, 1947)
	R. G. Stoneham	(Dec. 3, 1947)
	R. F. Tate	(Dec. 19, 1942)
	F. B. Thompson	(Nov. 22, 1949)
	R. A. Willoughby	(Dec. 11, 1946)
Georgia Alpha	R. K. Butz	(Jan. 19, 1949)
	B. F. Hadnot	(Jan. 19, 1949)
	A. T. Hind, Jr.	(Nov. 8, 1950)
	G. N. Wallon	(Feb. 1, 1950)
Illinois Alpha	B. V. Dean	(May 16, 1951)
	C. B. Hanneken	(May 9, 1950)
	J. H. Hornback	(May 9, 1950)
	G. R. Livesay	(May 19, 1944)
	E. R. Mullins, Jr.	(May 9, 1950)
Illinois Beta	D. J. Thompson	(Nov. 16, 1948)
Iowa Alpha	V. W. Bolie	(Apr. 19, 1949)
	Fred Chong	(May 17, 1951)
	A. M. Feyerherm	(May 23, 1950)
	L. D. Gates, Jr.	(Apr. 19, 1949)
	C. H. Lindahl	(Apr. 20, 1948)
	M. R. Mickey, Jr.	(Apr. 20, 1948)
	H. D. Mills	(Dec. 4, 1947)
Kansas Alpha	R. C. Fisher	(Jan. 5, 1949)
	W. C. Foreman	(Apr. 25, 1941)
	J. R. Larkin	(Jan. 5, 1949)
	J. D. Riley	(May 13, 1947)
Kentucky Alpha	W. C. Royster	(Feb. 26, 1947)
	R. E. Wheeler	(Apr., 1948)
Missouri Alpha	W. L. Stamey, Jr.	(May, 1949)

New York Alpha	H. G. Rice	(Dec. 15, 1948)
	Samuel Schechter	(Dec. 11, 1947)
New York Delta	Bernard Fleishman	(1948)
	W. M. Hirsch	(Dec. 13, 1946)
	M. D. Kruskal	(Dec. 13, 1946)
North Carolina Beta	Meyer Dwass	(Nov. 16, 1951)
	Emilie V. Haynsworth	(Dec. 6, 1949)
Ohio Alpha	E. R. Fadell	(June 2, 1949)
	E. W. Martin, Jr.	(May 14, 1948)
	R. V. Mendenhall	(May 14, 1947)
	H. E. Tinnappel	(June 6, 1939)
Oregon Alpha	I. J. Christopher	(May 25, 1950)
	A. E. Livingston	(Apr. 29, 1949)
	C. K. Tsao	(Apr. 29, 1949)
Pennsylvania Alpha	Jean M. Calloway	(May 18, 1948)
	Hyman Kamel	(Dec. 15, 1939)
	David Rosen	(May 22, 1950)
	Marvin Tomber	(May 18, 1948)
Pennsylvania Epsilon	G. J. Habetler	(May 26, 1950)
	C. D. Harris	(May 30, 1948)
	Phillips Whidden	(May 30, 1948)
Wisconsin Beta	R. J. Buehler	(May 21, 1948)
	G. P. Dineen	(May 21, 1948)
	G. F. Rose	(May 21, 1948)
	W. N. Smith	(May 21, 1948)
	Arnold Wendt	(March 24, 1949)

Since we have no master list of membership, we are very grateful to Secretary General J. Sutherland Frame for his work in preparing the above partial list of our members receiving their doctorates in mathematics in the year 1952. It is a partial list because he could only select from the 207 doctorates listed in the Bulletin (AMS, May, 1953) those who received degrees at institutions having chapters of Pi Mu Epsilon. It was a laborious task which involved many hours of searching through the Fraternity's files for each of these institutions, giving lists of initiates each year since the chapter was installed. Though exercising the greatest care, because of pressure of time and other matters, he is not certain that he did not miss some names. Nevertheless sixty Ph.D.'s earned in one year by members of Pi Mu Epsilon reflect great credit on the Fraternity! We realize, however, that many of our members, after being initiated, transfer to other universities to work on their doctorates, in some cases to a university within the U.S. where there is no chapter of Pi Mu Epsilon, and some few go to countries beyond our borders for their doctorates. In such cases there was no way for the Secretary to check membership in the Fraternity.

Following the recently voted amendment to our constitution concerning the corresponding secretaries of each chapter, the editor will be able to work more closely with each chapter in a study like that given above. Additional data on the successful candidates, like where presently employed, may be obtained.

A 1954 Summer Conference for Mathematics teachers will be held at the University of Oklahoma in the air conditioned Memorial Union building on June 9–10.

BOOK REVIEWS

Handbook of Probability and Statistics with Tables. By Richard S. Burington and Donald C. May, Jr., Sandusky, Ohio, Handbook Publishers, Inc., 1953. 340 pages.

This handbook attempts to present the basic principles of probability and statistics in a compact, pocket size form which can be used by people in various applied fields. It is quite comprehensive in its coverage of basic theory and definitions used in statistical analysis. The phenomenal growth of statistical methodology is evidenced by the author's devotion of three-quarters of the handbook to theory and explanation and only one-quarter to statistical tables. This might be contrasted with Burington's "Handbook of Mathematical Tables and Formulas" where only one-third of the book is devoted to definitions and formulas and two-thirds to tables. The new handbook fills a long-felt need in providing a companion handbook to the original and should become an integral part of every applied statistician's library.

The authors have covered the basic ideas in what I believe to be a wise choice of notation. This is an important point as there are almost as many notations as there are textbooks in this field. After the usual discussion of basic statistical measures, combination, permutations and probability, the authors present the general idea of a distribution function followed by a discussion of specific distributions such as the Binomial, Poisson, Normal, etc. Material is included on regression theory, time series, correlation, a short discussion of multiple and partial correlation, statistical inference, sampling distributions and a short section on analysis of variance. Finite differences and sequential analysis are also discussed and a 'once over lightly' on sampling inspection and quality control.

The tables are the ones a statistician likes to have handy including the binomial function (n = 1 to 20), the Poisson, normal curve, F, t, z, x^2 and a few mathematical tables useful in statistics.

It is certainly difficult to cover the amount of material these authors attempt in a way that will satisfy all readers. In the later chapters, the book ceases to be a handbook and becomes a mathematical discussion. For example, in the discussion of analysis of variance, the essential principles are there but not the techniques actually used in solving problems such as the problem on page 208. I believe the choice of heading in table 17.43.2 on page 236 is most unfortunate as the American Society for Quality Control has adopted symbols for these values which are widely accepted in quality control circles. It would seem worthwhile to publish an addendum showing that the author's M'/R_0 is A_2, $b(n)$ is c_2, k_n Is d_2, etc. It is true, however, that the symbols used are more descriptive of the actual statistical process involved but would be very confusing to the quality control man.

In general, I believe that this handbook fulfills its basic purpose and presents a wealth of material and tables in a handy, compact form.

Charles R. Hicks
Asst. Professor of Mathematics and Research Associate in the Statistical Laboratory, Purdue University

Theory of Equations. By C. C. MacDuffee. New York, John Wiley and Sons, Inc., 1954. vii + 120 pages. $3.75.

Professor MacDuffee's text provides an excellent introduction to the theory of equations for the general science student. It is interesting and novel that such a book should introduce, and apply to concrete problems, such concepts as "equivalence relation," "ring," "field," "euclidean ring" and others. In spite of the introduction to abstract algebra the text leans towards the practical side of the subject. The many excellent exercises allow the student to test his skill and .relate the theory to practical problems.

The table of contents reads: -1. Linear Systems. -2. Rational Solutions. -3. Polynomials. -4. Real Roots. -5. Complex Roots. -6. Relations among the Roots. -7. Systems of Higher Degree. Answers to Exercises. Index.

The publishers are to be congratulated on the format of the book. The reviewer found no misprints.

ACKNOWLEDGMENTS

Besides acknowledging with thanks the assistance of the associate editors and business manager, the editor wishes to express appreciation to other persons who have given so freely of their services and have thus made possible the publishing of this issue of the Journal. We are grateful for:

Technical and literary contributions from: R. C. Archibald. E. G. Begle (for the AMS), J. Sutherland Frame, A. J. Goldman, Helen J. McAleer and Mildred Taylor.

Refereeing papers: Abe Gelbart, Harry W. Reddick and Warren V. Shepard.

Book Reviews: Walter R. Baum, Charles R. Hicks and George Leger.

Problems and Solutions: We wish especially to thank Editor Leo Moser and his collaborators for their continued and loyal support of the Problem Department.

Services rendered in typing manuscript: Barbara Hughbanks, Joan Seha and Rets Spaulding.

Final composition of the manuscript for the camera: The careful work of June Hegendorfer and her very able staff.

Financial support from our advertisers: L. G. Balfour Company; Cushing-Malloy, Inc.; Handbook Publishers, Inc.; H. M. Gehman, Secretary-Treasurer of MAA; John Wiley and Sons, Inc.

Finally, we wish to acknowledge receipt of complimentary copies of new publications:

O. U. MATHEMATICS LETTER, Vol. III, Nos. 1 and 2, Sept. and Dec., 1953.

PREPARING A TECHNICAL MANUSCRIPT, McGraw-Hill Book Company, Inc.

PROFESSIONAL OPPORTUNITIES IN MATHEMATICS, 2nd. ed., Jan. 1954, from H. M. Gehman, Secretary-Treasurer, MAA.

THE MATHEMATICS STUDENT JOURNAL (Sponsored by the NCTM), Washington, Vol. 1, No. 1, Feb. 1954.

THEORY OF EQUATIONS, C. C. MacDuffee, 1954, John Wiley and Sons, Inc.

THE TRANSIT OF CHI EPSILON, Fall 1953, Vol. 25, No. 2.

INITIATES, ACADEMIC YEAR 1951 - 1952

(Continued from Vol. 1. No. 5

KENTUCKY ALPHA, University of Kentucky

(Spring, 1952)

Carl Berger
John R. Davis
George Farney
Virginia Hanly
Robert D. Haun, Jr.
Richard Sprague

INITIATES, ACADEMIC YEAR 1952 - 1953

(Continued from Vol. 1, No. 5

ALABAMA BETA, Alabama Polytechnic Institute

Charter members who were already members of the Fraternity at the time the Chapter was installed, April 21, 1953:

J. C. Eaves
Ernest Ikenberry
Nathaniel Macon
E. P. Miles, Jr.
B. E. Mitchell
W. V. Parker

Other students elected to the Auburn Mathematics Club since the time of the petition and initiated into Pi Mu Epsilon, Spring, 1953:

Am Alvord
Warren Andrews
H. B. Armitage
R. M. Arthur
Claire Aucoin
Clayton Aucoin
Frank Barker
Howard Barringer
Clare Ann Campbell
Carolyn Cosby
J. C. Dowdle
M. M. Duncan
Paul Gallier
Henry Hartsfield
John Herron
M. L. Hicks
Marjorie Higgins
Johnny Johnson
H. W. Kelley
Darwin Kilbourn
Dale Koehler
Parker Lamb
John C. Lampkin
Doris Jeanne Lindsey
June Long
Alfred Matthews
R. B. McMillan
Irene Pace
John S. Parke
Emily Ann Parker
George Sarinoperilos
Nettie Maye Staggers
Alex Taylor
Carl David Todd
Arvid Wahlquist
Jim Watson
Porter Webster
W. H. Whitaker
Paul Williams

CALIFORNIA ALPHA, University of California, Los Angeles

(January 9, 1953)

Afton H. Cayford
John W. Lindsay
Masako Oba
Robert R. Phelps
Dana E. Quade
Wilbur K. Sepetoski
Roger Haines Skinner
Jess Richard Westlake

NEW YORK ALPHA, Syracuse University

'December 1952)

Walter R. Baum
Norbert Bischof
Richard H. Bruns
John D. Chase
Helene Cooper
Robert E. Downing
Virginia Feldmann
George Finkbeiner
Robert I. Gray
Patricia R. Hansell
Fritz J. Hemmer
Cnarles A. Johnson
Sally A. Keller
Paul A. Kenline
Warren A. Lombard
Robert A. Mack
Alfred U. MacRae
Thomas E. Manwarren
George L. Mulfinger
Ira Nemeroff
Victor J. Pietrafesa
Frank A. Raymond
Joseph E. Rizzo, Jr.
Herbert M. Schoen
Charles W. Serby
Joyce E. Shorin
Harold Siegel
Emmanuel Stern
William F. Terrell
Rolf L. Thorkildsen
John H. Van De Walker
Clarence Vanselow
Ralph S. Wiegand, Jr.

NEW YORK THETA, Cornell University

(May 22, 1953)

Norman N. Axelrod
Douglas P. Baird
Robert M. Blumenthal
John W. Brace
Chao K. Chow
Miidren Cohen
Leonard Evens
Janet Fowler
Mary Anne Friederich
Marcia L. Goldberg
Tema Hasnas
Raquel Heller
David Hertzig
Daniel J. Kleitman
David Lubell
Elliot Mendelson
Jean-Pierre Meyer
Norman Morse
Steven Orey
Jack Peretz
Joel D. Pincus
Filomena Reyes
Jerome Sacks
Harvey M. Schein
David E. Schroer
Stanley Siegleman
Charles Standish
Norman B. Stein
Gilbert A. Stengle
Roberta Torrance
R. J. Walker
Steven Weinberg
Berhard Weisblum
Jacob Wolfowitz

NORTH CAROLINA ALPHA, Duke University

(December 10, 1952)

Joan Corgett
Francis P. Knowles

(We regret that the above two names were received by the Editor after Number Nine of the Journal went to press.)

INITIATES, ACADEMIC YEAR 1953 • 1954

ALABAMA BETA, Alabama Polytechnic Institute

(January 26, 1954)

Denis Harold Alcock
Eleanor Allison
Newton Steele Andrews
Elizabeth R. Barnhart
Robert Clothier
Gerald Cunningham
Anna Jane Gritz
Nolan Hardin
James Hinton
Miriam Horton
Ho Kang Liu
Robert Lowder
James Lowry
John E. Rives
George Sarinopoulos

COLORADO BETA, University of Denver

(November 18, 1953

Marvin F. Anderson
Sarah Gorelick
Bill Yuen Lee
Thayer Masoner

DISTRICT OF COLUMBIA ALPHA. Howard University

(November 30, 1953

Harriett Elizabeth Gregg
William Harrell Smith
James Sunnie Winbush

ILLINOIS ALPHA, University of Illinois

(December 10, 1953'

Donald Ray Arnold
Algirdas A. Avizionis
Donald Lester Bitzer
Ernest William Carperos
Phil Ramon DeProtino
Luella Seyer Dickhaut
Allen Dana Harper
Russell Harold Hopps
Eugene Lyle Hubbard
Richard Jay Kenyon
Raymond F. Kramer, Jr.
Herbert W. Kuchne
Edward Kung
Sager Daryl Larson
William Lichtenberger
Clifford Allan Long
Charles Leo McDonough
Benjamin H. McLemore
James Blaney Rice
Kenneth Rose
Lily Hannah Seshu
Sundaram Seshu
John H. Strathman
Tommy Stanley Ullom
Porter J. Womeldorff
Keith A. Yarborough

MICHIGAN ALPHA, Michigan Slate College

(October 20, 1953'

William M. Crampton
Julian A. Crawford
John R. Davis
Arden D. Day
Cecil O. Etter
M. Paul Hagelberg
Douglas J. Harvey
Clyde M. Hyde
Gerald W. Isaacs
Leo Jedynak
Robert M. Jones
George I. Kingsley
E. Louis LeBay
John J. Lenosky
John S. Perry
Marjorie A. Premo
Richard D. Verheul

MISSOURI ALPHA, University of Missouri

(December 9, 1953'

Rex Miller Barnes
John Dwight Bentley
Kenneth Wilbur Campen
Thomas Marshall Carter
Franklin Voris Engle
Clayton Wayne Freear
Virginia Ann Froerer
Eugene Kent Johnson
Jimmy Gordon Karoh
Marvin B. Kaufman
Michael F, McDonald
Merril Eugene Neal
David Lee Ohsiek
James Deane Patterson
Charles B. Philibert
Frank J. Pike

MONTANA ALPHA, Montana State University

(Spring, 1954)

Ralph Bingham
John Blackwood
John Frankino
Albert Gilman
Charles Grunn
Noel H. Johnson
William Lien
Edward Overturf
John Maruin
Frank Mentala
Robert McRae
Sheldon Rio
Gertrude Stene

NEW HAMPSHIRE ALPHA, University of New Hampshire

(December 7, 1953)

Laurence **Baldi**
Edward Ralph Brooks
Patrick Thomas Cahill
Arthur R. Calawa
Charles Edwin Campbell
John C. Chadbourne
Robert F. Church
Ronald Rogers Clark
Constance M. Foley
Robert R. Garipay
Gunnar **Heskestad**
Wayne **Olin Jackson**
Wendell **Jesseman**
Nicolas Johnson
Evelyn Jones
Paul R. Josephson
Chris D. **Kehas**
Donald Shaw Kelly
Wayne **Overman**
Charles H. Snow
Ralph **Stajdohar**
Donald **Penn** Varney

NEW YORK ALPHA, Syracuse University

(February 12, 1954)

Everett **E.** Aldrige
Donald Austin
Andrew A. Benvenuto
Eduard **J.** Ballard
Albert Dewey, **Jr.**
Olga J. Guarini
Simon Hellerstein
James E. **Hennessy**
Richard I. Hirshberg
Robert J. Holbrook
Leo F. Johnson
Walter W. Jones
Henry **J.** Juda
John F. Jureller
Ronald H. **Kanner**
James A. Kennedy
Robert A. **Kurtz**
Wylan A. Liddle
George L. Luther
Donald R. **MacRae**
Myron L. Moffitt
Stanley A. **Mosier**
Albert A. **Mullin**
Florence **Oglebay**
John W. Schaefer
Richard **Seikaly**
Rou F. Shortt
Kelvin C. Smith
Vonda **J. Stratton**
Reinhold E. Tomek
Robert **J.** Wallis
Charles **J. Zablocki**

NEW **YORK** BETA, Hunter College

(October 27, 1953)

Sandra Biderman
Lucille Chang
Rhoda Davis
Frances **Goldman**
Blanche **Kaye**
Jean **Lenz**
Danuta Milford
Rivkah Molotin
Lorraine Nayer

NEW YORK GAMMA, Brooklyn College

(Fall, 1953)

Edmund **Eisenberg**
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