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TO BEGIN TO LIVE

Tragedy does not have to have an unhappy outcome, but in the company of educated men, to recognize that life is tragedy is to begin to live

Dean John E. Burchard
Massachusetts Institute of Technology

My title comes from a half remembered and since unverified statement by the poet Yeats. As I recall it, this reads: "To recognize that life is tragedy is to begin to live." I shall talk about some of the elements of tragedy in one particular world, the world of the company of educated men.

This is not a world which is somber; indeed, it is a world of great gratifications. It contains comedy as well as tragedy and much of the time neither. But it does contain tragedy and to begin to recognize it is not inappropriate for you at this moment.

Our world, especially our Western world, particularly our American world, has the bad habit of debasing its verbal coinage. We use words with special meanings, first in metaphorical and soon in literal ways, so that their special meanings are twisted or destroyed. We overuse our superlatives so that our world is one in which it is hard to suggest that something is really large or really fine or actually unique. We treat the word "genius" lightly and apply it to the merely talented. And so we have done with the word "tragedy." We speak of tragic events which are merely unhappy events. They are not the same thing. Tragedy does not necessarily even have an unhappy outcome.

Different races have made the ultimate definition of tragedy in different terms. Most of you will recall, I hope, that the terms of Shakespeare were not those of Sophocles, will realize that the terms of today are likely to be still different. But it has always been clear that to rise to the dignity of

*Reprinted by permission from The Technology Review, November 1956, edited at the Massachusetts Institute of Technology.

tragedy the event, or better the sequence of events, the situation, or better the combination of situations, must have a certain scale--that, as the dictionary would remind you, tragedy must be serious, complete, and of a certain magnitude.

Such possibilities did rest in the dilemmas of Orestes, of Oedipus, of Othello, of Lear. The outcome need not always be unhappy but there is certain to be bitterness along the way. The death of Antigone was not necessarily tragic though the result for Creon was clearly so; yet both endured the tragedy. The death of Socrates was tragedy for those who killed him, but not for Socrates. Orestes escaped the pursuit of the Angry Ones in the end; yet the pursuit had been there. So to talk as much of tragedy as I am going to do today does not imply that doom is inevitable but only that it is possible. It cannot fail to imply, however, that even if doom is averted there will nonetheless have been some tragedy in the process of averting it.

We are thus not to construe the proverb of Yeats in the sense of those personal bereavements, accidents, and frustrations that each of us must suffer on his way through life. As we come to understand these and bear with them, we do of course sharpen our character and our preparation for other and perhaps greater trials. But at this level prosperity may be more dangerous for us than adversity as many soothsayers have reminded us. Indeed, it has always been remarkable what fortitude people can show when personal adversity is all that is encountered. Many of us are more craven in anticipation of trouble than we are in its realization. Fewer still of us can stand success.

But I mean to propose a larger tragedy and one which must somehow be encountered by you; one which, if you encounter it bravely and wisely, will offer you the beginning of life as Yeats proposes it.

This is the tragedy of the educated man, or, better, the tragedy of the company of educated men. In absolute numbers this company is substantial; in proportion to the company of all men it is tiny. It is a large enough company so that its collective experience can reach to the heights or depths of tragedy; it is small enough so that its relations with the entire group of human beings can bring tragedy and disaster upon it; it is important enough, too, so that if these relations

break asunder, disaster, if not tragedy, can also come to the noneducated group. This is the tragedy of which I wish to mention six aspects.

You do not yet quite belong to the company of educated men. But every action you have taken up to now indicates that you aspire to belong to it. You have gone through a considerable number of preliminaries. The door through which you pass tomorrow is one of the many doors along the corridors toward the company of the educated. You have passed several already. There are several more ahead of you.

Indeed, it is one of the puzzles of belonging to the company of educated men that you can never in an absolute sense be quite sure you do belong. For you as an individual there will always be another door, still closed, leading to still another, still more secret, room. If as an individual you ever cease to perceive that there is another such door, it is even probable that you will then cease to belong in the company of educated men.

There is also a puzzle for each of us in the choosing of the corridors and the doors. On the one hand we may choose doors which lead into ever larger and larger rooms, where the scale of the chamber obscures the detail of the parts so that we perceive ever more dimly what is in each room we have entered; and there are doors which lead down narrower and narrower corridors into smaller and smaller rooms, more and more precise in their contents. How simple life would be if this last were the only right way, if in the final <u>naos</u> we could find the one simple and completely discernible thing which could be known as the ultimate truth or at least all we would ever need to know! But things do not work that way. There is no reason to think that the ultimate and the whole will lie in one single clear truth obtained by an assiduous and persistent walk through the ever-narrowing corridors of the single idea. By this process we do become expert in something. Unless we are reasonably expert in something we cannot expect to be maximum citizens of the modern world. But no subject we can elect to pursue to this degree of refinement will yield us all the ultimate truth nor will we find in the final <u>naos</u> much to help us with all the other problems of our lives or, more importantly, of the life of the world.

On the other hand if we choose just to move into the wider and wider rooms, there is a good chance that our thinking and our observations will become so vague that we cannot be said to have educated perceptions at all. Suddenly when we throw open the largest and most brilliantly decorated door of all, we may find not another chamber but rather that we have fallen outside the temple of the educated altogether.

It may be impossible for you to conjecture a physical performance which would let you walk through both the narrow and the wide corridors, those with the converging walls and those with the diverging; but in the metaphorical performance you are doomed to just such an effort. The two easy ways out are to specialize to the point where nobody else understands you and then the walls of the ultimate naos will be so close they stifle you, and the space they enclose so trivial that no one will miss you; or you may refuse to specialize at all and thus evaporate into the fog. Each of you will seek his own compromise in this difficult set of choices. It is the first aspect of the tragedy of the educated world that there is literally no one who can tell you until after the event, and perhaps not then, whether the choices you make are wise or foolish.

I was not speaking lightly when I said you were not yet really educated. But at some point and long before you have satisfied yourself that you belong in the company of educated men you will actually have been accepted into this company. That day is not yet, of course. The most the ceremonies of the next days proclaim is that by your actions thus far you have proved promising squires. Many vigils are before you and the guerdon of knighthood is not yet to be laid upon you.

You may never know when it has actually been placed on you, though you will probably be aware of the vigils. For you may become a member of the company of educated men without ever studying another course formally in your whole life; and you may work for and succeedin gaining a doctoral degree without earning inclusion in the company of the educated. At the moment you probably have a clearer inkling of the **kind** of discipline that must be self-imposed if you seek the company of the educated through graduate study than if you seek it in life. But in fundamentals the discipline is exactly the same.

What this means for the scholar was eloquently defined by Mark van Doren in an address at the First Bicentennial Convocation of Columbia University. As I read this, try to think in other contexts, and of how what he is saying for the scholar

is also true of the man of affairs or of any other member of the company of educated men. Of the scholar, van Doren said that he was always busy, "with scarcely the time to pause and tell us, should we ask, how much he knows; and more particularly, how much of what he knows.

"To the extent that he is a true scholar he will contemplate this question of the what, and seriously ask it of himself. Is he studying the right thing?--which means, for true scholars, the most difficult, the most hidden; the most abstract, the most inaccesible thing. Has he been content thus far with fields of ignorance that others have defined? Has he discovered any for himself? And if he has, is it the farthest field, beyond whose fences, conceivably, the simple truth sits looking at itself? Often this farthest field seems nearest to the uninitiated mind, which asks elementary questions about it: What is it, after all? Why are you studying it? What would it mean to know what you say you want to know? Is it important? What difference will it make? Or, in a more friendly voice, even an eager one: What is electricity? What is life? What is poetry? Can history be true, and if so, what history is most true? Is there such a thing as human nature, and does it grow? What is government? What is law? What is money? What are the stars, and why is there so much space between them? Where is God? And if man knew everything, would he be God?"*

Many of you, indeed perhaps most of you, are not even going to try to be scholars in this high sense; some of you will even secede altogether from the company of educated men. But if you are to remain in that company it is important that you ponder such matters even if your task in life may seem to be utterly pragmatic and possibly even routine and pedestrian. For it is the second aspect of the tragedy of the company of educated men that so many who started to be in that company, and who still deem themselves to be so, do not really understand that scholars must think in these terms, that they must continue to question even those truths held by their fellows to be most self-evident, in fact, that these are perhaps the truths that need most to be questioned. Thus the company of educated men is often divided and the scholarly group is left unsupported in time of trial by many of the once educated.

*Mark van Doren, "The Kinds of Knowledge," The American Scholar, 24: 412 (Autumn, 1955, No. 4).

You will be able to remember enough examples from recent American history so that I need not weigh this point down with detail. It is particularly important then for those of you, probably the most of you, who will move to affairs and practical matters never to forget this. Through your work you will do much good in the world. But you must always remember what belonging to the company of educated men implies even for those who in their daily life seem formally to have abandoned it but really have not. They will ask comparable questions about their job and their other activities and they will support with steadfast understanding the company of educated men against the misunderstandings of the rest of the world.

For it is the third aspect of the tragedy of the company of educated men that it is not really loved or admired by the world around it. Learning is not admired for its own sake in very many quarters, and never has been. Scientists and technologists admittedly are in short supply but not because the world as a whole is anxious that there should be more science. The world as a whole is afraid, and does covet the offsetting protections that it entrusts to military technology; and this is the main reason you are so much wanted. At a lower level of intensity, but still seriously, it covets the labor-saving or amusing devices that come from technology so that for this too you are indispensable and sought out. But it does not on the whole admire you just because you have been trained to seek the truth wherever this may lead you, however much it may challenge long-cherished myths. Indeed, it is this potential in you which it fears.

The greatest boon you and your technological colleagues could contribute to the world (and it is not impossible that you can contribute it) is a development in which there need no longer be bickering for a distribution of an inadequate food supply or an inadequate supply of various mineral resources or of anything else which makes it possible to provide health and a high level of physical welfare for everyone in the world, not just for a small portion of the population of the world living mostly in the Western Hemisphere. It is not certain that this provision together with that leisure which can also permit a higher development of other elements of culture will necessarily lead to the abolition of the stupidity of war; but it is probably a necessary condition for such an abolition. Save for the virtue of the search for absolute truth, which is a virtue

that is somewhat mystical and becomes more an article of faith than of proof, this is the largest virtue you can bring to the world; and many of your elder colleagues think it is not impossible that you should bring it. Yet this is not the reason everybody worries about the fact that you are in short supply.

Part of the fault for this misunderstanding no doubt lies with the company of educated men; perhaps the greater part of the fault. We all have been guilty, partly as a matter of personal convenience and partly as a matter of self-esteem, of marking ourselves off from the crowd, of adopting, each for his own field, its own esoteric language. It is hard enough to transfer ideas from one field to another at best; some great physicists contend that today it may be impossible. Modern physics is, for example, dealing with matters which can in no way be explained by an appeal to the language of common sense which is the only language that the common man can expect to know. And besides, as Lewis Mumford has suggested, there are two great facets to a man's life, the Promethean and the Orphic, the technical and the artistic. One is "mainly a struggle with the environment, the other an ideal expression and enjoyment of his own nature."* Each man perhaps has some of each side; each man perhaps has a greater emphasis on one or the other. It has all too often been the sad spectacle, however, that those who were mostly Orphic men felt compelled to assert that Promethean men were of lesser clay while Promethean men on the other hand, well regarded as they were by a pragmatic society, had felt driven to try either to make Orphic men seem absurd or else to pretend with equal folly that Promethean activities were in fact actually Orphic too. There is something aesthetic in the struggle with the physical environment and there is something practical in the effort to make an ideal expression of man's nature, but nothing is gained by the effort of the lovers of one or the other activity to assume for it a higher or more complete place than it needs or deserves. In fact, these quarrels which have been going on for a long time now have simply led general man, or what Ortega y Gasset called mass man, into an innate distrust of both which he shows overtly to the useless Orpheus and only in times of witch-hunts to the useful Prometheus.

In a limited sense there is probably no such thine any more as a unity even of science; it is laboring hard, though many

*Lewis Mumford, The Transformations of Man, page 27 (New York: Harper and Brothers, 1956).

attempt the labor, to try to establish an absolute unity between the creative process involved, say, in the development of a new concept in physics and the writing of a great epic or even sonnet; it becomes almost semantic gabble to talk of an absolute unity of knowledge though scholars spend a lot of time in such discussions.

This unity cannot now rest on details, if it ever could. The degree to which it exists has not been better stated than by James B. Conant when he said, "Men and women studying, thinking, and writing in libraries, research institutes, museums, and universities, as well as the lone scholar, writer, and artist--all have one attribute in common: They are all engaged in a creative activity whose produce each one hopes will have significance for a long period of time. To the degree that a scientist or scholar is dedicated to the advancement of learning as such, his ambition must be to contribute to a long-range human enterprise, not to an immediate undertaking. Indeed, the ambition of all those to whom I am refering is summed up in the famous words of John Milton, when he wrote of his desire 'to leave something so written to aftertimes as they should not willingly let it die.'"*

It is a fourth element of the tragedy of the company of educated men that they have so often forgotten this principle. Harassed by their inability to comprehend the details of another kind of scholarship or by their lack of personal interest in these details, they have consoled themselves by declaring that the other things were unimportant. It has been in that way from time to time that the mass men have destroyed parts of what Conant calls "the Citadel of Learning."

But this only points the way to the next aspect of the tragedy, that of the difficulty of communication between the company of educated men and the larger company of mass men who do not seek this communication very much. The communication will not be established by exhortation. Its lack will not be atoned for by giving up. It cannot rely in any large way on educational broadcasting or television. Last Sunday [June 3] Boston television viewers were deprived of a careful account of the St. Lawrence Waterway because a baseball game dragged on. But most of them were more content with what they saw, and would have been bored and angry with the alternative. Yet it will hardlv serve to have an elite of the knowing who have

*James B. Conant, "The Citadel of Learning." Yale Review, XLV:51 (Autumn, 1955, No. 1).

managed in one way or another to do more than tolerate each other and a mass of the unknowing who have their own different code and often their scorn and fear of what can perhaps actually be called a modern sacerdotal group. The problem of how to build a bridge across this gulf is perplexing. Your predecessors have watched the chasm widen, not narrow, while at the same time their efforts to bridge it have been essentially failures. This is the fifth aspect of tragedy of the company to which you have aspired. Most of the time most of us in this company try to forget the chasm by working on things that are familiar; sometimes when our colleagues try more they are scolded by their fellows for abandoning the machine upon which they were skilled workmen and trying to build communication bridges, an art in which no one is skilled. Then when a crisis arises, and we have seen several, we agitate and scream and sometimes almost by sheer force of words throw temporary stagings across. But we have done nothing to produce permanence. There is little reason, for example, why the general public should believe us when we insist that it is for human good, even for the national good, that scholars and scholarly ideas should circulate freely in the world if we have not succeeded in explaining to them why this is so; and the why has to consist of more than an assertion by us that it is so; it probably requires some little experience with actual situations. This we have not found out how to provide.

You who have elected to throw your lot with those who value knowledge have no doubt had many reasons for the choice. A few may have been idealistic and noble, many may have been materialistic and practical. There is no doubt that each of you will be tempted to stay out of the dusty and tiring and often terrifying intergroup fields in which you must deal not with the knowledge and the language of your own educated tribe but with others without this knowledge, without this language, perhaps even with a hostility to the language and to what they presume to be the knowledge; and if not hostility, at least a massive disinterest.

It is easy enough to win rewards of cash and of comfortable physical life and even of some public approval by never sticking your neck out, by adhering to your specialized last, by holding your curiosity in check, most of all by keeping it steadfastly focused on a narrow and relatively familiar objective. You can even feel smug about this and join the wolf pack of those who snarl at the heels of any scholar who wanders too far outside the certificated training for which he boasts degrees. You can be in this sense a useful citizen, a good man by modest definition, perhaps even a happy man. But you will not be a hero.

You will not have grandeur, you will not be a hero, and the world needs heroes more than it needs useful hands. The way of the hero in these matters is hard, tedious, despairing, risky. You may turn out not a hero but a fool. You may turn out not useful but useless. You will be criticized, stoned verbally, and you may not even be happy in your effort. But there is just a chance that you may be one of those who can help to save the company of educated men from a destruction which is more threatening than anyone would like to believe. It is always threatening, of course. There have been Dark Ages before, and there can be again.

And this brings me to the final part of the tragedy that I must mention. There would be no surer way to a Dark Ages than a resumption of mass hostilities such as have plagued the world now for nearly half a century. The physical possibilities in this are well enough known, I would hope, to everyone and surely they are to you. Beyond the weapons of physical destruction there loom those of destruction of the mind. The Dark Ages are even more implicit in the latter than in the former though they are of course potential in either. You need as part of the company of educated men to permit yourself no relaxation in your struggle against such an outcome. You can help as citizens, of course, in keeping your own nation on a prudent path. You can continuously ask what the best ways are to keep other nations on prudent paths. You can continuously wonder whether the proportions of money and attention your country spends on weapons on the one hand and on aid and international education and understanding on the other are realistic proportions. You can work for the idyllic day which is potential in the applications of modern science in which at least the economic reasons for war have become invalid. We have no reason to be certain that Lewis **Mumford** was wrong when he depicted his One World Man, the **suces**sor to Archaic Man, Civilized Man, Axial Man, Mechanized Man, a **man** on whom new forms "dimly emerging in man's unconscious . . . begin to beckon him and hold before him the promise of creativity: a life that will not be at the mercy of chance or fettered to irrelevant necessities. . . .

"In carrying man's self-transformation to this further stage, world culture may bring about a fresh release of spiritual energy that will unveil new potentialities, no more visible in the human self today than radium was in the physical world a century ago, though always present. . . ."*

Yet we are far from this millennium on the technological side, and particularly on the spiritual. It is the final aspect of the tragedy of the company of educated men that it is not a single company. If a war were to begin tomorrow the educated men of the world would be aligned in two camps and each would put all its education at the service of its side. Scientists and technologists would work night and day for weapons; psychologists and poets and painters for persuasions; historians for immediate justifications; philosophers for ultimate justifications; priests would supplicate God from both hordes. We must not think that there would not be educated men and devout men on both sides. The plain fact is, then, that educated men have themselves not found an answer to this major question; and in time of crisis they will, as of now, all behave like mass men.

These are the tragic questions you have brought upon yourselves by electing to join the company of educated men; you will have difficulty all your lives in developing the right balance between your specialized and your general competence and the amount of time you must devote to each; you will perhaps betray the company you once belonged to by not understanding and supporting them in crisis, or if you have remained in the company you will perhaps be betrayed; you will not be loved or admired by society in general for anything except your usefulness as defined by that society, which will not be the definition your company will make; you will forget that others in your company, doing things you do not understand and in which you are not interested, still belong to your company; **you** will struggle and apparently most of the time in vain to communicate with the whole of your company, or you will relax and not try, which is worse; even more you will give up trying or be constantly frustrated in your efforts to pierce the veil of misunderstanding which separates your company from that of men in general and when you are tempted to an heroic effort in this endeavor you will be scolded even by fellows of your own company; worst of all, you will know that

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***Lewis Mumford, _op. cit._, page 249.**

in your company there is a force which can separate you on the instant of a faulty decision by people who may not even be in the company at all, a force which will split the company of educated men asunder, the force of **nationalism.**

These are the elements of your tragedy. As I said at the beginning, tragedy does not have to have an unhappy outcome. But the working out of the outcome whether it be happy or unhappy has some hard stones along the path. Yet when you stand straight in the company of educated men and have confronted these problems bravely, even if not successfully, you will know that you have been in the right company, you will understand that "to recognize that life is tragedy is to begin to live."

* * * * *

"The moving power of mathematical invention is not reasoning but imagination."

— A. DeMorgan

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"If you do not rest on the good foundation of nature, you will labor with little honor and less profit."

— Leonardo Da Vinci

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A GIRL MATHEMATICIAN IN INDUSTRY

Joyce Pickard
Westinghouse Electric Corporation

Most juniors in college feel a touch of panic when they consider the question "What am I going to do for a living?" For engineers and business majors graduating at the present time, this question is modified into the milder problem "For which companies shall I interview?" Similarly, education majors consider "For which schools shall I **interview?"**

Two years ago this June, my own version of the question was "What can a coed math major do besides teach?" Having no education courses or desire to teach, I wondered if I shouldn't have chosen a different major. Since I really wanted to work for industry, perhaps when the new semester rolled around I should transfer to secretarial training. However, my love for math triumphed, and I again filled my schedule with math subjects.

One day a former professor of mine said "Joyce, are you planning on signing up for either of the Illiac courses?" I vaguely remembered hearing about a mathematical machine called Illiac from one of the electrical engineers. After talking to my professor for awhile, I realized that this was no adding machine--at least no ordinary adding machine. It seemed that Illiac performed the triviality of an addition of two numbers in **75** microseconds. I decided to find out more about this machine-to-end-all-mathematicians, and enrolled in the **"Digital** Computers" course the next semester.

Illiac was only one of the machines discussed, although it was stressed because we could use it. The instructor explained that the Illiac is digital because it handles numbers **as** sets of discrete-valued digits, rather than as variable scale readings. It is automatic, since one merely needs tell it how to proceed and starts it, and it will continue automatically through all successive orders until a "stop" order is reached.

Thus any complicated problem can be broken down into a set of arithmetic operations and given to the machine for solution. The occurrence of cycles during a solution makes it possible to set up **"loops"** which are gone through as many times as desired. These loops usually save a tremendous amount of space inside the machine where instructions and numbers are stored.

Now, most companies have recurrent problems which change in analysis very little if at all. **A** set of instructions (a **"code"**) from which the digital computer produces correct answers corresponding to different sets of input numbers, is invaluable to a company which has the problem that the code solves recurring a great many times. Here indeed is a chance for a girl mathematician in industry!

Shortly after graduation day in June, 1955, I started work with these amazing digital computers. At all times a machine has an operator to perform any manual control, and an engineer to take care of preventive as well as "curative" maintenance, so that being a girl is no disadvantage at all. As a matter of fact, I firmly believe that these machines respond readily to a little feminine charm!

In the days of computer-scarcity, my company rented time on computers belonging to other companies in various cities, so that I became a traveling mathematician. I remember with pleasure, for instance, spending six months in Boston, or enjoying scenery on a weekend between Friday's work in New York City and Monday's work in Los Angeles. You see, there **are** other ways to see the world besides joining the Navy.

In general, a woman's salary is lower in the mathematical field than that of a man doing the same work. This is understandable, because the average woman leaves the company after three to four years. However, it is possible for a woman to reach exactly the same position as a man is if she is ambitious and stays with the company over five years. Also, this difference has gradually been changing and will eventually disappear.

Effort is made to analyze dissatisfactions which may be strictly feminine. I remember the complaints of a large office, full of girls only. This was eventually corrected by Â¥desegregatio^{n}n We were transferred to smaller offices, containing at most two men and two women. Usually the occupants of any office are working on one project only.

The general atmosphere of our offices is conducive to concentration; we are in general apart from desk calculators and typewriters. The daily routine consists of working on a "routine" which is part or all of a "code" for the general solution of a problem. One starts with a "flow diagram," which sketches roughly the logical steps leading to the solution; this is known as programming. By this breakdown, a programmer can avoid getting "lost," since he can code part of his problem at a time; also, he can isolate errors more easily when he trys his code on the machine.

Then he writes down the actual list of instructions which will do the job; this is **"coding."**

After programming and coding the problem, a programmer is ready to "sign up for computer time." In general, an installation keeps a "log" to account for the expensive minutes of machine time. Since most coding is done "symbolically," first one uses a coded routine which transforms his own symbolic code into the machine's language. Then this new form of the code is used to solve a test problem with known solution; looking for code errors ("bugs^{w}) is known as "debugging."

Finally comes the big day when all test problems seem to go through all right, and the code is "put into production" for general use.

The following few days usually find the programmer trembling in fear of a visit from a problem requestor who has received results which he feels are wrong, or whose problem won't go through the code at all. However, the error can often be traced to improper input numbers, since a requestor is used to a different form for some other code that he has used.

All in all, this business of computers is a new and exciting field, which has come into its own in the past ten years. Better explore it!

A PARADOX

George R. Sell
Marquette University

One of the favorite problems given on many of the modern IQ tests is to give a set of numbers and ask which of these numbers can be "tossed out." For example, 3 would be tossed out from the set (2,3,4,6,8) because it is the only odd number. Now given the following set (2,5,9,13), which number would you toss out and for what reason?

Answer: One could toss out 2 because it is the only even number, or one could toss out 9 because it is the only non-prime number, or one could toss out 13 because it does not fit in the sequence $A_n - A_{n-1} = 1 + (A_{n-1} - A_{n-2})$. Hence one could toss out either 2, 9 or 13. Therefore one should toss out 5 because it is the only number that cannot be tossed out.

* * * * *

Little Jack Horner sat in a corner

Eating his pie. He said, "Shoot!

I stuck in my thumb, but instead of a plum

I found an irrational root!"

— A. W. Boldyreff

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NEW OFFICERS OF THE FRATERNITY

The new national officers of PI MU EPSILON, elected early this year, are listed below. As is customary, we give also a vita of each. Professor RICHARD V. ANDREE, University of Oklahoma, continues as Secretary-Treasurer- General, an office in which he has performed yeoman service. Professor R. F. GRAESSER, University of Arizona, continues as one of the Councilors-General. Vitas of these gentlemen were published in Volume 2, Number 2, pages 86-88.

DIRECTOR-GENERAL:

JAMES SUTHERLAND FRAME, Professor of Mathematics and Head of the Department of Mathematics, Michigan State University. Native of New York, N. Y., A. B., A.M., Ph. D. Harvard; traveling fellow from Harvard in Göttingen and Zürich; Instr. and Asst. Prof. Brown Univ. ; Chairman Dept. Allegheny College; Prof. and Head Dept. Michigan State 1943 - Inst. for Adv. Study (50-51). Assoc. ed. "Am. Math Monthly" (42-46), "Pi Mu Epsilon Journal" (49-57). Am. Math. Soc., Math. Asn. (Bd. of Governors 50-53) AAUP (Nat. Council 48-50), Mich. Acad. Sci., Arts, Letters, (V.P. 56-57, Pres. elect 57-58). Pi Mu Epsilon (Sec. Treas. Gen. 51-54, V. Dir. Gen. 54-57), Phi Beta Kappa (P. B. K. Associates 56 -), Sigma Xi, Phi Kappa Phi. Representations of finite groups; continued fractions; methods of approximation; trimetric ruler for space drawings.

VICE DIRECTOR-GENERAL:

ORIN FRINK was born in Brooklyn, New York, in 1901. He attended Columbia University for seven years, receiving the A. B., A.M., and Ph. D. degrees, the latter in 1926. In 1925-1926 he was Instructor in Mathematics at Princeton University, and from 1926 to 1928 was National Research Fellow at Princeton and the University of Chicago. From 1928 to the present he has been at Penn State, serving as Head of the Mathematics Department since 1949. At one time he was Problems and Solutions editor of the American Mathematical Monthly. He has written papers in analysis, topology, and abstract algebra, and is especially interested in lattice theory. During World War II he was at Wright Field in Dayton, Ohio, working on application of mathematics to radar and guided missiles.

EDITOR OF THE PI MU EPSILON JOURNAL:

FRANCIS REGAN received his A. B. degree from Indiana State Teachers College, 1922, his LL. B. degree from LaSalle Extension University, 1926, his A. M. from Indiana University, 1930 and his PhD. from the University of Michigan, 1932, where he held a non-teaching University Fellowship. He taught from 1923-25 in high schools in Indiana. From 1925-29 he was professor of commerce at Columbus College, Sioux Falls, S. D. He was assistant professor of mathematics at Colorado A and M, Fort Collins, 1929-30. In the fall of 1932 he became instructor of mathematics at St. Louis University. In 1934 he became assistant professor, in 1939 associate professor and in 1945 professor. During the year 1949-50 he was acting director of the department and in the fall of 1950 he became director of the department, which position he still holds. He has been chairman of the Missouri Section of the Mathematical Association twice. He is a member of Phi Beta Kappa, Sigma Xi and Pi Mu Epsilon. He is a member of the Institute of Mathematical Statistics, the Mathematical Association and the American Mathematical Society. He and his students have papers published in the fields of foundations of probability and analysis.

COUNCILORS-GENERAL:

EMANUEL H. C. HILDEBRANDT: University of Chicago, B. S., 1922; University of Michigan, M. A., 1930; Ph. D., 1932. Head of Mathematics Department, High School, Stevens Point, Wisconsin, 1922-24; Principal of same high school, 1924-28; Instructor, University of Michigan, 1929-31; Assistant Professor of Mathematics, DePauw University, Greencastle, Indiana, 1931-33; Instructor, Brooklyn College, Brooklyn, N. Y., 1933-34; Associate Professor of Mathematics, New Jersey State Teachers College, Montclair, New Jersey, 1934-43; Associate Professor of Mathematics, Northwestern University, 1943- ; Fulbright Professor of Mathematics, Higher Teachers Training College, Baghdad, Iraq, 1956-57.

American Mathematical Society

Mathematical Association of America

- Associate Editor of Monthly, 1939-42
- Member of Board of Governors, 1948-50

National Council of Teachers of Mathematics

- Editor of 18th Yearbook published in 1945
- Member of Board of Directors, 1944-47
- Vice President, 1947-48
- President, 1948-50
- Editor of The Mathematics Teacher, 1950-53

Men's Mathematics Club of Chicago

- President, 1954-55

Central Association of Science and Mathematics Teachers

Pi Mu Epsilon

- Councillor-General, 1942-45
- Vice-Director General, 1945-48
- Secretary-Treasurer General, 1948-51

Kappa Mu Epsilon

Sigma Xi

HARRIET M. GRIFFIN, born in Brooklyn, New York, 1903. Parents: Harry and Madeline (Gully) Griffin. Education: A. B., Hunter College; M. A., Columbia University; Ph. D., New York University. (Special fields of interest, abstract algebra and the theory of numbers; thesis, The Abelian Quasi-Group.) Honors: Phi Beta Kappa, Pi Mu Epsilon (Vice-Director and one of the charter members of the chapter of Pi Mu Epsilon that was established at Hunter College through the good offices of Professor Tomlinson Fort who was Director.), Key-Pin Society of New York University, Sigma Xi. Teacher at Hunter College 1926-1930, Brooklyn College 1930- -- where I am Professor of Mathematics.
Member of the Mathematical Association of America, American Mathematical Society, American Association for the Advancement of Science, Albertus Magnus Guild.
Author of Elementary Theory of Numbers, McGraw-Hill, 1954.

ROBERT LOUIS SAN SOUCI: Born: 30 April 1927, Adams, Massachusetts. Education: Adams High School, Adams, Massachusetts; A. B., University of Massachusetts, 1949; M. A., Univ. of Wisconsin, 1950; Ph. D., University of Wisconsin, 1953. Experience: Instructor in Mathematics, Univ. of Oregon, 1953-1955; Assistant Professor of Mathematics, Univ. of Oregon, 1955-1957. Memberships: Member of the American Mathematical Society, Mathematical Association of America, Sigma Xi, Pi Mu Epsilon, Phi Kappa Phi, reviewing staff for MATHEMATICAL REVIEWS. publications: Several publications in mathematical journals.

BOOK REVIEWS

Scientific French, By W. N. Locke; Scientific German, By G. E. Condoyannis, New York, John Wiley, 1957, $2.25 and $2.50.

These are pocket-size volumes, spirally bound, with good, stiff covers. They describe in concise fashion the structural elements of the language, arranging the discussion in such a way that the development of a reading knowledge of it is facilitated. Practice readings are chosen from scientific material. These handy, appealing books should be of considerable use to the graduate student who is preparing for language exams. In fact, with these and good dictionaries to help him, he ought to be able to learn to read French and German by himself.

It is to be hoped that the publishers will soon produce a similar introduction to scientific Russian.

Topics in Number Theory. By W. J. **LeVeque. Addison-**Wesley Publishing Company, Reading, Massachusetts, 1956, **Vol.** I, x + 198 pp. **,** $5.50; Vol. II, viii + 270 pp., $6.50.

In only a few American universities today is the theory of numbers regarded as a serious branch of mathematics, worthy of more than a passing glance in the training of graduate students. Part of the reason for this unfortunate gap in our training program may have been the lack of a suitable textbook. **"Suitable"** probably involves, among other things, that the book be in English, that it fit roughly the expected training and proficiencies of a beginning graduate student, that it be adequately motivated, and not merely a collection of isolated tricks and puzzles, and finally, that it have contact with the past and future of the student's mathematical training and experience.

In this two-volume work, the author has effectively removed the absence of a suitable textbook as an excuse for the inadequate treatment of number theory. Volume I was written primarily to provide, in a single book, the necessary background for Volume II. It is to the second volume that the

title "Topics in Number Theory" properly belongs; the first volume could more aptly be called "An Introduction to Number Theory" or something of the sort. Since the separate volumes each attempt different things, it will be best to take them up separately after a few remarks on the points of style that are common to both.

The book has been made as readable as possible, considering the difficulty of some of the subjects treated. When there are difficulties the author takes pains to point out what they are. He takes the trouble to preface a formal proof or definition by a crude heuristic discussion, a general theorem by a simple example, and so on. For instance, in the chapter on Dirichlet's theorem on the existence of primes in arithmetic progressions, he first proves that there are infinitely many primes of the form $4k + 1$ by the method used in the general case. In other words, he recognizes the reader's need to know where he is going, and why. Unfortunately, this kind of clarity is often achieved only at the expense of elegance. Indeed, the exposition occasionally becomes tedious, and the reader may find himself longing for a sample from the forbidden bag of tricks.

Volume I is a completely successful textbook in elementary number theory. Except for the geometry of numbers, all of the standard elementary topics are taken up. As a matter of fact, there is undoubtedly too much material here for a single semester, but there should be no troublein cutting it down to fit. The motivation is excellent throughout, particularly in the last chapter, where continued fractions arise naturally from the problem of "best" approximation to real numbers. This is in contrast to the usual procedure of introducing continued fractions arbitrarily, leaving the discovery of their use in approximation problems as the last in a series of happy accidents.

The first volume should be an excellent textbook for just about any first graduate or advanced undergraduate course in number theory, but the teacher who decides to use Volume II as a continuation may often find himself at odds with the author's selection of topics, and it is probably safe to say that the specialist in number theory giving such a second course will rely on this volume as only one of a number of sources.

The first chapter contains a treatment of binary quadratic forms, using principally the geometry of the complex plane under the action of the group of unimodular bilinear transformations. In the second chapter, the author goes into some of the fundamentals of algebraic number theory. The subject is pursued further in the third chapter, where it is applied to Diophantine equations, particularly to the famous Fermat equation $x^n + y^n = z^n$.

The four remaining chapters are each essentially concerned with a famous and important theorem. Chapter four is devoted to the Thue-Siegel-Roth theorem on the approximation of algebraic numbers by rationals. The author here gives his own extension to algebraic number fields. Chapter five is on irrational and transcendental numbers. A theorem of Mahler is used to prove that π and e are transcendental, and the last half of the chapter is given to a proof of the Hilbert-Gelfond-Schneider theorem. Chapter six gives the previously mentioned Dirichlet theorem, and the last chapter is principally devoted to a standard function-theoretic proof of the Prime Number Theorem.

Thus, there is no mention of the Hardy-Littlewood method, of automorphic functions, of Schnirelman density, of partitions, and so on. It would be hard to explain the absence of these topics, as the author seems to suggest in his preface, on the grounds that the methods and results are of little importance. Within the limitations of its subject matter, though, the second volume does fill the need for a suitable text. The need now is for an appropriate third volume.

L. A. Rubel
Institute for Advanced Study

Nonparametric Methods in Statistics. By D. A. S. Fraser, John Wiley and Sons, New York, 1957. x + 299 pp., $8.50.

This is a systematic treatment of statistical methods applicable to inference problems for which the family of possible probability measures is large. These methods are to be contrasted with those based on some very special family, for example, the normal family. Here, many of the results that have been obtained in nonparametric statistical theory during recent years appear in a book for the first time.

The first two chapters, comprising about forty percent of the book, review some of the fundamental ideas and methods of mathematical statistics. Conditional probabilities and expectations are defined with the use of the Radon-Nikodym theorem. The notions of sufficiency and completeness are introduced and are used repeatedly in the development of the theory. The general decision problem is outlined. The areas of estimation, testing hypotheses, confidence regions, and tolerance regions, are surveyed. The emphasis is on general methods and ideas. Optimum procedures for a number of common parametric problems are obtained in order to illustrate the theory. Succeeding chapters contain applications to nonparametric problems.

Titles of the remaining chapters of the book are as follows: Nonparametric Problems, The Estimation of Real Parameters and Tolerance Regions, The Theory of Hypothesis Testing, Limiting Distributions, Large-Sample Properties of Tests. The section on estimation is chiefly devoted to methodsfor obtaining uniformly minimum risk unbiased estimates. The chapter on testing hypotheses concentrates on uniformly most powerful tests or, where these do not exist, on best similar tests, best unbiased tests, best invariant tests, locally most powerful tests, and the like. Most of the well known nonparametric tests are mentioned in this chapter or in the problem section at the end of the chapter. The chapter on limiting distributions summarizes results needed in the last chapter. Some of these results--for example, the classical forms of the central limit theorem--are widely known. Other results, less well known, have been developed primarily for use in connection with nonparametric procedures. The last chapter discusses methods for comparing the relative efficiency of two sequences of tests. These results suggest that certain nonparametric tests are nearly as efficient as the best parametric tests when the latter are applicable provided that the sample size is not too small.

References and problems are given at the end of each chapter. A total of about 150 problems are given, most of which involve application of the theory to special cases. Most of the problems are of excellent quality and altogether they comprise one of the most valuable features of the book.

As the author suggests, this book may well be used as a text for two types of courses. The first two chapters may be used in connection with a second course in mathematical statistics surveying recent small sample methods. The remainder of the book is suitable for use in connection with a graduate course in nonparametric methods. This book will also prove to be of considerable value as a reference to a rapidly developing branch of mathematical statistics.

This book contains a number of typographical and other minor errors most of which are easily spotted and some of which are amusing. The same problem appears twice on the same page (see 26 and 31 on page 33). A paper of the author which appeared in the Canadian Journal of Mathematics is referred to on three different occasions. Twice the reader is referred to the 1953 volume; once he is referred to the 1955 volume. But where is it? The reader will find his patience rewarded when he discovers the paper in the 1954 volume.

D. L. **Burkholder**
University of Illinois

Vector Analysis. By Homer E. **Newell,** Jr. New York, **McGraw-Hill** Book Company, Inc., 1955. xi + 216 pp. $5.50.

A really satisfactory preparation for an understanding of much of vector analysis would include the equivalent of a good course in advanced calculus. Then, for example, a more rigorous **"proof"** of Stokes' theorem could be given than what usually appears in texts on vector analysis. Since it is not generally feasible to require of students the preparation suggested above, many authors attempt to develop the necessary mathematics as needed. Where the details become involved arguments are often used which are based on plausibility and intuition.

The author of the book under review clearly recognizes this problem of a lack of an adequate background, and he has tried to remedy the situation by what is intended to be a more careful attention to the mathematical formulation. "...the **mathematics,"** he states in the preface, "enriched with physical meaning becomes easier to remember and to manipulate, and applications become more apparent." Such a development will in part, the author believes, "...get the student to think in terms of **vectors,"** which in turn will alleviate the tendency that "...many students who have been exposed to a course in vector analysis, once released from the discipline of the course, fail to apply vector techniques even where the benefits are most obvious."

This reviewer is not convinced that the author has succeeded in this endeavor, at least not with much of the material

in its present form. "It is the intent of this text," the author continues, "to develop the algebra and calculus of vectors in the way in which the physicist and engineer will want to use them." However, vectors in general coordinates are not introduced until chapter 7; rectangular coordinates are used until then, in spite of the fact that, for instance, the electrostatic field intensity of a point charge is most easily represented with spherical coordinates.

The treatment of scalars and vectors in chapter 1 could be improved considerably in this reviewer's opinion. For example, it seems more appropriate to define right- and left-handed sets of vectors using the vector product rather than employing the former in the definition of the latter. The author does point out two items usually omitted: the first, **"magnitude** and direction alone do not make a vector quantity," found on page 6, and the second, "the vector product is not associative," on page 19.

Chapter 2 is entitled, "A review of some mathematical concepts." The discussion is in much more detail than that usually found in vector analysis texts. Two criticisms are in order: (1) the usefulness of the text as a reference or for self study is considerably decreased by the frequent practice of leaving the definitions of important expressions to be formulated as exercises, and (2) the proof of a theorem important enough to be indicated as such (page 45) should not be left to the student. Either a proof should be given or a plausible argument stated which is supported by an appropriate reference.

Chapters 3 and 4 are concerned with vector calculus. Divergence and curl are introduced as they should be, independently of a coordinate system, as is the gradient, although belatedly. A student referring to the book for the definition of divergence (page 56) might be led to believe that ΔV was restricted to parallelepipeds unless by chance he read the last paragraph of the following section. Also it may be difficult for the student in these chapters as well as in others to distinguish arguments supposedly rigorous from those based on intuition.

Chapters 5 and 6 include a lengthy discussion of the operator ∇. While the notation is convenient, the value of much of this development seems questionable to this reviewer. For example, the **following symbols** clearly require **careful definitions** by the author: $\int \vec{ds}$, $\int \phi \vec{ds}$, $\int \operatorname{grad} \phi \, dv$, $\int \vec{ds} \times \vec{A}$. Part I concludes with a general discussion of vector fields and potential theory in chapter 8.

Part II is devoted to applications, principally to motions in space and to electromagnetic theory. It is difficult to evaluate such brief sketches in view of the trouble many students usually have with full length texts on the same subjects.

Answers are included for most of the problems in Part I, although the answers to all problems involving the formulation of definitions are unfortunately omitted.

In view of the above and other similar observations, this reviewer concludes that the usefulness of the book as a text is limited.

D. D. **Aufenkamp**
University of Illinois

Modern Trigonometry. By John C. Brixey and Richard V. Andree. New York, Holt, 1955. xii + 210 pp., $3.50.

Modern Trigonometry by John C. Brixey and Richard V. Andree is a well-organized text intended for the modern student of trigonometry. The authors have written the book mainly to prepare the student for more advanced mathematics. They realize, for example, that "the numerical solution of triangles is only a minor section of a course in modern trigonometry. ··

On the whole, the authors have succeeded in writing a new and useful text in trigonometry. In their development they give a brief but substantial review of algebra and then go into trigonometric functions, exponents, logarithms, the graphing of functions, identities, polar coordinates, complex numbers, and De **Moivre's** Theorem. The book concludes with a chapter dealing with miscellaneous subjects such as congruences, the Moebius strip, and an introduction to a finite geometry. The purpose of concluding in this way is to inspire the more able students to expand their knowledge of mathematics by studying these topics.

The development of each chapter consists of various explanatory paragraphs, exercises which include problems from many allied fields, and a self-test at the end. The self-test is designed to be a good review of the chapter as well as a reliable test of **one's** knowledge of it.

The theoretical development centers around numerous **well-**chosen examples. Because of this there may be a loss of generality, but any such loss is well compensated for by the lucidity resulting from the direct applications of the theory.

One point on which the authors seem a little formal is the notion of a function and its domain of definition. I do not think that a student who does not already possess the concept of a function will be much illumined by **this** discussion. It would have been good for the authors to use some analogy with experience at this point, and then explain that a function is like a rule, that is, "Do this!" However, a rule may apply only to certain individuals. **Then** bring in the notion of a domain of definition.

Without exception, the authors are very precise with their definitions and the development of the theory. Another good point that is stressed is the importance of proper care in making approximate computations. A final point is that the rather extensive bibliography at the end of the book will be of value not only to the student but to the teacher as well.

George Roger Sell
Marquette University

The Theory of Functions of Real Variables (Second Edition). By L. M. Graves. International Series in Pure and Applied Mathematics. New York, **McGraw-Hill,** 1956. 12 + 375 pp. $7.50.

This is the second edition of Professor Graves' book of the same title which first appeared in 1946. The second edition differs from the first one in that some proofs have been simplified, a few minor corrections have been made, and two new chapters have been added to increase the scope of the book.

In the Introduction the author states that the purposes of the book are to provide a survey of the field of analysis from its foundations, to review the fundamental concepts and theorems of the calculus from a rigorous point of view, and to acquaint the reader with the theorems and methods whichhave proved most useful for research in analysis. This herculean task is accomplished by omitting many proofs and relegating several of the less difficult results to the exercises. This may occasion slow reading at times, but the reader, if he so desires, can seek help in the many references to the literature the author has conveniently provided at the end of each chapter.

The book has been divided into fourteen chapters. Chapter I includes a brief discussion of the logical notions of negation, conjunction, alternation, variables, universal quantifiers, and existential quantifiers. We are told what operations are permissible with these entities and what symbols will be used to represent them. The set-theoretic notions of union, intersection, and inclusion are presented and some examples are given to demonstrate the technique of translating ordinary sentences into the symbolism which has been introduced.

Chapter II discusses the way in which the real numbers can be rigorously constructed from the positive integers by way of the rationals and **Dedekind's** theory of cuts. Throughout, the author points out what properties of the various systems are required to obtain the desired results. In this way the reader is introduced to the ideas of linearly and well ordered sets, groups, semi-groups, and ordered fields. This chapter includes an outline of the proof of the important algebraic theorem: All complete ordered fields are algebraically isomorphic to the real number system.

Chapter **III** deals with point sets in Euclidean spaces and how some can be classified according to their topological and structural properties. Included are precise discussions of the Bolzano-Weierstrass theorem and the **Heine-Borel** theorem. Chapters IV and V are concerned primarily with real valued functions. The former presents a discussion of certain classes of these functions (**e.g.** the continuous and semi-continuous functions) and most of the important concepts which are related to them (such as upper and lower bounds and right and left hand limits). The latter provides a thorough study of the differential properties of real valued functions. Included in this chapter is the extended mean value theorem of the differential calculus in one and higher dimensions. The results are applied to evaluating certain indeterminate forms.

Following a concise treatment of the theory of **Riemann** integration given in Chapter VI, the important notion of uniform convergence is introduced in Chapter VII. There it is clearly shown that this notion is relevant to the study of those situations where there occur interchanges in limiting operations, in particular, to the study of integrals which contain an arbitrary parameter, double integrals, and infinite series.

The chapter also introduces the method developed by **Baire** for classifying certain functions, and presents some of the important facts which are known about the class of all continuous functions which are defined on a subset of an n-dimensional Euclidean space. **Dini's** uniform convergence theorem, **Weierstrass's** approximation theorem and Ascoli's compactness theorem are treated in this function space setting.

The contents of Chapters **VIII** and IX are not often found in a book on real variables, though few would deny the importance of implicit function theory and fixed point theorems (Chapter VIII) or the existence of solutions to ordinary differential equations (Chapter IX).

The next three chapters, containing 124 pages, cover quite adequately the theory of Lebesgue measure and integration. Included are most of the basic results on convergence, multiple Lebesgue integrals, the Lebesgue classes L_p, and Lebesgue-Stieltjes integrals. Also a brief glimpse of linear vector space concepts is provided by the **Riesz** Representation Theorem for linear functionals on the space of continuous functions.

Chapter XIII deals with the set-theoretic topics of cardinal and ordinal numbers. The algebraic operations of addition, multiplication and exponentiation are defined for these numbers. Several properties of these operations are proved by use of the Axiom of Choice, or by the axioms of Zermelo and Zorn which are shown to be equivalent to it. In Chapter XIV the important concept of a metric space is discussed and several examples of this type of space are given. It is also shown that many results of an analytical nature follow rather easily from arguments which employ the Axiom of Choice or the results from the general theory of metric spaces.

In conclusion, this reviewer feels that the text provides an excellent introduction to the theory of real variables. The addition of two new chapters (Chapters XIII and XIV) has greatly enhanced the book's value over the first edition as an introduction to real variable analysis.

K. S. **Kretschmer**

BOOKS RECEIVED FOR REVIEW

Beckenbach, E. F. (Editor): Modern Mathematics for the Engineer, New York, McGraw-Hill, 1956.

Brand, Louis: Vector Analysis, New York, John Wiley, 1957, $6.00.

Churchman, C. W., Ackoff, R. L., and Arnoff, E. L.: Introduction to Operations Research, New York, John Wiley, 1957, $12.00.

Davis, H. T. (Editor): Studies in Differential Equations, Evanston, Ill., Northwestern University Press, 1956, $1.75.

Thrall, R. M., and Tornheim, L., Vector Spaces and Matrices, New York, John Wiley, 1957, $6.75.

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Note: Offers from our readers to review these books or books previously listed will be appreciated. The reviewer retains the book as reward for his efforts. Requests should be addressed to FRANZ E. HOHN, 374 MATHEMATICS BUILDING, UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS.

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

93. Proposed by Michael J. Pascual, Siena College

Derive a formula for the solutions of the equation

$$(a_1 + a_2 i)\, z^2 + (b_1 + b_2 i)\, z + (c_1 + c_2 i) = 0$$

which gives the roots in the form $A + Bi$.

94. Proposed by Pedro A. Piza, San Juan, Puerto Rico

Let $S_k = S_k(n) = 1^k + 2^k + \dots + n^k$.

Prove that

$$225\,(S_1^2 + S_2^2 + S_3^2 + S_4^2 + S_5^2) =$$

$$400\, S_1^6 + 88\, S_1^5 + 190\, S_1^4 + 196\, S_1^3 + 251\, S_1^2.$$

95. Proposed by Huseyin Demir, Zonguldak, Turkey.

Find the probability that any given four points on a plane be the vertices of a convex polygon.

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

A circle (p) touches the diameter AB of a semicircle (O) in D, and arc AB of the semicircle in R, $(AD < DB)$. The perpendicular to OR at P cuts the arc RB in S. If $RS^2 = DB^2 - AD^2$, find the ratio AD/DB.

SOLUTIONS

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

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

Solution by the proposer.

The given equation can be written in the form

$$(2^{2^m}+1)\,x + (2^{2^n}+1)\,y = a^2 + b^2$$

As is well known, a necessary condition for solvability of the Diophantine equation

$$cx + dy = e$$

is that (c,d) divides e. Hence it suffices to show that

$$(2^{2^m}+1,\ 2^{2^n}+1) = 1 \qquad (m>n)$$

This follows from

$$(2^{2^m}+1) = (2^{2^m}-1) + 2 = (2^{2^{m-1}}+1)(2^{2^{m-2}}+1)\ldots$$

$$\ldots(5)(3) + 2.$$

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.

Comment by Leon **Bankoff,** Los Angeles, California.

This problem together with the following solution appears in the book Geometrical Problems by Miles Bland, Cambridge, 1819, p. 259.

Let the lines AB, AC, DE, DC form the four triangles ABC, AEF, DCE, DBF; and let the circles circumscribing AEF, DBF, intersect each other in G; the circles circumscribing the triangles ABC, DEC will also pass through G.

Join GA, GE, GF, GB, GD. Because the points G, F, B, D are in the circumference of a circle, the angle GDB = GFA = GEA, i.e. GDC = GEA, and hence the points G, E, C, D are in the circumference of the same circle, i.e. the circle circumscribing ECD passes through G. Also since the angle GAE = GFD = GBD, i.e. GAC = GBD, the points G, A, C, B are in the circumference of the same circle; or the circle circumscribing ACB also passes through G.

82. Proposed by C. W. Trigg, 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.

Solution by the Proposer.

Let the vertices of one face of a cube with edge x be A, B, C, D and the orthogonal projections of these vertices on the opposite face be A^1, B^1, C^1, D^1. Make a cut along $A^1C^1CB^1AD^1C$, and a second cut along D^1DB. Thus the faces will each be cut into isosceles right triangles. By unfolding the two congruent pieces around the edges of the cube and onto a plane, and joining each of DD^1 to a C^1C, a hollow square is formed with exterior side $2\sqrt{2}\,x$ and interior side $\sqrt{2}\,x$.

Also solved by R. B. Wright.

85. Proposed by R. Isaacs, Van Nuys, California.

Let $x_1, x_2, \ldots, x_n$ $(n \geq 2)$ be distinct points in space. Define further x_{n+1} as the midpoint of x_1 and x_2; x_{n+2} as the midpoint of x_2 and x_3; ... x_k as the midpoint of x_{k-n} and x_{k-n+1}. Show that the sequence $\{x_k\}$ converges and find its limit.

Solution by the proposer.

Place a unit weight at x_1 and two unit weights at each of $x_2, \ldots, x_n$. Whenever we form a midpoint, let us displace a unit weight from each of the two starting points to the constructed midpoint. It is clear that the resulting process

(1) does not disturb the center of gravity

(2) causes all weights to approach the desired limit.

Thus the limit is the center of gravity of the above initial weighting.

Also solved by G. J. Smith Jr.

87. Proposed by E. P. Starke, Rutgers University.

The centroid G of a triangle ABC is actually the center of area of ABC. Determine K, the centroid of the triangle considered as being composed of three linear segments. Show how to construct K and find some interesting geometric properties of this point.

Solution by the proposer.

The total moment of the three sides with respect to BC equals $(c + b)h_a/2$, whence the distance of K from BC is

(1) $(c + b)h_a/2(a + b + c)$.

Similarly the distances of K from CA and AB respectively are

$(a + c)h_b/2(a + b + c)$, $(a + b)h_c/2(a + b + c)$.

It is easy to show that if BA is extended to C_2 and BC to A_2, where $AC_2 = AC = CA_2$, and if B' is the intersection of CC_2 and AA_2, then K is the midpoint of BB'.

Take B as origin, BC as positive x-axis, and let A be on the positive side of BC. We have

$A:(c \cos B,\ c \sin B)$, $A_2:(a + b,\ 0)$,

$C:(a,\ 0)$, $C_2:(\overline{c+b} \cos B,\ \overline{c+b} \sin B)$.

Now an easy computation gives the equations of CC_2 and AA_2 from which the ordinate of B' is found to be $(c + b)h_a/(a + b + c)$, and the ordinate of K, the midpoint of BB', agrees with (1).

The same argument, using side AB as axis, evidently shows that K is at the correct distance from side AB; and the same point would have been obtained had we started by extending any other two sides of ABC.

Suppose A' and C' are constructed analogously to B' above. Then the hexagon AB'CA'BC' has the property that its opposite sides are equal and parallel.

89. Proposed by R. B. Wright, University of Nebraska.

Evaluate the product

$$\prod_{n=1}^{\infty} \left(\cos \frac{2}{2n-1} + i(-1)^{n+1} \sin \frac{2}{2n-1}\right)$$

where $i^2 = -1$.

Solution by M. Barr, University of Pennsylvania.

$$\prod_{n=1}^{\infty} \left(\cos \frac{2}{2n-1} + i(-1)^{n+1} \sin \frac{2}{2n-1}\right)$$

$$= \prod_{n=1}^{\infty} \exp 2i \frac{(-1)^{n+1}}{2n-1}$$

$$= \exp 2i \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{2n-1} = \exp(2i\pi/4) = i.$$

Also solved by M. A. Krasny, F.T. Phelps 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, Louisiana. These reports will be published in the chronological order in which **they** are received.

REPORTS OF THE CHAPTERS

ALPHA OF OKLAHOMA, University of Oklahoma

The Oklahoma Alpha Chapter held eight meetings during the 1955-56 year including the annual banquet. The following papers were presented:

"Polynomials" by Mr. Frank **Polas**
"Rings" by Dr. Gene Levy
"Number **Mysticism"** by Mr. Edward Brandt
"A **Talk"** by Dr. C. E. Springer
"Theory of Games" by Mr. John Thomas
"A Talk" by Mr. Thomas J. Head
"The German Educational System" by Dr. Gunter G. Ecker, visiting Professor of Physics.

The annual spring banquet was held on May 11 at which time twenty-three new members were honored. The speaker for the occasion was Dr. Richard G. Fowler, Chairman of the Department of Physics. The title of his address was: "Oxford University", where he studied during the year 1953-54. Also, on this occasion, awards were presented to the winners of the problem-box contest.

Officers for 1956-57 are: Director, Betty Ruth Estes; Vice-Director, John D. Thomas; Secretary-Treasurer, Patricia Walls; Faculty Sponsor, Mr. Earl **LaFon;** Corresponding Secretary, Dr. Dora **McFarland.**

ALPHA OF VIRGINIA, University of Richmond

In addition to the initiation meeting and several business meetings the Virginia Alpha Chapter held three program meetings during the year of 1955-56. The following papers were presented:

'Understanding Digital Computers" by Dr. **Arthur** C. Downing, Oak Ridge National Laboratories
'Roulettes" by Dr. R. C. Yates, College of William and **Mary**
'Some Fundamental Concepts in Modern Algebra" by Dr. R. E. **Heaton**

Each year the Chapter sponsors Prize Examinations, one for freshmen and one for sophomores. This year the winners were:

Freshman Examination
First Place **($10.00),** G. D. **Thaxton**
Second Place **(5.00),** W. E. Trout, III
Sophomore Examination
First Place **($10.00),** R. S. Dunning and R. **O.** Delap (a tie)
Second Place (5. **00),** C. R. **Tolbert**

Officers for 1955-56 were: President Helen Crittenden; Vice-president, Philip A. Flournoy; Secretary, Jane Anderson; Treasurer, Samuel R. Stone.

Officers for 1956-57 are: President, Jane Saunders; **Vice-**President, Patricia Moore; Secretary, Mary Katherine Parr; Treasurer, Peggy Graves.

ALPHA OF NORTH CAROLINA, Duke University

The North Carolina Aopha Chapter held two meetings during the year of 1955-56. At the first meeting six students were initiated, and twenty-two students were initiated at the second meeting. The following papers were presented:

"Job Opportunities" by Miss Fannie Mitchell, Director of the Duke Appointment Office
"Scientists and **Computers"** by Dr. Sullivan G. Campbell, visiting professor from Oak Ridge.

Officers for 1956-57 are: Director, Theodore M. Parker, Jr.; Vice-Director, James M. Hicks; Secretary, Dolores Urquiza; Treasurer, James Webb **Redmond,** Jr.

ALPHA OF GEORGIA, University of Georgia

The Georgia Alpha Chapter held eight program meetings during the year of 1955-56. In addition there were several business meetings and three initiation meetings. A total of twenty-two new members were added during the year. The following papers were presented:

"Countability" by James J. Andrews
"Measure and Integration Theory" by R. D. Boswell, Jr.
"p-adic Integers" by S. T. **Hu**
"Wide Open Sets" by D. F. Barrow
"Generalized Sequences" by M. K. Fort, Jr.
"Algebraic Formulas for **Counting"** by G. B. Huff
"A Famous Problem in Algebraic **Geometry"** by T. R. Brahana
"Functional Equations" by R. D. Boswell, Jr.

At the meeting on February 1, the chapter presented a wallet in appreciation of "his many years of service" to Professor Barrow who was to retire at the end of the year.

On May **17th,** the two Prize Awards, offered by the chapter for excellence in mathematics, were presented. Tommy B. Southerland won the prize in freshman mathematics. Fred D. Rose wrote the winning paper on the examination in mathematics beyond the first college year.

A new project started by the chapter was a freshman mathematics club.

Officers for 1955-56 were: President, R. D. Boswell, Jr.; Vice-president, James T. Hinely, Jr.; Secretary, Thomas G. Roberts; Treasurer, J. Walter Lynch; Faculty Advisor, M. K. Fort, Jr.

Officers for 1956-57 are: President, James T. Hinely; Vice-president, Ronald M. Rutledge; Secretary, Helen C. **Raisty;** Treasurer, Joel Knight.

* * * * * *

Professor S. H. Caldwell of the Department of Electrical Engineering of the Massachusetts Institute of Technology once asked his colleague, Professor Norbert Wiener, **"Why is it** that mathematicians write only for other mathematicians?"

Professor Wiener replied, "It is much worse than that. Some of them write only for **posterity!"**

* * * * * *

Perhaps you have never thought of it in just that way, but the cow-licks in your hair are a good illustration of the theorem that every tangential vector distribution on a sphere has at least one point of discontinuity.

* * * * * *

INITIATES

ACADEMIC YEARS 1955-56 (continued), 1956-57 (continued)

ALABAMA ALPHA, University of Alabama
(November 28, 1956)

Clair Frank Asquith
Donald B. Bowerman
Joseph E. Bowles
Ben Davis Crane
Bettye Rae Crane
Hubert T. Davis
Herschel C. Doss
Rudolf Festa
Jane Golden

Luis Gonzalez
Anthony D. Gregoire
James I. Harrison, III
William A. Hoffman, III
Judson A. Lovingood
Edgar Darby Mason
William Randolph Mountcastle
James E. Norman, Jr.

Andrew P. Papadeas
Hugh Mallory Privett, Jr.
Louis H. Reynolds
Alexander J. Shuskus
Gaston Smith
John Thomas Sax
William E. Watts
Raymond C. Watson
Clifton Thomas Whyburn

ALABAMA BETA, Alabama Polytechnic Institute
(February 12, 1957)

William F. Allen, Jr.
Escar Lynwood Bailey
Donald Henry Clanton
George Thomas Crocker
Steve J. Denton
Lucy Ann Driscoll
William H. Fulcher
Jimmie Dale Gilbert
Theron Wallace Hawkes, III

Mary E. Holder
Marvin Edward Houston
Rosemary Kopel
Ella Sue Lindsey
Paul W. Lindsey, Jr.
Patsy Ann Maxwell
Paul E. Major
Jimmy E. McDowell

William J. Patterson, Jr.
James L. Peeler
Katie B. Peoples
Donald S. Pierre
William T. Sharpe
James R. Sheffield, Jr.
John G. Swann
John Fostee Wilson
Theodore S. Worozbyt

ARKANSAS ALPHA, University of Arkansas
(March 28, 1956)

Richard E. Baker
J. E. Bass
James E. Crump

Lee L. Denny
Jim D. Geiger
Robert M. Gray
Vernon E. McBryde

Charles R. McLaughlin
Charles R. Moody
Robert J. Scroggs

(November 1, 1956)

Gerald W. Andrews
Robert H. Biggadike
Richard A. Blake
Ronald L. Boyles
Ronald K. Crow
Thomas J. Epperson

James C. Frazier
Billy E. Green
Paul Heindselman
Richard Henthorne
Hubert Jones, Jr.
Bill C. Madden
John W. Meux

William L. Norman
Koyo Ocada
Daniel L. Rodgers
Terry M. Stark
Joseph F. Stokes
Kenneth G. Wheeless

(December 5, 1956)

Paul P. Stiedle

(April 11, 1957)

James Larry Black
Frank Ballew Canfield, Jr.
Rosemary Henbest
Collin James Hightower

Phillip N. Mace
James Kenneth McGrew
Larry Eugene Orlicek

James Boyd Pearson, Jr.
James Ellis Sehnert
James Lowell Stage
Leopold Ernest Zellner

CALIFORNIA ALPHA, University of California at Los Angeles
(January 26, 1957)

Frank J. Bauer
David Braverman
Richard Oswald Duda

David Benjamin Kaplan
Fred Krimm
Bruce Robert Kubert

Deborah Silverman
Robert Allen Sparks
Herbert Takahashi Suyematsu

FLORIDA BETA, Florida State University
Charter members received on occasion of installation of chapter
(October 5, 1956)

Dwight B. Goodner (Illinois Alpha)
H. C. Griffith (Missouri Alpha)
Thomas L. Wade (Alabama Alpha)

Charter Members

(October 5, 1956)

James Watson Ellis
John G. Harvey
Nickolas Heerema

Edgar P. Kelly
John T. MacLean
Joe M. Plant
Robert L. Plunkett

James E. Snover
Howard E. Taylor
Richard M. Vinson

(October 5, 1956)

Stanley R. Bender
Donald V. Easter
Martha O. Lisle

Paul J. McCarthy
Hugh Walter McCurdy, Jr.
Bruce J. McDonald
Clifton N. Mills

Margaret J. Schmidt
George W. Polites
Carl A. Schulz

Members transferred from other chapters

John L. Bagg (Michigan Alpha)
Robert A. Kromhout (Kansas Beta)
Ora S. Kromhout (Illinois Alpha)

Charles W. McArthur (Louisiana Alpha)
Eugene D. Nichols (Illinois Alpha)
William T. Stratton (Kansas Beta)

GEORGIA ALPHA, University of Georgia
(November 7, 1956)

Julian J. Bugg
Gene Merrill Durrence
James Ellis

John V. Hancock
John Leiding Keller
William Lindsey Mock
Fred David Rose

Pinckney Alston Steiner, II
Thyrza Frances White
William L. Woodrum

(February 20, 1957)

Robert Park Everett
Walt G. Horstman

Andrew S. Rogowski
Edwin L. Tolnas

Tonis J. Tonisson
Harry Jack Watson

ILLINOIS BETA, Northwestern University
(January 15, 1957)

William Bearden
Tad Alan Beckman
Byron Birtman
Robert S. Bowen
W. A. Brill
Frederick D. Browne
Francis J. Brule
Bruce W. Crawford
Leo E. Daub
James Weld Davis
Mary Karel DeHaye
Don Elson
Sheldon Feldman
Anthony Ferraro
Robert Todd George
Art Guttensohn
Charles M. Hall
George Hawley
R. Brad Herbert
Stan Jacobs
Gordon James
Audrey H. Johnson
Cecile Kaplan
Barbara Kegerreis
Donald L. Kerste
Harry Richard King
Alvin Knox
Ronald E. Kolar
Gerald Neal Koppel
Nancy Kozelka
Phillip G. Larson
Rolland Metzger
Philip McNamee
Frank Miholits
Warren P. Miner
Henry Murray
Roy Nelson
Earl Nesbitt
Jack W. Newhard
Sungik Francis Paik
David B. Park, Jr.
Charles E. Penaz
Charles Rose
Paul L. Schutt
Lyle H. Schwartz
Grant B. Skelton
Daniel Steinmeyer
James L. Stokes
Ronald J. Vernon
John W. Wilkins

(January 15, 1957)

Thomas J. Burgess
Lawrence Singer
Russell V. Theiss
John W. Van Ness

ILLINOIS GAMMA, DePaul University
(April 2, 1957)

Louis Max Weiner
Guido Leopold Weiss
Raymond A. Guilgenbach
John De Cicco

ILLINOIS DELTA, Southern Illinois University
Charter members initiated on the occasion of the installation of the chapter
(January 18, 1957)

Marvin Barker
Imogene Beckemeyer
Louis Bessen
Amos Black
Angelo Bollero
Albert Boyles
Fahrni Dehdah
Adb Daqqaq
Faiz Daqqaq
Billy Dixon
Shirley Gipson
Robert Gower
Richard Hunsaker
Allan Jones
Morton R. Kenner
Lawrence E. Larson
Wilbur C. McDaniel
Kourken Mardirosian
Russell Peacock
Paul Phillips
Inis Richardson
Ross Schneider
Ernest Shult
Leslie Sims
Cynthia Ward
Harold Ward

INDIANA ALPHA, Purdue University
(April 28, 1957)

Roger Lee Bollenbacher
Robert G. Carleton
Alfred Clark
Donald R. Croley, Jr.
Limus K. R. Han
Grant Hosack
Von Eugene Kistler
John Tredwell
Marvin L. Vestal
Jean A. Weil

KANSAS GAMMA, University of Wichita
(December 14, 1956)

Ralph Bargen
Joe F. Cox
Charles D. Crook

LOUISIANA ALPHA, Louisiana State University
(November 2, 1956)

Robert Lee Raborn

MARYLAND ALPHA, University of Maryland
Initiated on occasion of the installation of the chapter
(April 16, 1956)

Harold Charles Berry
James H. Bramble
Louis W. Ehrlich
James Hill
Leon Katz
Benjamin Y. C. Koo
Michael D. Kudlick
Steven H. Schot
William B. Zeleny

MISSOURI ALPHA, University of Missouri
(December 5, 1956)

Charles Jones Bryan
Veldon Dale Holaday
George Paul Huber
Harold L. March
Tommie Stewart Plummer
Harold Dean Rule
James Carson Schloemann
Edwin Martin Sheen
James William Teegarden
Ernest Robert Thompson, Jr.
Eugene Robert Warring

MISSOURI GAMMA, Saint Louis University
(April 25, 1957)

John A. Albertini
Merle Allen
John N. Applebaum
Patricia A. Bailey
Robert Bannister
Robert H. Beutler
Royal J. Bondie, Jr.
Russell Breeckelmann
Gerald Chmielewski
Daniel Cronin
Donald M. Cunningham, S.J.
Peter A. Danna
DeWitt William Davis
Loretta M. DeLurgio
John E. Doll, S.J.
Louis Duncan
Robert L. Eigel
Margaret M. Faust
Margarita H. Fennell
Jeanette Fernandez
Clark Fitch
Patrick W. Flaut
Kent Floyd
Martin Flynn, C. R.
Francis Foppe
Lawrence Frederick
Marcella Fritschie
Robert A. Gray
James C. Greeson, Jr.
Norman J. Guinzy
George A. Gustis
Willard J. Hannon, Jr.
James C. Hendrix
Don Hinds
Carl H. Hoffman, Jr.
Lee C. Horack
Sr. Mary Suzanne Kelly
John P. Kenny
Donald Ketter
William J. Kidd, S.J.
John Conrad Klosterman
Roy N. Knauber
Donald R. Kozlowski
James L. Kramer
Gregory J. Krol

Mary Lou Krug
Paladugu Lakshmaiah
James Y. C. Leong
Katherine S. Lipps
Francis T. Lyons
George A. Matusek, Jr.
Mary Patricia McAnaw
Thomas V. McTigue, Jr.
William Noonan
Jose R. Padro
John L. Pokoski
Thomas Pozsgay
James M. Prebil
Lucy A. Reuter
John W. Riner, Jr.
Nicholas Ropar, Jr.
Merle E. Ross
John O. Rottler
Michael K. Sain
Meinrade H. Schilly
Phyllis A. Schmidt
Robert C. Sessler, S. J.
Francis E. Slojkowski
Robert Teng
James D. Thomas
Richard B. Trefny
William T. Valenta
Marie Catherine Vohsen
James E. Weir
Lester P. Weissert
Jerry L. Wessel
William Wright
Mary E. Young
Ralph R. Zoellner

MONTANA ALPHA, Montana State University
(December 4, 1956)

Andrew Browman
Gavin Bjork
Robert Engle
Harry Eylar
Bruce Jacobson
Mike S. Moheban
Wolfgang Schmidt
Louis Schmittroth

NEBRASKA ALPHA, University of Nebraska
(December 11, 1956)

Clay Wilson Crites
Melvin Fredrick Earnest
Robert Leroy Gallawa
Sharon Kaye Hocker
Ronald Ralph Hornby
Robert A. Jameson
James Junior Jirik
William Charles Kinsel
Fred T. Phelps Jr.
Keith Barton Schafer
Vernon Ray Schoep
Lawrence J. Schumacher
Ronald Roy Smith
Glen Underhill
Robert Thomas Westmore

NEW JERSEY ALPHA, Rutgers University
(April 23, 1956)

Kenneth H. Bergman
Nat Wyeth Fritsche
William Joiner
William R. Jones
James Joseph O'Brien
John C. Sessler
George R. Taylor

(November 26, 1956)

Milton T. Austin
Stephen P. Coburn
Edward A. Cohen
Gerald J. Dreiss
Karsten Dierk
Clifford A. Ellis
Edward G. Fiorito
Charles Gane
Hugh M. Hilden
Neville Kallenbach
Kwok Kuen Lai
Paul Lenoble
John S. Merritt
Bernhart W. Nelson
Richard V. Olson
Angelo Pelios
William B. Pierce
Francis E. Pirigyi
Dennis L. Rodkin
Norman Schulaner
Arthur Sullivan
Jack Harris Taub
William L. Theobold
Costa Tsipis

NEW YORK BETA, Hunter College
(October 31, 1956)

Sheila Freifeld
Ruby Fried
Gladys Ginsburg
Marion Carol Kavee
Roberta Mondschein
Barbara Saul
Annabella Siegel
Eleanore Triolo

(March 20, 1957)

Marie Costanza
(Mrs.) Erin Offritt DiBello
Emily Louise Wizemann

NEW YORK GAMMA, Brooklyn College
(December 14, 1956)

Juliana Arak
Edmund Brigmanis
Marilyn Fisher
Joel Horden
Carmela Landolfi
Paul Levenglick
Irene Levine
Carol Sue Marous
Berta Meltzer
Aaron Paukler
Harold Schechter
Joseph Shpiz
Charles Sondik

NEW YORK DELTA, New York University
(1955–56)

Charles Newton Bressel
Stanley Kleinman
Morton Lowengrub

NEW YORK EPSILON, St. Lawrence University
(November 14, 1956)

Robert L. Chrestensen
Richard R. Collins
Arthur S. Foster
Elizabeth A. Johnson
Robert V. Lyle
James C. Magee
Jack A. Maybee
Ellen L. McDonald
Jerry L. Weinberg
Peter J. Wolfe

(March 5, 1957)

Bartlett D. Craft
Robert A. Isaksen
Magdalene Karros
Richard A. Meili
Coe D. Suydam, Jr.

NORTH CAROLINA ALPHA, Duke University
(December 13, 1956)

Stephen D. Baker
Craig A. Brandon
Terry Cracknell
Jean Dickinson
Joseph C. Eggleston
Robert O. Gamble
Carol Margaret Hess
J. Edwards Jenkins
Berma L. McDowell
David L. Nealy
Wilber Stewart
Nancy Margaret Turnbull
Richard J. Wood
David M. Young

NORTH CAROLINA BETA, University of North Carolina
(March 14, 1957)

Norman Carroll Armstrong
Ellen Evelyn Brauer
Romulus Jack Brown
Larry Lee Bumgarner
Nancy Faust Carter
Robert Edward Clark
Luther Thomas Conner, Jr.
Robert Lee Crain
William Grady Dotson, Jr.
Andrew Emerson Johnson, Jr.
James Hawthorne Keller
Joseph Phelps McAllister
Komarath Padmavally
Prabir Roy
James Edgar Shockley, Jr.
David Phillip Stanford

OHIO GAMMA, University of Toledo
(March 24, 1957)

Carl Richard Hirschle
Carl R. Hutter
John L. Peterson
Howard N. Punches
Katharine D. Roose
Charles E. Young

OHIO DELTA, Miami University
(November 12, 1956)

Anna Elizabeth Cohn
Wesley Northey Mathews
John Thorton McClaughry
Paul Spargur Phillips, Jr.
Ralph Raymond Sherman, Jr.
Jack Franklin Southard
David Eiting Sponsler
Frances Evelyn Susco
Joan Erna Wagner
Mark Hay Wagner
Paul Denton Yeary
James Alden Yeither

OHIO EPSILON, Kent State University
(February 20, 1957)

Marilyn L. Boich
Paul L. Evans
Edward J. Friihauf
Earl R. Hopkins
John D. Huffnagle
Wayne A. Hutchison
Byron W. Johnson
William E. Oser
Lucy J. Sanchez

OKLAHOMA ALPHA, University of Oklahoma
(December 7, 1954)

James L. Box
Gerald L. Glahn
Robert E. Hill

(May 3, 1955)

Edward L. Battiste
Mitchell Burrus
William J. Cody, Jr.
Betty Ruth Estes
Jerry A. Hood
Philip J. Martin
Franklin E. Niles
Bob R. Parker
George R. Read, Jr.
Sherman C. Reed
Jack Reynolds
Charles M. Starks
Richard E. Waddell
Elizabeth Wells

(February 7, 1956)

John H. Iiildebrant
M. Laverne Loman
Lee M. Maxwell
Carolyn Ratcliff
George Spillman
Charles K. Stone
Patricia Ann Walls

(May 8, 1956)

Roy Dan Beveridge
Homer P. Bucker, Jr.
Carl Procter Dean
Edward V. Harris
Jerry D. Kennedy
Jack C. Konklin
Charles F. Kyger
Inez McFall
Merry Morgan
Albert LeRoy Mullikin
Daniel N. Schmoker
Joseph N. Snyder
Douglas S. Sullivan
George A. Thomas
Frances Louise Walker
Roy F. Waller

(December 4, 1956)

Lyndon D. Boyer
Kayland Bradford
William E. Brigham
Melvan DeWayne Carter
Charles Dees
Ronald C. Elkins
Jimmy Hoag
Connie D. Matthews
Eugene McConnell
Corinne Parks
Rex Ponsor
Avis C. Slater
Susanne Springer
Robert E. Stong
Richard P. Storm
James H. Terhune
Bradley R. Thompson
Robert R. Welland

OKLAHOMA BETA, Oklahoma A. & M. College
(December 19, 1956)

Charles Bryan Brown
Ronald Eugene Cummings
John L. Fike
John W. Hamblin
Crawford Allen Irvine
Yihan Kao
Mohammad Ali Khan
Arthur Earl Oldehoeft
Marilyn Arvonia Ray
William Mingle Roberts
Robert Campbell Roundings
Gary Neil Spears
Jack Duane Testerman
Claude C. Thompson
Fred O. Turner
Tahteh Yang
Eugene Nance Zavodny

PENNSYLVANIA ALPHA, University of Pennsylvania
(February 24, 1956)

Igor Arlievsky
Leonard Bidwell
D. Stuart Currie
Richard I. Feinbloom
Clifford D. Ferris
William G. Figueroa
Sanford H. Glassman
Saul Herman
Marian E. Kallis
Morton Kanefsky
Edwin L. Kaplan
J. David Kramer, Jr.
Gary B. Laison
Kurt Lichtenfeld
Leonard M. Magid
Leon R. Miamidian
John E. Molyneux
William Pinsky
Arnold B. Popkin
Donald I. Promish
Charlene Senape
Seymour M. Shenkman
Melvin M. Shralow
H. Francis Thornton
Gerald D. Weinstein
Sheldon Weisman
Sandra S. White
Howard L. Yudkin

(March 22, 1957)

T. Roberts Appel
Catharine G. Baldwin
Michael Barr
Edward M. Brown
Daniel Edelman
John Engelbrecht
Lawrence B. Erlich
Louis D. Ferretti
Ira Goldberg
Harry F. Lutz
Theodore Oslick
Marc Peck
Howard Rosen
Myrna Schmidt
Marianne Silverstein
Rhoda Solomon
Gerald H. Stein
Donald Waldorf
Paul Weinberg

PENNSYLVANIA BETA, Bucknell University
(January 23, 1957)

William A. Beck
James Beidleman
James Berger
Robert R. Dederer
Stanley Dice
Oresto Digiondomenico
Ronald Fisher
Graydon Goss
James Herb
Young Gul Kim
Larry Kirkland
Karl Klose
Clemente Kovalich
Nile Lestrange
Gerald Porter
Barbara Stech
William Sponaugle
Fue Lane Wong

PENNSYLVANIA GAMMA, Lehigh University
(May 7, 1957)

Leo Glenn Bonney, Jr.
Robert Lawrence Brown
Carter L. Cole
Howard Feltman Foulke
Joe Natale Ginocchio
Wayne Clement Harris
David Robert Hughes
Thomas Haley Hughes
Douglas J. Kim
Frank Eugene Labar
Robert Irving Miller
William Schuler Pierce
David Eugene Setzer
Edward Charles Shaffer
Jack Leon Smith
Frederick Vescial
Joseph Kazemer Walendziewicz
Russell Harry Williams

PENNSYLVANIA DELTA, Pennsylvania State University
(February 27, 1957)

Neil Bernstein
Ronald H. Bothur
Fred A. Brooks
Gerald E. Cooper
William Craig
Leland H. Dole
Ronald Drake
Richard F. Erdley
Hilda Feist
Francis J. Felix
Paul C. Gilmore
Harry Gonshor
Richard D. Guild
Allan M. Krall
Barry F. Kramer
Pearl Laird
James Leitzel
Larry W. Lock
David B. Lombard
Barbara MacWilliams
Bertha Mather
Edward J. McHugh
Richard A. Mollo
George N. Raney
David Richardson
Emory Richardson
James S. Rupp
Edwin V. Selander
Mary Selander
Robert L. Shutt
John O. Stoner
Richard N. Yasko

WISCONSIN BETA, University of Wisconsin
(October 17, 1956)

Robert C. Beach
Dr. C. E. Burgess
Paul Doudna
Samuel R. Filippone
Gloria C. Ford
Hillel H. Gershenson
John S. Gipson
Mona Haxby
Donald Hinkkanen
Dr. Klaus Krickeberg
Dr. Joseph B. Kruskal
Joseph L. Mazanec
Carol A. McDuffee
Relita Neumann
Frederick R. Parker
Joseph N. Payne
Donald L. Prullage
Arthur Wayne Roberts
Leda Sachnoff
Richard Schauer
Martin John Schrader
Elizabeth H. Schwarz
Charles P. Sequin
James F. Smick
Thomas J. Smith
Elsa B. Struble
George W. Struble
John L. Traub
Karl H. Usow
Walter C. Whitson
William Wiersma, Jr.
Linus Young

ANNOUNCEMENT OF SUMMER MEETING

The Pi Mu Epsilon Fraternity will hold its biennial meeting in conjunction with the summer meetings of the Mathematical Association of America and the American Mathematical Society at Pennsylvania State University, University Park, Pennsylvania, August 26-30, 1957.

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Many copies of the PI MU EPSILON JOURNAL are returned to our office because the "PERMANENT mailing address" supplied by the chapter secretary is not permanent enough, or because the addressee has not left proper forwarding. instructions. We refuse to be insulted by anybody's lack of interest in our journal, but we hate to spend all that money on return postage. Can you help? All we want is an accurate set of addresses, so far as these can be provided.

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We are dreadfully sorry that this issue comes out so late. When a person foolishly undertakes to do too many things, some of them just don't get done on time, that's all. We hope your new editor and his staff can manage better than we did.

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Those of you who haven't yet read it should look up Paul Halmos' delightful article "Nicolas Bourbaki" in the May, 1957, Scientific American, page 88. It is an anecdotal history of the genesis and progress of the famous French treatise on mathematics. Fortunately, Professor Halmos does not hesitate to name names, except, of course, his own.

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As the old saying suggests, "One man's Hermite is another man's Poisson."

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