New Mexico State University
Department of Mathematical Sciences
Annual Report for 1964-65

SECTION A

Staff meetings were held at least twice each month and lasted an average of one and one-half hours. Some time was devoted to routine departmental business at each staff meeting. One major item dealt with in a number of meetings was the search for new staff. Another major item of business in practically every staff meeting was an overall review of the department activities. This review was necessary since the growth of the department has made it necessary to assign to committees responsibility for many activities that could formerly be handled by the department head and the department staff as a whole. Some of the results of these discussions are mentioned under "Improvements" below.

STUDENT CREDIT HOURS PRODUCED

	Summer 1964	Fall 1964	Spring 1964
A. Undergraduate	1320	5767	4781
B. Graduate	288	1122	786

NUMBER OF MAJORS

A. Undergraduate	40	132	117
B. Graduate	51	87	77

NUMBER OF DEGREES AWARDED

A. Undergraduate	18
B. Graduate	
1. Master of Science	13
2. Doctor of Philosophy	5

COLLOQUIA AND FACULTY SEMINAR SESSIONS

Dr. Melvin Henriksen, "Multiplicative Summability Methods and the Stone-Cech Compactification," August 24, 1964.

Dr. Thomas Ferguson, "Game Theory and Statistical Decisions Theory," December 7, 1964.

- Dr. R. Khazanie, "Markov Processes," December 12, 1964.
- Dr. Donald Stevens, "Probability," January 8, 1965.
- Dr. John McCloskey, "The Computer Simulation of a Model for the Distribution of Individuals by Species in an Environment," January 11, 1965.
- Dr. Galen Seever, "Non-negative Projections on $c_0(X)$," February 11, 1965.
- Dr. Charlotte Froese, "The Numerical Solution of Certain Two Point Boundary Condition Differential Equations," February 19, 1965.

- Dr. A. A. Baylor, "Mathematical Models for Economics," February 20, 1965.
- Dr. Donald Owen, "Tolerance Limits and Sampling Plans," February 25, 1965.
- Dr. Edgar Rutter, "Ring Theory," March 5, 1965.
- Dr. Howard Egan, "The Frattini-Subgroup and its Relation to Generalizations of Nilpotent Groups," March 9, 1965.
- Dr. Louis Solomon, "Recent Results on Classical Groups," March 11, 1965.
- Mr. Dalton Tarwater, "Galois' Theory of Abelian Groups," March 15, 1965.
- Dr. Alston Householder, "The Kantorovitch and Related Inequalities," March 16, 1965.
- Dr. M. L. Juncosa, "Monte Carlo Methods and Random Number Generation," March 23, 1965.
- Dr. F. D. Williams, "A Hopf Construction for Homotopy-Commutative H-Spaces," March 24, 1965.
- Dr. H. W. Davis, "The Mean Value of Almost Periodic Functions," March 26, 1965.
- Dr. R. J. Griego, "Some Aspects of Potential Theory," April 29, 1965.
- Dr. Ray Mines, "On a Conjecture of Harrison," May 6, 1965.
- Pi Mu Epsilon speakers: Dr. Robert Wisner, Dr. Fred Richman, Dr. John Thomas, Jimmie Johnson, Dr. Arthur Kruse, Dr. Dorothy Daybell, and Dennis Bertholf.
- Drs. E. A. Walker, Richman, Irwin and C. Walker conducted an Algebra Seminar for faculty and students.
- The annual Holiday Symposium in Mathematics was held during the week of December 28, 1964 through January 1, 1965. Ten lectures by Mark Kac on "Probability Theory and Differential Equations" were well received by our staff and about 30 mathematicians from the Southwest.

DISTINGUISHED VISITORS

- Dr. Mark Kac, Rockefeller Institute, New York.
- Dr. William Rosen, National Science Foundation.
- Dr. Milton Rose, Mathematics Research Division, NSF.
- Dr. Melvin Henriksen, Department Chairman, Case Institute of Technology.
- Dr. Alston Householder, Head of Mathematics Panel, Oak Ridge Institute of Nuclear Studies.

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SECTION B

UNDERGRADUATE SCHOLARSHIPS

- National Science Foundation Individual Study Grants 10
- Physical Science Laboratory Scholarships 4

GRANTS RECEIVED BY DEPARTMENT

- National Science Foundation Individual Study Grant, $10,000
- National Science Foundation College Teacher Institute, $50,000
- Research grants listed in Section C.

GRADUATE SCHOOL SUCCESS OF GRADUATES

Our records here are incomplete. Of the 19 graduated during this period, we know of 4 who have been in graduate school. All are proceeding at a normal pace.

IMPROVEMENTS

A. Instruction

Large lecture sections taught by senior faculty with small (15 to 20 students) help sessions taught by teaching assistants have proven effective. Although final decisions have not been made, tighter control of the instruction in all courses through the senior -first year graduate level way be instituted next year. Departmental committees will choose all textbooks and will prepare course outlines in these courses. This was formerly done only for freshman and sophomore classes. This will tend to provide greater guidance to young staff members in the handling of these large classes.

B. Curriculum

1. Undergraduate

A revised sequence of courses for science majors was started this year with the cooperation of the engineering college. Some minor changes will be made next year but on the whole the new sequence seems to represent a definite improvement. A revision of this sequence on the junior level was made and the new courses will be offered next year.

The statistics course for business and behavioral science majors was completely revised and significantly improved. A new course in statistics for engineering students was offered with success. Since this is not yet required, it will be small for at least one more year.

New courses, the beginning of a sequence of courses, in computing science, were introduced and will be offered next year. Plans have been laid for a greatly expanded sequence of courses on the junior level and higher in both computer science and statistics. Staff additions this year in these areas have made it possible to broaden significantly the opportunities for majors in these areas and for service courses for non-mathematics students.

Staff committees with the responsibility for providing recommendations, consultation (both in and outside the department) and continued study, and evaluation of the courses have been set up. One committee has specific responsibility for mathematics service courses, one for the undergraduate mathematics majors' program, and one has responsibility for the graduate curriculum. These committees have just started to function but they are expected to be of considerable value in improving our whole program.

A curriculum for undergraduate honors students is being developed. The first year of this program will be implemented next year and will consist of a Tutorial Problem Seminar and a special section of calculus.

2. Graduate

Several new courses were introduced to meet the needs of students and staff interests. They are: 476 - Automatic Computer Programming, 477 - Numerical Analysis, 505 - Mathematical Machine Theory, and 689 - Algebraic Number Theory. Plans for expanding the offerings in statistics and computer sciences have been discussed with a view to implementation next year. Consideration of the graduate level applied mathematics

curriculum has continued but final plans await staff additions in this area.

A staff committee charged with the overall contro1 of the qualifying, master's, preliminary and final examinations was formed and is functioning effectively.

C. Library

The mathematics library is excellent. Over 140 current journals are subscribed to and back issues of most of these are relatively complete. A considerable expansion in journal subscriptions in statistics and computer sciences was made this year to anticipate an expansion of our program in these areas.
There is still a need for more graduate books. It will be necessary to purchase multiple copies of many of these in the future.

D. Equipment

No major items of equipment were purchased this year. The new mathematics building might be regarded as a significant piece of equipment, inasmuch as the library and his office with its desk and blackboard is the mathematician's laboratory for research. Plans for this building, supported partially by a $210,000 NSF grant, have been completed this year.

E. Staff

New staff members who have been hired are: Dr. Donald Stevens, Dr. J. Mack Adams, Dr. Edgar Rutter, Dr. Louis Solomon, Dr. Frank Williams and Dr. G. S. Rogers. The members who have resigned are: Dr. Don lick and Dr. Donald Ferguson. Dr. John Giever and Dr. Edward Thorp will be on a year[?]s leave of absence. Drs. Rogers, Stevens and Rutter will aid us in developing our program in statistics. Dr. Adams holds a joint appointment with the Computing Center. At this writing there are at least three vacancies.

F. Advisor Program

A new advisor program was set up this year. Graduate and undergraduate committees now take care of the advisees. The previous practice of assigning advisees to all staff members led to a too diffuse assignment of responsibility. The present committee is expected to provide better advising and a better advisor-advisee relationship on both the undergraduate and graduate level.

STUDENT MAJORS

Committees on both the graduate and undergraduate level handle the problem of student recruitment and recommend students for fellowships and scholarships (such as NSF traineeships, PSL Freshman Scholarships, etc.).

A tutorial program will be started next year as a means of attracting very high quality undergraduate students. Ten special freshman scholarships for top freshman students will provide a nucleus around which this program will be built.

PROFESSIONAL SERVICE

Dr. Wisner serves as an editorial consultant for McGraw-Hill and John Wiley and Sons Publishing Companies and editor for Wadsworth Publishing Company.
Dr. Edward Gaughan participated in the Visiting Scientist Program of the New Mexico Academy of Sciences.
Dr. Ralph Crouch was a Visiting Lecturer for the Mathematical Association of America.

He was invited to lecture at the National Council of Teachers of Mathematics summer meeting.

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STRENGTHS, WEAKNESSES AND NEEDS

A. Strengths

Our major strength still remains a close-knit, dedicated, and active staff. The new staff added for next year are of very high quality and will further strengthen the group. A fairly successful effort was made to add staff with research and teaching interest in statistics, computer science and applied mathematics, and continued efforts must and will be made. It has been gratifying to see the staff respond to the need for having committees handle part of the heavy duties.

The second annual Holiday Symposium was held this year with Dr. Mark Kac of the Rockefeller Institute presenting a series of five two-hour lectures. The symposium was attended by approximately 30 mathematicians in addition to local mathematicians. The series of symposia has been of great value in drawing attention to our department.

Five will receive their Ph.D. degrees this year. These young people have easily found attractive academic positions.

The willingness of the staff to satisfy the service needs of the rest of the university must be regarded as a distinct and important strength. Many of the new sequences of service courses make heavy demands on the staff both in planning the courses and in teaching them.

B. Weaknesses

Although we are still holding our own insofar as starting salaries are concerned (by necessity!) more must be done in providing a broader range of intermediate and top salaries. We can be badly hurt by losing some of our top research people and top salaries in all ranks must be increased significantly

The present office building is becoming badly overcrowded [illegible] we had to provide space for 12 students outside Walden Hall and next year place will have to be found for 24. Fortunately a new building should be ready sometime next year. It will provide space for the anticipated growth of the department over the next five years.

Closer coordination of departmental thinking about service courses and the user department's desires is necessary. This is primarily a matter of education in both directions. It is expected that the committee structure set up in the department this year will help alleviate this situation.

C. Needs

The major need is for additional staff. The senior staff has remained relatively constant for the past two years. Most of the new staff added have been replacements for staff who are leaving or retiring. Our staff has been strengthened but not enlarged. We need at least four new staff positions next year in addition to any replacements if the increased demands on the department are to be met. So far, we have met these demands by more efficient use of staff (e.g. large sections) but these devices will not suffice indefinitely. Note, for

example, that the total student credit hours of the department increased from 13,036 to 14,064 last year, for a percentage increase of 8.4%, despite no increase in staff. With a growing enrollment, this increase will continue.

The second need is higher salaries. All of the staff who left this year received substantial increases in pay. Our own graduates go out at salaries exceeding those we offer beginners.

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SECTION C

RESEARCH PAPERS PUBLISHED BY FACULTY

- "Index Problem for Infinite Symmetric Groups,' Dr. Edward Gaughan, Proc. Amer. Math. Soc., 1964.
- "Homologically Complete Spaces," Dr, Arthur Kruse, Portugal. Math., 1964.
- "A Note on the Partition Calculus of P. Erdos and R. Rado," Dr. Arthur Kruse, 1965.
- "Generalized Quotient Rings," Dr. Fred Richman, to appear in Proc. Math. Soc.
- "General Channels in Information Theory," Dr. Nathan Scarritt, to appear in Illinois J. Math.
- "Operators Representation Theorems," Dr. Edward Thorp (with R. Whitley), to appear in Illinois J. Math.
- "A Partial Analysis of Go," Dr. Edward Thorp, (with W. Walden), Computer Journal 7, 1964.
- "Probability," Dr. Edward Thorp, Cosmopolitan, 1964.
- "Repeated Independent Trials and a Class of Dice Problems," Dr. Edward Thorp, Am. Math. Monthly, 1964.
- "Isometrically Isomorphic Sets,' Dr. Edward Thorp, Am. Math. Monthly, 1964.
- "The Number of Beans in a Bottle," Dr. Edward Thorp, to appear inPopular Mechanics.
- "An Attempt at Strongest Vector Topology," Dr. Edward Thorp, to appear in Amer. Math. Monthly.
- "The Number of Basic Subgroups of p-Groups," Dr. E. A. Walker (with S. Khabbaz), Acta. Math. Sci. Hung., 1964.
- "Quotient Categories and Quasi-Isomophisms of Abelian Groups," Dr. E. A. Walker, Publishing House of Hungarian Acad. of Sciences, 1964.
- "On the Number of Basic Subgroups of Abelian Torsion Groups," Dr. E. A. Walker, (with S. Khabbaz), to appear in Acta. Math. Sci. Hung.
- "Primary Abelian Groups as Modules over their Endomorphism Rings," Dr. Fred Richman and Dr. E. A. Walker, to appear in Math. Zeit.
- "A Note on the Partition Calculus of P. Erdos and R. Rado," Dr. Arthur Kruse, J. London Math. Soc., 1965.
- "Grothendieck Universes and the Super-complete Models of Shepherdson," Dr. Arthur Kruse, Composito Mathematica, to appear.
- "An Application of a Family Homotopy Extension Theorem to ANR Spaces," Dr. Arthur Kruse (with P. Liebnitz), to appear in Pac. J. of Math.

RESEARCH PAPERS BY FORMER STUDENTS

- "Weak Perfect Compactness and Generalized Adjoints," Dr. David Arterburn, to appear J. Fur. die Reine and Augewandte Math.
- "Prewhitening, filtering and recoloring dietized trajectory data," Dr. Alfred Carver, PSL-NMSU, 1964.
- "The k-externally Disconnected Spaces as Projectures," Dr. Henry Cohen, Canadian J. Math., 1964.
- "Injective Envelopes of Banach Spaces," Dr. Henry Cohen, to appear Bull. Am. Math. Soc.

- "Conditions Under Which all Bounded linear Operators are Compact," Dr. Elton Lacy (with R. Whitley), to appear Math. Ann.
- "Strictly singular operators and their Conjugates," Dr. Robert Whitley, to appear in Trans. Am. Math. Soc.
- "Conditions Under Which all the Bounded Linear Operators are Compact," Dr. Robert Whitley (with E. Lacey), to appear in Math. Ann.
- "Operator Representation Theorem," Dr. Robert Whitley (with E. Thorp), to appear in Ill. J. Math.
- "Projecting *m* onto c_0," Dr. Robert Whitley, to appear in Am. Math. Monthly.

RESEARCH PAPERS PRESENTED AT MEETINGS BY FACULTY

- "Countable Direct Sums of Torsion Complete Groups," Dr. Fred Richman, Western Regional Meeting of the American Mathematical Society at Stanford, Regional.
- "Teaching Mathematics: A Christian Method," Dr. Robert Wisner, Southwest Section of the Mathematical Association of America, Regional.
- "Divisibility in Matrix Semigroups," Dr. Robert Wisner, American Mathematical Society, New York City, Regional.

RESEARCH PAPERS PRESENTED AT MEETINGS BY FORMER STUDENTS

- "The Generalized Adjoint of a Compact Operator," Dr. David Arterburn, Southwest Section of M.A.A., Regional.
- "Complete Continuity Conditions on Spaces of Type CCK," Dr. Elton Lacy, Texas Section of M.A.A., State.
- "A Winning Bet in Nevada Baccarat," Dr. William Walden, Annual Meeting of A. Math. Soc., National.
- "Operator Representation Theorems," Dr. Robert Whitley, Annual Meeting of Am. Math. Soc., National.

RESEARCH IN PROGRESS

Dr. Ralph Crouch, Infinite Symmetric Groups

Dr. Dorothy Daybell, Operator Representation Theorems in Locally Convex Spaces

Dr. Donald Ferguson, Infinite Products of Sets of Natural Numbers

Dr. Edward Gaughan, Topologies for Infinite Symmetric Groups

Dr. John Giever, Network Theory

Dr. John Irwin, Special Summands in Abelian p-Groups

Dr. Don Lick, Sets and Domains of Convergence of Taylor Dirichlet Series

Dr. Arthur Kruse, Some Consistency Problems in Axiomatic Set Theory

Dr. Nathan Scarritt, Probability Theory on Algebraic Structures

Dr. Edward Thorp, Stock Market; Functional Analysis

Dr. C. Walker, Abelian Groups

Dr. E. A. Walker, Abelian Groups

Dr. Robert Wisner, Matrix Number Theory

RESEARCH AND THESIS ADVISORS OF GRADUATE STUDENTS

Dr. Edward Gaughan	3 doctoral research students
Dr. Edward Thorp	1 doctoral research student
Dr. John Irwin	1 doctoral research student
Dr. Fred Richman	1 doctoral research student
Dr. John Thomas	1 doctoral research student
Dr. E. A. Walker	1 doctoral research student

GRADUATE ASSISTANTS

Teaching		
	State general	24
Research		
	Research Associates	4
	Physical Science Laboratory	2
	Officers in Training Program	1
	Wallops Island Program	1
	Bell Telephone Program	4

GRADUATE FELLOWSHIPS

NASA Traineeships	2
NDEA Fellowships	2
NSF Cooperative Fellowships	1
NSF Science Faculty	2

PROPOSALS RESULTING IN GRANTS (Active during year)

- Dr. R. B. Crouch, National Science Foundation Facilities Grant, $210,000
- Dr. J. B. Giever, National Science Foundation College Institute, $50,000
- Dr. E. O. Thorp, Air Force Office of Scientific Research, $32,000
- Dr. E. A. Walker, NSF Research Grant, $40,000

GRANT PROPOSALS PENDING

- Dr. R. B. Crouch, National Science Foundation, A Program of Science Development at New Mexico

State University, *$5,306,900*

- Dr. E. D. Gaughan and Dr. R. J. Wisner, Freshman Tutorial Program in Mathewatics, *$3,445*
- Dr. John Irwin and Dr. Fred Richman, On the Structure of Primary Abelian Groups, *$72, 863*
- Dr. R. J. Wisner, Holiday Symposium. This program will cover a three-year period with a symposium being held each year. These symposia will be attended by mathematicians from all over the United States, *$15,917*
- Dr. R. J. Wisner, Undergraduate Research Participation Program for three years, *$31,500*

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