Department of Mathematical Sciences
ANNUAL REPORT 1993

November 23, 1993

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1 Special Recognition

Members of the department were recognized for their work in research and curricular activities. Assistant Professor Jerry Lodder was awarded a Joint Vice President/College Research Award to study in France and he delivered a plenary address at the conference on Homologie des algebres noncommutatives in France last summer. Professor Hung Nguyen spent the spring semester on leave as a Visiting Professor in the Endowed Chair of Fuzzy Theory at the Tokyo Institute of Technology. Associate Professor David Pengelley was honored with the *Award for Distinguished College or University Teaching of Mathematics* by the Southwest Section of the Mathematical Association of America. Professor Joseph Zund was elected a Fellow of the Royal Astronomical Society and was an invited speaker at the First International Symposium on the Mathematical and Physical Foundations of Geodesy, in Germany. The high school curriculum development program, coordinated by Dave Finston, Art Knoebel and Douglas Kurtz, was acknowledged by the National Council of Teachers of Mathematics and the Southwest Educational Development Laboratory. Finally, the department was recognized for its collective work on innovative calculus instruction as one of the four featured programs on the video conference, *Meeting the Challenge: Calculus Renewal*, which was supported by the National Science Foundation.

2 Personnel Changes

The department hired a new Assistant Professor this year, Arkady Vaintrob. After finishing a Ph. D. in mathematics at Moscow State University, Professor Vaintrob spent three years at the University of the Humanities in Moscow before going to the University of Texas, Austin, as an Instructor and Visiting Scholar. His research is on geometry, with interests in mathematical physics and mathematics education. Dr. Vaintrob was hired to replace Assistant Professor Aristomenis Siskakis, who resigned spring 1992 to accept a position at the University of Thessalonika, Greece. The department continued for a second year the appointment of Visiting Assistant Professor, Tony Wang, a statistician from the University of Windsor, Ontario, Canada. We will be interviewing during the current year to replace Dr. Carol Walker, who

accepted the position of Associate Dean of the College of Arts and Sciences and Director of the Arts and Sciences Research Center.

Over the summer, our half-time computer specialist position was converted to a full-time position. Laura Deibel, who was in the half-time position, accepted the full-time appointment in July.

3 Local Community Relations

The department is entering the fourth year of the high school mathematics program, directed by principal investigators Dave Finston, Art Knoebel and Douglas Kurtz, which incorporates discovery learning, cooperative learning and writing in mathematics. This work is funded by the Teacher Preparation and Enhancement program of the National Science Foundation. To date, thirty-two mathematics teachers from Las Cruces, Mayfield and Oñate High Schools have participated in the program, and eight new teachers have recently joined the effort. Several of the teachers, along with the principal investigators, have made presentations about the program at local and regional meetings. During the year, this program received recognition from the National Council of Teachers of Mathematics and the Southwest Educational Development Laboratory. The National Council of Teachers of Mathematics selected Mayfield High School as one of twelve schools in the nation to be part of case studies on how schools implement change and incorporate the recent NCTM standards in their schools. Mayfield was initially visited in the spring, and it was one of only four of the twelve which received follow-up visits this fall. The Southwest Educational Development Laboratory, one of ten regional educational labs in the country, selected this program as the New Mexico choice for its "Successful Practices" and "Alternative Assessments" programs. Additionally, David Finston and Douglas Kurtz were awarded funding from the state of New Mexico with an Eisenhower grant from the Commission on Higher Education and further funding from the State Department of Education and the Systemic Initiative in Math and Science Education (SIMSE) to work with local high school teachers Roger Greer and Marilyn Gutman to run a workshop about projects for middle school teachers from Las Cruces and Socorro.

For the fifth year in a row, the department hosted the "NMSU Math Challenge", three contests for high school students. Students from Las Cruces

High School, Mayfield High School, Oñate High School, Mesilla Valley Christian School, Deming High School, Gadsden High School and Hot Springs High School participated. Eight student teams from five area high schools spent a weekend solving an original modeling problem, 'Turning the Corner'. The top two teams were invited to the campus on March 6, 1993, to present their solutions orally to the judges and interested spectators. Later that same day, there was a quick-answer, fast-paced bowl contest where ten four-member high school teams competed against the clock and each other to solve problems from algebra, geometry, and calculus. In addition to the two team activities, 307 students from seven area high schools competed in a two-part sequence of written examinations. Eight top-scoring students were recognized with awards of calculators and t-shirts.

The department maintains several display cases in public areas in Science Hall, near the department office. These help to introduce visitors to the members of the department and to give them and us timely information about mathematical topics of current interest.

Two faculty members serve on a joint committee with members of the Dona Ana Branch Community College mathematics faculty. Their activities include publishing a mathematics problem solving contest in the *Round-Up*, working to develop a smooth transition from branch college to main campus mathematics courses, and arranging mini-conferences involving members of both faculties at the beginning of each semester.

One faculty member served as a judge in the Southwest Regional Science Fair. Another has been involved with the mathematics curriculum revision currently being conducted by the Las Cruces Public Schools. Two faculty members taught classes at elementary or middle schools, and one invited the students in her geometry course for elementary teachers to present projects at an elementary school.

4   Outside Relations

The department continued to take an active part in the national and international mathematics communities, and has been visible through publications, presentations and appointments to professional organizations. Several faculty members spent funded visits at prestigious institutions. The department continued to attract distinguished visitors to present lectures during their vis-

its to New Mexico State University. Our Holiday Symposium Series brings outstanding mathematicians to campus for a series of in-depth lectures; this year's main speaker is Clifford Taubes of Harvard University. We hosted the twice yearly New Mexico Geometry and Topology Seminar, which is run in conjunction with the University of New Mexico. (See section 8 on research.)

In another direction, the current research of Roger Hunter for his company *TCI Software Research, Inc.*, promises to have an impact on mathematicians around the world. This work centers on improving the interface between symbolic and numeric computations. This project began with the creation of the *Scientific Word* word processing system, an interface between the simplicity of the *Microsoft Windows* operating system and the computer type-setting system T$_{E}$X, the current standard for mathematical documentation preparation. The latest version of *Scientific Word* incorporates the power of the computer algebra system *Maple* to perform mathematical operations while working inside of *Scientific Word*. This gives the user a natural-language setup to input mathematics to *Maple*.

The Mathematics Learning Center has continued to host visitors who are interested in developing similar programs. As a result of a campus visit of two faculty in the spring, Indiana University-Purdue at Fort Wayne is currently establishing a pre-calculus program modeled directly upon the Learning Center structure.

Another way we gain recognition is through the performances of our students. Our success in the national Mathematics Modeling Competition continued this year, under the sponsorship of Caroline Sweezy, as two NMSU teams participated in the competition and one was acknowledged as a "Successful Participant". On a more regional level, we held our annual Honors Assembly Ceremony to honor achievement in mathematics. This year, after increasing our standards for selection significantly, fifty-three students were recognized.

For the second year in a row, Reinhard Laubenbacher was co-director of an NSF-sponsored summer enrichment workshop for talented high school mathematics students. One of our graduate students served as the senior support staff member for this program. The program ran at Colorado College during the summer and attracted over twenty students from the southwest and the nation.

5 Curricular Activities

The department has a long history of commitment to quality education and innovation in the presentation of mathematics, striving to address student needs. Members of the department have participated in several diverse educational development programs aimed at students taking higher-level mathematics courses. Some of this work is funded and some is not. The majority of the department's faculty members are involved in at least one of these programs. Our highly successful "student research projects" program has brought national attention to the department. The program emphasizes discovery learning through the inclusion of student research projects in the calculus courses. During the past year, faculty members have given workshops and talks about our projects program at regional and national conferences, and on other campuses. This has given us the opportunity to tell the mathematics community about the evolution of our ideas about the use of projects.

In October, California State University, Long Beach, broadcast a nationally televised video workshop, with funding from National Science Foundation. The four-hour workshop, *Meeting the Challenge: Calculus Renewal*, highlighted four calculus program by including mini-documentaries on each and having program developers on hand to answer questions. The mathematics departments chosen were from Harvard University, Duke University and Oregon State University, in addition to our department. David Pengelley went to Long Beach to appear during the live broadcast. The documentary filmed at New Mexico State University included interviews with Vice President Conroy, Dean Casillas and Walker, and Professors Cohen, Finston, Gehrke and Kurtz, in addition to segments filmed in classes taught by Marcus Cohen, Dave Finston and Mai Gehrke. It also included an interview with Jim Greene, a local high school teacher who has participated in our high school program. From the feedback we have already received, we know that conference has brought attention to NMSU and increased interest in our curriculum work at both the university and high school levels.

In a refinement of our original work with projects and motivated by newer faculty members becoming involved in the program, we have incorporated project-like activities into the classroom of our calculus classes, using assignments we call "themes". This involves the students in discovery based cooperative learning activities covering the core material of the course. We

have seen significant improvement in student success rates (on the order of 10% to 15%). Though we have not had the chance to formally evaluate the use of themes, these initial indications are quite positive. We have made several presentations on our use of themes, getting very positive receptions. The executive director of publications for the Mathematical Association of America has solicited a proposal for a book about our themes courses.

Marcus Cohen and David Pengelley were supported by a grant from the National Science Foundation to disseminate the ideas of our calculus program and to develop student research projects in calculus, vector calculus and differential equations. They presented workshops and presentations around the country explaining their program, and they and other involved members of our faculty are in demand as speakers at conferences and workshops. Their book *Student Research Projects in Calculus*, written with Ed Gaughan, Arthur Knoebel and Douglas Kurtz, published by the Mathematical Association of America, has sold over 2500 copies in its first two years and is already in its second printing. The work on vector calculus and differential equations courses was conducted by Marcus Cohen, who is currently bringing these ideas into our third semester calculus course and working on a book about these assignments.

During the 1991-1992 academic year, the members of the department selected a new text book for our scientific calculus sequence. In conjunction with this new text and based on our experience with projects in calculus, we completely redesigned the syllabi for these courses, removing topics where appropriate and streamlining the course more in line with our current ideas about mathematics education. During this process, we met with representatives of the College of Engineering and the Departments of Computer Science and Physics about these revisions, as well as contacting the mathematics departments at our branch campuses for their feedback. The success of these meeting led us to continue to meet with these faculty this past year. Based on our discussions, we are revising the content of several other mathematics courses — differential equations and linear algebra — to better meet the needs of the university. Currently, we are meeting with faculty members from agriculture, business, biology and chemistry to discuss our Math 142G course, a calculus course that serves their students, and we plan to continue these discussions to revise other courses as well.

This process of meeting with faculty members in departments that are "customers" of specific mathematics courses serves as an example of an in-

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creasing departmental awareness of the concept of Total Quality Management. The department is implementing TQM principles in various ways. Our involvement with the Dona Ana Branch Community College and the Las Cruces Public Schools represents avenues of communication with some of our "suppliers". Frank Williams represented the university at a national institute on TQM in higher education. Departmental faculty are increasingly making use of TQM principles in their courses, and much of the curriculum development listed in this report makes use of these principles.

We are using two mastery-based skills examinations in calculus, one for differentiation skills and the other for integration skills. We continue to refine the tests and their implementation each semester. The members of the department are somewhat divided on how best to use these instruments and we are looking for alternative ways to use them.

The use of projects and themes has been adapted to many other courses in the department. In addition to the courses mentioned above, faculty members have used such assignments in finite mathematics, linear algebra and geometry. Ideas about discovery learning and cooperative learning have been incorporated into many of our advanced courses, including some graduate courses.

During the year, we created a computer lab containing computers equipped with the mathematics word processing and computing software *Scientific Word* with *Maple*. The software allows for easy input of mathematical expressions and performs numerical and symbolic computations. Students in our sophomore-level linear algebra course and several graduate courses use this software. In addition, this software serves as the foundation for a new test-generation system which was developed by *TCI Software Research, Inc.*, for use by the Mathematics Learning Center.

In line with the developments in calculus, a proposal for a joint effort involving research and college faculty was submitted to NSF to introduce project-like materials in our precalculus classes, college algebra and trigonometry. Though this proposal was not funded, we are continuing to pursue this goal. This program will benefit from the curricular programs at the local high schools and in our calculus courses. It will create a consistent collection of courses at the high schools and the university.

The Mathematics Learning Center, with funding from the National Science Foundation, purchased 120 hand-held graphing calculators and piloted their use in three sections of college algebra in spring, 1993. This fall, stu-

dents in all sections of college algebra and trigonometry are required to use a graphing calculator in class, on their homework, and for testing. We are using a new college algebra text that fully integrates the graphing calculator and a new trigonometry text that includes graphing calculator activities. We are undergoing a process of modifying our traditional requirements in order to more fully realize the opportunities for student exploration and problem solving afforded by this new technology. Although support was promised for only one brand of calculator, students are using a variety of models and we are attempting to respond to student needs. A student survey done in October indicates that most students applaud the new requirement.

Faculty members are active in the Honors program at the university. Reinhard Laubenbacher and David Pengelley continue the development of two courses offered jointly as Honors and Mathematics courses, and both approved for General Education: a sophomore course "Spirit and Evolution of Mathematics" and a senior level course "Great Theorems: The Art of Mathematics". The sophomore course meets the mathematics General Education requirement, and the senior level course meets the "viewing a wider world" General Education requirement. These courses have received tremendous support from Tom Hoeksema, director of the Honors program, and Laubenbacher and Pengelley are working on manuscripts of books from both courses. They have recently been awarded funding from the National Science Foundation for this work.

The department has taken a leadership role in the university's General Education program with the introduction of four new courses (Math 110G, Hon/Math 275G, Hon/Math 411G, Stat 210G) and revision of two others (Math 112G, Math 142G) to meet the General Education guidelines. Math 110G (Mathematics Appreciation) presents a broad view of mathematics, outlining important directions of the discipline. Both Math 110G and Stat 210G (Statistics for Contemporary Living) strive to impart an understanding and appreciation of what mathematics is and how it affects people's lives. Math 112G and Math 142G have been expanded to encompass the spirit of General Education. A resource binder has been created for Math 142G to help future instructors; it includes videos, research projects, work sheets, manipulatives, historical enrichment information, and topics for essays and term papers. Hon/Math 275G and Hon/Math 411G view mathematics as a human endeavor and discusses great mathematical ideas in the historical context in which they developed. All of these courses are designed

from the point of view that education about mathematics should be for the mathematically inquisitive, not just for the mathematically talented.

Ray Mines and Frank Williams were supported by the National Science Foundation in a joint effort with faculty members in Computer Science to develop coordinated courses in beginning computer science and finite and discrete mathematics. They are revising the mathematics courses that computer science students take as part of their major, in order to synchronize the teaching of materials in mathematics and computer science courses. This work explicitly applies Total Quality Management principles to the improvement of student learning.

Ray Mines, in conjunction with Richard Cabe of the Department of Economics, has developed a course "Fun and Games" that was offered for the first time in the Spring. They plan to propose it as a continuing course in the future.

Three of our graduate students completed their doctorates in 1993. Christopher Stuart wrote a thesis titled "Weak Sequential Completeness in Sequence Spaces" under the direction of Charles Swartz; he accepted a position at Loyola University in Chicago. Gamal Hussien's thesis, "Baer Near-rings and Near Rings with Boolean Orthogonalities," was written under the direction of Joseph Kist and Arthur Kruse. Xiao-Min Wang completed her thesis, "Asymptotic Validity of the Bootstrap in Non-regular Models," under Hung Nguyen. Both Gamal and Xiao-Min have completed their work during the fall semester. The department also awarded ten master's degrees in 1993. There are sixteen new mathematics graduate students enrolled this year, for a total of thirty-three full-time students, and eight part-time students. The Graduate Studies Committee made a proposal to the department to include a foreign language requirement for the Ph. D. degree. This was revised and accepted by the departmental faculty members.

As part of the department commitment to helping students with special needs, Sandra Geiger is assigned as Special Students Program Coordinator to monitor students who are handicapped, have learning disabilities, or are experiencing great difficulties in their classes. In particular, she monitors students repeating a Mathematics Learning Center class more than one time. She also tracks Native American students and acts as liaison with the American Indian Program Office and Student Support Services. She is also the departmental Americans with Disabilities Act (ADA) contact.

One of the strengths of our program is the participation of graduate stu-

dents and talented undergraduates as tutors and graders in the Mathematics Learning Center. This provides a history of experience with the peer-tutoring aspect of learning, which is inherent in the cooperative learning projects now taking place in many of our other classes.

We currently have several courses under revision or development. We are implementing a revised program in discrete mathematics, following course development supported by the grant with Computer Science. Algebraists in the department plan to develop new applied algebra courses at the junior and senior levels. Faculty members are involved in creating an undergraduate course in topology and a graduate course on braid groups, which has applications to mathematics and physics. As part of the program to assess the outcomes of student learning (see the following section), we are creating a seminar course for mathematics majors. Mathematics faculty members are involved in discussions of a possible new interdisciplinary doctoral program in cognitive science.

Our Teaching Committee is active in overseeing the coordination of multi-section courses and classroom observations of faculty members and graduate student teaching assistants. This year, they are sponsoring a series of teaching colloquia, which have included topics such as the use of *Scientific Word* with *Maple* in mathematics classes and Total Quality Management in higher education.

As mentioned above, the department is active in curricular programs outside the university. The high school mathematics teacher enhancement program has brought national attention to Mayfield High School. Work on a resource book about the high school projects, designed for high school mathematics teachers, is underway. An outgrowth of this program is the work of David Finston and Douglas Kurtz with local high school teachers Roger Greer and Marilyn Gutman to run an institute about projects for middle school teachers from Las Cruces and Socorro. The middle school teachers are currently using some of the seventy five projects they wrote at the institute. Of the twenty-one institutes funded by the Commission on Higher Education, the State Department of Education and the Systemic Initiative in Math and Science Education for summer, 1993, our institute was the most highly rated by participants and the SIMSE staff. Moreover, our institute is being used as the model of a successful institute for the remaining four years of the program, and guidelines for future institutes have been rewritten so that they conform more closely to ours.

The summer enrichment program for high school students, co-directed by Reinhard Laubenbacher, continued this past summer. According to student evaluations, this program was phenomenally successful at encouraging students to continue their study of mathematics. Cynthia Woodburn, one of our graduate students, was the senior support staff member for this activity.

6   Assessing the Outcomes of Student Learning

Members of the department have spent the past year developing initial proposals for assessing of the outcomes of student learning (outcomes assessment) of our undergraduate majors and graduate students. Working with little direction and no funding, we have been able to devise useful models to begin the implementation of outcomes assessment for the department. At the retreat in January conducted by Dr. Nichols, we were complimented on the quality of the first draft of our model for undergraduate outcomes assessment (which we had less than twenty-four hours to draft). The department's leadership role in this area is enhanced by the participation of Richard Bagby on the university's Outcome Assessment Committee.

The undergraduate program evaluation includes a seminar course for mathematics majors and a survey for graduates of our undergraduate program. We have drafted questions and begun to work with the Institutional Studies office at the university to conduct the survey. Members of our Undergraduate Majors/Minors Committee has begun to design the format of the seminar course this fall. The Graduate Studies Committee has submitted a proposal for the graduate program. This too involves a survey of graduates with advanced degrees that has been submitted to the Institutional Studies office.

7   Computing Facilities

The department currently has thirteen *Sun* computers, one *NeXT* computer, twenty-seven *IBM* compatible 486-based PC's, eight *IBM* compatible 386-based PC's, eight 286-based PC's, many *IBM* PC's of an earlier vintage, one *MacIntosh*, and an assortment of terminals. These machines are used by

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faculty members and graduate students for research and for the preparation of teaching materials and the handling of student grade records.

We created a computer lab incorporating state-of-the-art equipment and software. A small equipment grant from *IBM*, support from the Arts & Sciences Research Center, and a software grant from *TCI Software Research, Inc.* allowed us to purchase and network eight 486-based PC's. This lab has been used for students in sophomore-level and senior-level linear algebra courses and a graduate-level algebraic number theory course. We plan to use money from Instructional Equipment Bond Issue Funds to add several more computers to this lab. Three 286-based PC's, provided with educational software that addresses the development of skills in algebra and trigonometry, are being used by students in the Mathematics Learning Center.

This year, we have reconstructed the network in Walden Hall. This took place in four segments: (1) take Walden Hall off of the main university trunk line and connect Walden Hall to our network in Science Hall; (2) rebuild the network for the first floor faculty offices; (3) rebuild the Mathematics Learning Center network; and, finally, (4) rebuild the network for the second floor faculty offices. All of this work should be done by the end of the year.

8   Research Activities

Members of the department have been productive in research this past year. Twenty-seven of the tenure-track faculty members had a total of thirty-seven papers appear in print, thirty-four papers accepted for publication, and twenty-seven papers submitted for publication. In addition, they published one series of textbooks for elementary school mathematics books. Faculty members also have at least seven books in preparation, including two research texts, a translation, graduate and undergraduate texts, and college level and high school level educational resource books. Faculty members presented twenty-eight talks on their research at conferences and twenty talks at other universities, and delivered three workshops on curricular development and mathematics education.

Much of the research being conducted by members of the department is joint work with faculty members at other institutions. Several are conducting research while on leave from the university: Susan Hermiller at the at the Mathematical Sciences Research Institute in Berkeley, California, and at the

University of Melbourne; Hung Nguyen in the chair of Fuzzy Theory at the Tokyo Institute of Technology; and Gerald Lodder at the Université Louis-Pasteur in Strasbourg, France. Art Knoebel (University of New Mexico), Reinhard Laubenbacher (Cornell University), Caroline Sweezy (University or Chicago) and Carol Walker (Florida Atlantic University) spent part of the year on sabbatical leave working with researchers at their host institutions. Three of our graduate students earned their Ph. D. degrees this past year, and several of them continue to do research with their advisors.

Several faculty members received continuing support for their research. Joseph Zund was supported by the Air Force for research in mathematical geodesy, Patrick Morandi and Susana Salamanca-Riba, received individual research support from the National Science Foundation for work in algebra and Lie group representations, David Finston and Mai Gehrke were supported by a grant from the National Security Agency for research in algebra and logic, and Susan Hermiller was awarded a grant from the Division of International Programs at the National Science Foundation to conduct research in Australia. Roger Hunter continued his Small Business Research Innovations grant Phase II from the National Science Foundation for development of an interactive computational enhancement of the scientific document processing system *Scientific Word* which he produced under the SBIR Phase I grant. Eight faculty members have conducted funded educational research work on seven projects during the past year; some of these projects involved joint work with the Department of Computer Science or the high schools in Las Cruces.

This year's Holiday Symposium Series, which will actually take place in January, 1994, will host a research conference on analytic gauge theory, featuring Clifford Taubes as the main speaker. The symposium will be funded by the Conference Board of the Mathematical Sciences. Over eighty mathematicians are expected to attended this year's event, and several of them will present talks. Plans for next year's symposium are already underway. Professor Bernd Strumfels of Cornell University has expressed his interest in preparing lectures on 'Gröbner bases and their applications."

The New Mexico Geometry and Topology Seminar was started several years ago by mathematicians at the University of New Mexico and New Mexico State University to bring them together twice a year. We continued to co-host the seminars and three of our faculty members, Jerry Lodder, Arkady Vaintrob and Frank Williams, spoke at the one this fall.

The department sponsors several weekly seminars and a weekly colloquium. The seminars specialize in algebra, harmonic analysis, functional analysis, mathematical physics, statistics, and algebraic topology. Almost all faculty members and many graduate students attend at least one of the seminars.

To give a sense of the active research groups in the department, below is a list of areas of research and the faculty members active in those areas.

Algebra: Faculty members in algebra include David Finston, Mai Gehrke, Susan Hermiller, Roger Hunter, Arthur Knoebel, Reinhard Laubenbacher, Ray Mines, Patrick Morandi, Susana Salamanca-Riba and Carol Walker. The algebraists, together with several graduate students and other interested faculty members, held weekly research seminars throughout 1993. Five algebraists are currently supported on research grants.

Analysis: Analysts include Josefina Alvarez (1990), Richard Bagby, Joseph Kist, Douglas Kurtz, Joaquin Loustaunau, Charles Swartz, and Caroline Sweezy. The analysts in residence held weekly research seminars in 1993.

Topology: Gerald Dunn, Gerald Lodder, David Pengelley, Ross Staffeldt and Frank Williams work in various areas of algebraic topology and K-theory. They met weekly throughout 1993, together with graduate students, for a research seminar. Mark Mandelkern works in constructive topology and analysis. Jerry Lodder was a recipient of a Joint Vice President/College Research Award to continue his work in France.

Logic, **Foundations and Philosophy**: Mai Gehrke is also a logician. Arthur Kruse is the senior researcher in logic and foundations. Ray Mines has research interest mathematical philosophy. Mark Mandelkern, Ray Mines and Bill Julian continue to contribute in areas of constructive mathematics.

Mathematics Curriculum: Three different National Science Foundation curriculum development or teacher enhancement grants were in effect during 1993, with Principal Investigators Marcus Cohen, David Finston, Arthur Knoebel, Douglas Kurtz, and David Pengelley. David Finston and Douglas Kurtz were awarded funding from the state of New Mexico with funds from CHE, SDE and SIMSE to run a workshop about projects for middle school teachers. Ray Mines and Frank Williams held a curriculum development grant for development of discrete mathematics courses and introductory computer science courses, jointly with Computer Science faculty.

Applied and Computational Mathematics: Joseph Zund has estab-

lished an international reputation in mathematical geodesy and has a research contract with the Air Force supporting his research in this area. William Julian (mathematical astronomy), Marcus Cohen (mathematical physics and biology), Ernest Barany and Arkady Vaintrob (mathematical physics) and Roger Hunter (scientific document processing) are active applied mathematicians.

9   Professional Service Contributions

The members of the department play an important service role to the mathematical community. Two faculty members served on the editorial boards of seven journals. Twenty members of the department served as referees for journals and books, reviewers for the two major mathematical abstract journals, and referees for grants to the National Science Foundation and the National Endowment for the Humanities. Five faculty members took part on conference organizing committees. Josefina Alvarez, David Pengelley and Carol Walker serve on national committees of the American Mathematical Society or the Mathematical Association of America. Several faculty members serve on advisory boards for educational programs.

There were members of the department on the Faculty Senate, the Faculty Library Committee, the University Appeals Boards, the University Discipline Committee, the Advisory Council on Administrative Policy, and Outcomes Assessment Committee. Our faculty members served as outside members on tenure and promotions committees for eight departments in the college. We have representatives on the Faculty Affairs, Improvement of Instruction and Student Relations, Planning, Research Affairs and Networking Committees. Faculty members also serve as advisors in the College of Arts and Sciences Advising Center and as advisors to student organizations.

10 Advanced Degrees Awarded 1993

Name	Degree
Gamal Hussien	Ph.D.
Dissertation: "Baer Near-rings and Near Rings	
with Boolean Orthogonalities"	
Co-advisor: Joseph Kist	
Co-advisor: Arthur Kruse	
Christopher Stuart	Ph.D.
Dissertation: "Weak Sequential Completeness	
in Sequence Spaces"	
Advisor: Charles Swartz	
Xiao-Min Wang	Ph.D.
Dissertation: "Asymptotic Validity of the	
Bootstrap in Non-regular Models"	
Advisor: Hung Nguyen	
David Emery	Master's
Advisor: Patrick Morandi	
Daniel Gagliardi	Master's
Advisor: Ross Staffeldt	
David Harris	Master's
Advisor: Charles Swartz	
Chun-Sheng Huang	Master's
Advisor: Richard Bagby	
Hui-Chuan Huang	Master's
Advisor: Joaquin Loustaunau	
Jillian Lee	Master's
Advisor: Charles Swartz	
Diane Martinez	Master's
Advisor: Charles Swartz	
James Strange	Master's
Advisor: Josefina Alvarez	
Karen Trujillo	Master's
Advisor: Douglas Kurtz	
Wei Zhang	Master's
Advisor: Charles Swartz	