THE UNIVERSITY of NEW MEXICO

To: Mark Peceny, Dean
College of Arts and Sciences

From: Terry A. Loring, Chair
Department of Mathematics and Statistics

Date: April 13, 2012

Re: Action Plan in response to the 2008 Academic Program Review

Background on the Program Review

Almost four years have elapsed since the site visit in April 2008, and since then three key people involved in the Self Study are no longer with the department: Alejandro Aceves, Kristoff Galicki and Donna George. With this in mind I would like our associate chair, Deborah Sulsky, to assist me in representing Mathematics and Statistics at the Action Plan meeting. Together we should be able to guide the team through all the changes which have occurred in the department since 2008.

Changes in Professors

Since the APR was written we have had further erosion in the ranks of our Professors, as evidenced by the table below:

Tenure-Stream Faculty	F1993	F1999	F2006	F2011
Applied Mathematics	13	11	10	9.5
Pure Mathematics	15	11	10	7
Statistics	7	9	6	6
Math Ed	2	1	1.5	2
Total	37	32	27.5	24.5

These numbers are based on data obtained from the Office of Institutional Research and the 1993 and 1999 UNM catalogs. These data reveal a disturbing drop in the number of Tenure-Stream Faculty between 1999 and 2011.

To put the numbers in perspective, note that we have three PhD concentrations: Pure Math, Applied Math and Statistics. At the undergraduate level we have two additional concentrations,

Mathematics Education and Mathematics of Computation.

Changes in Buildings

At the time of the APR site visit in 2008, our main facilities were in the Humanities building with some offices in Hokona Hall. The new Science and Mathematics Learning Center (SMLC) was supposed to "unite the previously scattered mathematics department" but at present Mathematics and Statistics is still housed in two buildings: the SMLC and the Humanities Building. The SMLC is our main facility and includes offices for some of our part-time instructors, graduate students and professors *emeriti*. It is unfortunate that the SMLC doesn't have quite enough room for the part time instructors and some emeritus professors, whose offices are located in the Humanities building.

Changes in strength of Groups

Only the Mathematics Education group has grown since 2008, due not to a new hire but to the fact that Professor Nakamaye moved there from the Pure Math group. Much of his research is in mathematics education and all of his teaching now supports our undergraduate degree in Math Ed. This group is substantially smaller than the others because we do not have a graduate degree in mathematics education.

Regarding the other three groups (Applied Mathematics, Pure Mathematics, and Statistics) which support both undergraduate and graduate degrees, only Applied Math has retained its 2006 size of 9.5 faculty members. Pure Math has shrunk from 10 to 7 faculty since then, and Statistics has had such high turnover that currently there is only one Statistics professor with tenure. All three areas are now in a "dangerous situation," to quote the Reviewer's Report. However, the planned hires of one full professor in Statistics, one Assistant or Associate Professor in Statistics, two Assistant Professors in Pure Math, and five Pre-Calculus lecturers will help considerably beginning Fall 2012.

Academic Program Review Committee Recommendations

Recommendation 1: Create some visiting professor lines, and bring some senior visitors immediately (originally for AY 08-09) to help with teaching and research.

Post-doctoral fellows, and professors visiting from other Universities, are critical for a small department in the mathematical sciences. Because we cannot have experts in all areas, the interchange of ideas follows the interchange of personnel. As we are generally not tied to physical laboratories, mathematical sciences typically utilizes this flow of personnel to a great extent. In recent years, however, our department has not been able to do so due to lack of financial resources.

Our short-term goal is to have one or two post-doctoral positions, each with a modest teaching load, filled every year starting FY13. We are managing carefully the endowed funds, in our

Efroymson account so that a three-year post-doctoral fellowship in Pure Mathematics will soon be possible. The MCTP grant (see response to recommendation #4) will provide some post-docs starting next year. We are set to meet this goal for several years, but need to plan for FY16 when the resources from the MCTP grant and the Efroymoson fund run low.

Recommendation 2: Hire 2 senior & 3 junior faculty members in Statistics over the next 3 years, and hire at similar level in Applied Math to replace lost positions.

We hired two assistant professors in Applied Mathematics to cover most of the losses that were anticipated in 2008. In Statistics we also hired three assistant professors, but with a less desirable outcome due to our inability to retain Statistics faculty. Besides G. Huerta, who is currently on leave without pay with an uncertain return date, we have only one tenured professor in Statistics. The other four faculty are assistant professors.

The underlying message in this recommendation is, however, very much valid today. We need to reverse some of the losses in the three groups that are struggling to support PhD programs. Our goal is to rebuild in a few years to where we have 12 professors in Pure Math, 12 in Applied Math and 12 in Statistics. If current search and retention efforts are successful, by Fall 2012 we will have 9 professors in Pure Math, 9.5 professors in Applied Math and 8 professors in Statistics. This gets us close to the desired strength of our department, which we hope to attain by 2015.

We are in the process of hiring additional permanent lectures, although our lecturers do not substantially help in supporting our seven degree programs. Rather, they are part of our effort to teach fewer core and service courses by part time instructors. The Reviewer's Report commented on this, stating that "Higher dependence on instructors who are hired on a semester by semester basis with funding uncertainty is affecting morale and quality of instruction may be suffering." (See Recommendation 10 for more details regarding Part Time Instruction.)

Recommendation 3: Encourage joint appointments to foster multidisciplinary research.

Applied Mathematics and Statistics are inherently interdisciplinary. Also, in our Pure Mathematics group, it is not uncommon for faculty to publish in physics or engineering journals or conference proceedings.

Although there are impediments to joint appointments, such as ambiguity in tenure standards and a difficulty in finding a pool of candidates that two departments find very well qualified, we are working at several levels to remove these. For instance, in the department we are working on a hiring plan that will allow a flexible response to possible joint appointments that arise during regular one-department searches. A clear and fair tenure process is essential if we are to make additional junior-level joint appointments. We are working with the college to clarify the process for tenure involving two departments.

With the assistance of the Dean, we can plan methods to utilize funding via joint appointment or otherwise from sources such as BA/MD, the cell signaling group, and the Center for Quantum Information and Control (CQulC).

Recommendation 4: Encourage Math Education initiatives in department

This APR recommendation did not distinguish Math Education outreach efforts from research in teaching methods in the Math Education group. Still, it points out the necessity of keeping our BA in Mathematics Education healthy so that courses taken by students within, or heading to, the College of Education are taught exceptionally well and advantage can be taken of the research and funding opportunities related to the teaching of mathematics.

Much of what happens in mathematics education is best seen as a joint responsibility of our department and the College of Education. Professor Rick Kitchen has a joint appointment in Mathematics and the College of Education; we would be wise to utilize him as a bridge between the colleges.

While the APR describes mathematics education initiatives as "low cost, high return," there is no specific budget for outreach in the College of Arts and Sciences. With budgets tighter now than they were in 2008, these initiatives cannot be funded (as they have previously) by diverting resources that are intended for teaching our service courses. The department would like help in finding funds on campus and elsewhere which can be utilized for outreach initiatives.

The "Mentoring Through Critical Transition Points" (MCTP) program was mentioned in the APR as there was a proposal pending at the NSF for substantial funding at the time of the visit. This grant was awarded, and all indications are that we will be successful in getting another 1.2 million dollars to support our MCTP program for another four years starting Summer 2012.

The UNM-PNM mathematics contest has been an annual event since 1966. The contest allows high schools to offer a high-level competition for their students that can be a great advantage for gaining admissions to elite colleges. The Albuquerque portion of the contest includes a public lecture in mathematics. Certainly this contest helps with undergraduate recruitment to STEM majors, and it provides statewide recognition to students who excel in mathematics. A grant of about $15,000 from PNM pays for costs such and prizes and bringing in an outside speaker. It does not, however, cover the one-semester course reductions given to the two faculty who run this event.

The most exciting thing the department of Mathematics and Statistics is doing in the way of Math Education is finding a better way to deliver the instruction of Pre-Calculus courses. In the Fall of 2011, the Dean of the College of Arts and Sciences gave us this charge. A working group led by Dr. Tamra Mason, our director of Pre-Calculus, was formed and immediately began focusing on Math 120, Intermediate Algebra. This course was chosen because it is known as a "killer course" due to low pass rates. The working group has now identified an emporium-style delivery for Math 120 content. Emporium Math takes students out of instructor-led lectures and into a computer lab monitored by trained faculty and graduate students, and it has proven to be highly successful at many other colleges and Universities including Kent State. President-elect Frank would like Emporium Math to be fast-tracked, with plans for a 5-section pilot to be rolled out by Fall 2012 and full roll-out by Fall 2013. At the time of this writing software is being chosen and campus planners are working on finding a suitable space.

Recommendation 5: Postpone discussion of separating Mathematics and Statistics until hiring plan (recommendation #2) is implemented and Stats has at least 10 faculty members.

We agree with this recommendation and have postponed further discussion. As mentioned in recommendation #2, we need to have 39 professors in the department: 12 in Pure Math, 12 in Applied Math, 12 in Statistics (with at least 3 of those being senior members), and 3 in Math Education. These are the degree programs we offered in 1993 when we had 37 professors, and we feel these numbers represent the minimums necessary for a department to successfully run three PhD-level, three masters-level and four undergraduate-level disciplines.

To explain how we arrived at these numbers, consider two institutions in Arizona. The Mathematics and Statistics Department at Northern Arizona University has only masters-level and undergraduate programs, and they have 28 professors. At Arizona State University, where they offer one more PhD program than we do, the School of Mathematical and Statistical Sciences has 64 professors. The free-standing Department of Statistics at Oregon State University has 12 professors for programs that include a PhD. The department of Mathematics and the department of Applied Mathematics at the University of Colorado at Boulder have 16 and 26 professors, respectively.

There are good arguments for and against Statistics as a separate department. By separating the departments each would be assured faculty well-versed in the teaching and research of the specific discipline. Tenure decisions requiring comment on specific training and publication standards would be made by faculty with more knowledge of the field. And colloquium speakers would be able to engage their specific audience, whereas now, speakers at UNM are typically unprepared to address both mathematics and statistics audiences. On the flip side, as a joint department we have an easier time hiring in an area such as Probability, which is not clearly in either discipline. Moreover, many of our graduate students will find employment in predominantly undergraduate campuses where faculty may be called upon to teach both basic statistics and mathematics.

The Statistics group needs to be strong enough to make a separate department a real possibility, even if the department chooses to stay unified. With 10 faculty members in Statistics, our goal of splitting Statistics to a separate department, perhaps with the hire of an external chair, might then be in reach. We would, however, need appropriate office space in order to make this a solid, viable department.

Recommendation 6: Reduce course load for faculty with active research grants to 2-1.

The chair and executive committee discussed this and agree there is a need to address the teaching over-loads which occur in our department. These overloads are due to the advising of graduate students, the organizing of working seminars and the direction of individual studies. Some researchers with grants receive funding for buyouts which cover their time appropriately; others do not. Thus we wish to address a broader issue, which is the overburdening of many of the very active researchers in our department.

We agreed that we must find a way to allow senior faculty to take research semesters, and also allow temporary reduced teaching loads for faculty starting up complex projects or writing complicated grant proposals. For example, whoever is the PI on the MCTP grant has a huge administrative burden during some semesters.

With funding assistance of $25,000 per year, we will be able to provide research semester opportunities for our senior faculty. The department will address the reduction in teaching loads internally by setting aside a portion of our F&A funds to cover course buyouts for faculty with high graduate student advising loads.

The buyout policy for grants in Arts & Sciences has been fixed for grants applied for after August 2012, allowing a return of 100% of the funds to the department. As we have many grants that were obtained under the old policy, we are requesting a one-time allocation of $30,000 to assist with funding postdoctoral fellows in the next year. At this time we only have access to the part-time budget, which is inadequate for compensating, at market rates, teaching by a research fellow with a PhD.

When we advertise for a new hire, we are competing against many schools that have a lesser teaching load. In order to stay competitive we may need to reduce the teaching load for all research active faculty to 2-1.

Recommendation 7: Explore collaborative research with the research centers and other successful departments.

Collaborative research with centers and departments on campus must be balanced with collaborative research that occurs between institutions. The APR did not address the needs of researchers in our department who are, or wish to, conduct joint research in subject areas not well represented on this campus.

There are distinct advantages to both on-campus and inter-campus collaboration. On-campus collaboration allows for cooperation in two graduate programs. Inter-campus collaboration leads to great contacts at other institutions that will assist our graduates in obtaining employment.

To explore these collaborative research opportunities, the department plans to conduct formal discussions and workshops with on-campus researchers in focused research topics in order to find common research interests and funding opportunities. We hope to accomplish this by June 2012. In preparation we have already set aside some department funds to cover talks that are jointly sponsored by other departments.

Recommendation 8: Apply for NSF SCREMS grants; use student fees or other sources to invest in upgrading computers for students.

The APR correctly identified structural imbalances with regard to investing in computing. The Mathematics and Statistics department uses substantial computing in research and is increasing the use of computers in instruction. We were grateful for the computing equipment, including a 5-node computing cluster and 18 workstations that were installed in the new SMLC when it

opened. However, finding funds for equipment is actually easier than finding funds to maintain that equipment, which makes budgeting difficult.

An exemplar here is our visualization lab which houses the computing cluster and specialized graphics, projection and communications equipment. A donation from Bank of America paid for leading-edge equipment and capital funds created the physical space. But our department must try to maintain this equipment with our own IT group (of one). The size of our IT "group" is smaller than it was two years ago, yet computing needs increase yearly. Since NSF SCREMS will fund only "limited support for professional systems administrators", we should be seeking funds for replacing IT personnel before acquiring more equipment.

The College is requesting student fees to help with computing resources for instructors.

Recommendation 9: Set up a common departmental tutorial room for the TAs to meet their students.

Our new SMLC building, completed in 2011, has such a room. Although it is possible that we may lose this room if we are to accommodate the new lecturers being hired to better deliver pre-calculus beginning Fall 2012, the SMLC has many other common areas currently meeting this need.

The chair and executive committee thought this seemed to be minor space issue in relation to the more serious space issues facing our department. Specifically, we have offices in two buildings that are 0.25 miles apart. It is likely that the new Math Learning Lab being designed for emporium style teaching will end up in a third location. Mathematics and Statistics would increase its functionality by being unified in one area of campus, even if it's not possible to be one building.

Recommendation 10: Allocate permanent budget lines to manage PTI hiring.

The recent actions of our dean and provost are leading to a replacement of some PTI funding by permanent lecturer funding, and there are plans to stabilize what PTI funding will remain. Mathematics and Statistics would like to hire enough lecturers to coordinate all 100 level courses, and currently is conducting a search for five new Pre-Calculus lecturers which will start in August 2012.

Recommendation 11: Use lapsed salary from course buyouts, sabbatical leaves and vacant positions to bring visitors and cover upper level courses.

In the 1990s we utilized resources such as research opportunity award supplements to NSF grants, course buyout funds, and the attractive nature of our sunshine to keep a flow of visitors to the department. Due to budget cuts this practice essentially stopped by 2008.

The College of Arts and Sciences is now helping to revise the accounting rules so that course buyouts from grants will return fully to the department. With an equitable cross-unit buyout policy we could buy-out time of Biostatisticians on North Campus to assist for a few years with

Statistics teaching and PhD student advising.

We also plan to fund teaching of a few courses, especially advanced service courses such as junior level differential equations and topics courses at the graduate level, to encourage sabbatical visitors. What is needed is funding matching the level we use for course buy-outs, which is at least $7,000 per course per semester. This is an important complement to the buyouts that faculty get from grants, so that we are properly replacing a professor's teaching. This will also assist us in planning around sabbaticals.

Recommendation 12: Develop a 5 year hiring plan consistent with University goals, resources and national needs.

The College of Arts & Sciences just recently disseminated its new document titled *Hiring Plans: Annual Submission and College Review Process* to all department chairs and directors. Included is a requirement for a "summary and justification of projected growth or faculty staffing needs for the next five or more years." It was reassuring to receive a concrete set of guidelines and refreshing to see long-term hiring planning encouraged. The Department of Mathematics and Statistics approved a five-year hiring plan in April of 2012 and this was submitted to college.