Department of Mathematics and Statistics: Program Review Fall 2010

The UAF Department of Mathematics and Statistics offers a total of seven degrees. The baccalaureate program offers a BS and a BA in Mathematics and a BS in Statistics. At the graduate level, the Department offers an MS, MAT, and PhD in Mathematics and an MS in Statistics. Starting Fall 2010, however, the BS in Statistics no longer exists as this degree was folded into the BS in Mathematics as an elective package option. (It is effectively the same degree with some modest strengthening of the degree requirements.)

a. Prospective Market

The Alaska Department of Labor provides an Alaska Occupational Forecast to 2018 (see http://www.labor.state.ak.us/research/iodata/occproj.htm#ed). According to this study, Middle School Teachers, Post Secondary Teachers, and Secondary Teachers are three of the 23 so called "Top Jobs" that require bachelor's degrees or above. All mathematics teachers in these categories will require at least a bachelor's degree in mathematics. Post Secondary teachers require additional graduate study. Notably, six more of the 23 occupations in the Top Jobs list are scientists or engineers all of which require significant mathematical education at the university level. This site also forecasts that both Statistician and Operations Research Analyst (essentially an applied mathematician) are occupations with increasing demand in Alaska.

The U.S. Department of Labor's Bureau of Labor and Statistics provides an Occupational Outlook Handbook (see http://www.bls.gov/oco/). In this handbook, Mathematicians, Actuaries, and Operations Research Analysts are described as occupations with much faster than average growth. Post-secondary teachers are expected to have faster than average growth. While employment for K-12 teachers is expected to be about average, mathematics is described as a high demand field with the best prospects. Statisticians are forecast to experience average growth.

Students completing graduate degrees from DMS have reliably been successful at the next stage of their careers, either finding employment in their chosen field or proceeding to further graduate study. Evidence of this can be seen from the CNSM Table of Graduate Employment. Of the six graduates in 2009-2010, five have found appropriate positions. The sixth student returned to her home country and the department has been unable to determine her employment status. The Department has generally been unsuccessful at determining where our undergraduate students go upon graduation. Student surveys are returned in such small numbers that no overall trend can be deduced. The Department is considering ways to better obtain such data.

b. Unique and Significant Service Achievements

Our faculty are diverse and very active in their respective fields. Every year each member completes an Annual Activities Report. These reports supply a comprehensive list of achievements and the one paragraph here cannot do justice to accomplishments of the faculty. We will attempt to give the reader a sense for the breadth of the Department members.

Since 1996, the statistics faculty have run a Consulting Seminar aimed at graduate students not only in Statistics but those in Fisheries, Biology and Wildlife Biology, and others. The goal of the seminar is to introduce statistics students to the process of consulting with

scientists and to help the scientists determine how to design and analyze their experiments. The fact that the Seminar has no shortage of scientists eager to participate is proof of the effectiveness of this service.

There are many examples of Alaska-specific contributions such as a special Professional Development Seminar run by Tony Rickard to help Alaska teachers implement a research-based Alaska-specific mathematics curriculum called Math in a Cultural Context Curriculum. Another example is a summer Research Experience for Undergraduates funded by NSF run by Alexi Rybkin which for two consecutive summers has introduced UAF undergraduates to mathematical modeling. This past summer, the students studied the mathematics of the tidal bore in Cook Inlet.

We have several faculty who regularly serve on NSF and other panels to evaluate grant proposals. Ed Bueler has overseen the development of the open source Parallel Ice Sheet Model, which is now in use by at least four major climate centers worldwide.

c. Similar Programs within the UA System

No other UA institution offers any degree in mathematics or statistics at the graduate level. Furthermore, no other UA institution offers any graduate-level mathematics courses. There is one graduate level statistics course in the UAA 2010-2011 catalog, while the graduate statistics courses in the UAS 2010-2011 catalog are taught at UAF. Thus, not only is UAF the only place a student in Alaska can pursue a graduate degree in mathematics or statistics, it is the only place graduate students in other areas (engineering, biology, geophysics, etc) have access to the graduate-level math and statistics courses integral to their degrees.

Most 4-year colleges have a BS or BA in Mathematics and this pattern holds for both UAA and UAS. However, UAF offers many courses unavailable at UAS or UAA including combinatorics, number theory, topology, and a wealth of statistics courses. This allows our undergraduate students to carve out degrees suited to their goals and interests, whether they are headed to graduate school or secondary education and whether their interests are in purer or more applied mathematics. Neither UAA nor UAS offers a baccalaureate degree in Statistics.

d. Unusual Features in Demand and Productivity

Before discussing the PAIR date for DMS in this section, we note that the most recent data provided by PAIR is incorrect in many instances and very difficult for the Department to verify in others. Some examples of errors include, faculty listed as part of the Department who are not part of the department and faculty with grant funding that fails to be listed. The calculation of FTEs is totally opaque as is the calculation of the student credit hours described as “Outside.”

Instructional PAIR Data

The total number of student credit hours produce in MATH and STAT courses has been steady at around 10,000 per year, though the distribution of those credits has changed slightly such that an increasing portion of them are classified as “Outside.” We believe this is because the Department has increased the offerings during the summer session and through the Center for Distance Education. The head counts of majors and degrees awarded are fairly stable (around 90 and 13 respectively). The numbers in any particular subsection are small and, as such, natural variation can produce seemingly large short-term swings.

The most unusual feature of the instructional data is in the section called Service Teaching. The ratio of credit hours produced by students with majors outside versus inside DMS is on the order of 10 to 1. Furthermore, the PAIR data attached does not include instruction during Summer Sessions or from CDE. Thus, the numbers (if not the ratio itself) is certainly higher. This data illustrate the crucial role DMS plays in supporting other degrees at UAF. The data do not show how many of these service credits occur at the graduate level and while this number would not be large, it is important to note that DMS has a significant service role even at the graduate level. In short, the demand for mathematics and statistics instruction is driven largely by service to other departments. Any increase in science and engineering students at the undergraduate and graduate levels will have a significant impact on the demand for math and statistics courses.

The PhD program recently graduated the first two students in more than 20 years. Both of these students found employment in their fields immediately upon graduation. The Department presently has two PhD students, both at the beginning of their study. The small number of PhD-holding faculty in DMS means that the number of PhD students the department can support will always be small. On the other hand, the PhD program requires few resources.

Faculty Productivity

From the point of view of DMS, over the past 5 academic years we have had between 13 and 14 permanent PhD-holding faculty in the Department, though not all of them were full time with the Department over these five years. Of those 13-14 faculty all of them have active research programs that regularly publish research articles in highly respected peer-reviewed journals. It should be noted that the rate of publication is much lower in the field of mathematics than in other fields. A rate of one paper per year is standard. All faculty in the Department average at least this rate and many are much higher. In 2009, the 14 DMS faculty published a total of 30 papers. Also, citations are not treated the same in mathematics as in other fields. Mathematics publications historically do not generate as many citations per paper and only recently have numbers of citations even been recorded. In particular, the so-called “h-factor” is effectively meaningless in this field for the reasons stated above.

A better measure of the research accomplishments of DMS faculty is the fact that over three-quarters of the faculty (11 of 14) obtained substantial external funding at some point over the last five academic years. Over 40 percent of the faculty (6 of 14) obtained substantial external funding for every one of the past 5 years. This is extremely unusual among mathematics faculty where external funding is the exception rather than the rule. In mathematics, it is common for highly-respected research mathematicians to have no external funding. Further evidence of the strength of our faculty is that 10 have research programs with ties to institutes and departments outside DMS including the Geophysical Institute, IAB, IARC, Computer Science, and Biology and Wildlife Biology. Again, this is exceptional among mathematics faculty nationwide. None of these partnerships were supported or encouraged in any formal way as a condition of hire by the University as in a joint-appointment upon hire, or some other financial incentive.

e. Performances and Exhibits (not applicable)

f. Successful Partnerships

Tony Rickard's association with the TASK Program resulted in several faculty and students receiving money for travel and many teachers receiving aid for continuing education courses. Ed Bueler is successfully mentoring a post-doctoral researcher employed by ARSC. Both Elizabeth Allman and John Rhodes have an NSF funded research program in bioinformatics and mathematical glaciology and are Senior Research associates at IAB. They regularly interact with faculty and graduate students in IAB. Sergei Avdonin, Ed Bueler, and David Maxwell have NSF and NASA funded research programs in mathematical glaciology with faculty and students in the Geophysical Institute.

g. Specialized Accreditation (none)

Summary

The strengths of the DMS programs include providing numerous crucial service courses to other departments, an excellent record placing MS, MAT, and PhD graduates, a faculty with uniformly-active research programs many of which are integrated with other UAF units and which receive substantial external funding. The MS in Mathematics and the MS in Statistics have graduated on average 1.8 and 3.2 students per year for the past 5 years. These programs have sustained and steady enrollment. Finally, the attached departmental assessment report shows that our undergraduate students routinely score very high on the ETS Major Field Test in Mathematics, a national standardized test.

One interesting piece of data that is not presently a part of this process is the program review the Department completed in 2006. In 2006 the report written by the external committee reviewing the program identified five prioritized needs. The first two highest-priority items on the list were (1) increased space and (2) increased faculty. Neither of these issues have been substantially addressed. Our space has effectively decreased. The Department has no computer lab, a Mathematics and Statistics Tutoring Lab that is bursting at the seams, inadequate office space for faculty, graduate students, and adjuncts, and no departmental lounge. Recently we sacrificed one of only three classrooms in our building so our adjuncts would have some kind of office space. Though two tenure-track mathematics faculty were hired in 2009, a direct comparison shows that in 2006 DMS had 2 full time instructors, 9 tenured or tenure-track math faculty and 4 tenured or tenure-track statistics faculty while in 2010 we have 2 full time instructors, 10 tenured or tenure-track math faculty and 3 tenured or tenure-track statistics faculty. Thus, the total number of permanent faculty has been constant. The result is that the department covers its classes, as it has done for years, by hiring many adjuncts. For example, in the Fall 2009 and Spring 2010 semesters 24 of 41 (or 58.8%) of the MATH courses were taught by adjuncts. There are several courses that are rarely taught by permanent faculty at all including several core courses.

UNIVERSITY OF ALASKA FAIRBANKS
Student Learning Outcomes Assessment Plan
Mathematics BA and BS
February 20, 2010

Expanded Statement of Institutional Purpose	Intended Objectives/Outcomes	Assessment Criteria and Procedures	Implementation (what, when, who)
MISSION STATEMENT: We shall provide a high quality mathematics education responsive to the needs of individual students and the diverse population of Alaska. **GOAL STATEMENT:** To assure that our graduates attain a solid understanding of mathematics and are adequately prepared to succeed in the job market or advanced study.	1) Our curriculum will meet national standards.	Comparison of UAF program to University of Washington, University of Wyoming, and University of North Dakota.	Every 3 years, the math assessment committee will compare the curriculum to that of the three specified institutions, and will include their findings and recommendations in its annual assessment report.
	2) Our students will attain mastery of core mathematical concepts comparable to those at other institutions.	All majors will take the ETS Major Fields Test in Mathematics.	Every spring, the instructor of Math 490, a required course for math majors, will require all students to take the Major Fields Test in Mathematics. The assessment committee will summarize results in its annual report.
	3) Our students will have opportunities to develop the necessary skills to achieve their career goals in mathematics.	A) Exit survey B) Alumni survey	A) Every spring, the instructor of Math 490, a required course for all math majors, will give all students an exit survey at the end of the course. The assessment committee will summarize results in its annual report. B) Every 3 years, alumni surveys will be sent to all students who graduated with a degree in mathematics 2,3, and 4 years prior. The assessment committee will summarize results in its annual report.
	4) Students will gain a broad background in liberal arts, fine arts, science, and ethics.	University core requirements fulfilled	Checked automatically by graduation office. These classes are separately assessed at the University level.
	5) We will monitor the effectiveness and implementation of our program requirements.	Transcript check of recent graduates	Every spring the department chair will review transcripts of graduating majors and communicate any problems or surprises to the assessment committee.

Annual Report for Academic Year 2009-2010

Department of Mathematics and Statistics Student Learning Outcomes Assessment for BS and BA Degrees in Mathematics

INTENDED OUTCOMES OBJECTIVES	ASSESSMENT CRITERIA	IMPLEMENTATION PROCEDURES (what, when, who)
1) Our curriculum will be comparable to national standards.	Compare our program to University of Washington, University of Wyoming, and University of North Dakota.	The math assessment committee will compare the curriculum at UAF to that of the three specified institutions (all state research universities) every three years and will include their findings and recommendations in the annual assessment report.

Report: The math assessment committee compared curricula against the specified institutions last academic year (2008-2009). Those findings are included here.

University of Wyoming (UWy)

The University of Wyoming offers a single undergraduate mathematics degree program requiring 48 semester credits, which is closely matched by our programs requiring 45 semester credits.

The required core consists of a calculus sequence, linear algebra, programming, and a "Math Majors Seminar". The "Math Majors Seminar" comes in two flavors, either an overview of classical problems, modern ideas and people in mathematics, or as a preparation course for the Putnam competition. These are interesting recruiting classes and have no equivalent at UAF. Beyond these requirements, all remaining classes are electives. There is a proofs class (coming in two flavors with an emphasis on either set theory or polynomials) that corresponds with our required proofs class. There is an algebra course that corresponds with our required algebra class, as well as a two semester analysis sequence that matches roughly with our required one semester analysis class. Among the electives, there is substantial overlap, with UAF offering more choice and more advanced courses. UAF offers topology, applied analysis, differential geometry, discrete math, and combinatorics, all of which have no equivalent at UWy. In addition, UWy has no capstone course similar to our Senior Seminar (F490).

Despite the lack of options at the upper division level, UWy has made creative and potentially interesting choices for beginning math majors, including a topics-based proofs class and a recruitment class. These are ideas that the undergraduate committee should investigate next year.

University of North Dakota (UND)

The University of North Dakota (UND) has a single mathematics degree program requiring 38 semester credits. The degree requires a calculus sequence, linear algebra, ODEs, and 24 elective credits including two year long sequences, at least one of which at the 400 level. Interestingly, UND has a proofs class (based on set theory) but it is not a requirement, and is only a suggested prerequisite for upper division courses. UND offers linear algebra in two varieties, one general class and one for math majors (forming part of a year-long algebra sequence). The set of available year-long sequences shows attention to the AMS recommendation that programs offer sequences of courses (although the sequence consisting of "take two of topology, complex, and number theory" shows excessive conformation to this idea).

The selection of electives at the two schools is comparable with some areas not overlapping (UAF offers differential geometry and non-Euclidean geometry; UND offers linear algebra for math majors, cryptological mathematics, numerical analysis II, and topics in operations research). The UAF curriculum is more rigorous, requiring more credit hours and insisting that an undergraduate learn both analysis and algebra at the upper division level. The UND offering of a linear algebra class for math majors is a positive aspect of their curriculum, and is one that is being discussed by the UAF undergraduate committee.

University of Washington (UW)
The University of Washington offers five undergraduate mathematics degrees: two BSc degrees and three BA degrees (including one with a teaching emphasis). Of these the “Standard” (as opposed to “Comprehensive”) BSc program is most comparable with our own. The Standard option requires 66 quarter credits of math classes, which corresponds well with our 45 semester credits.

The mandatory part of the UW program is very similar to our own, with overlap including a calculus sequence, proofs, linear algebra, and a two-quarter analysis sequence that corresponds with our one-semester analysis class. UAF requires abstract algebra whereas UW allows this as an option. UAF also has a capstone course with no equivalent at UW. Conversely, UW requires an advanced analysis course covering sophisticated topics such as the implicit function theorem that has no equivalent at UAF.

In addition to the above, UW requires 33 quarter credits of electives broken into two categories: an "Advanced Mathematics Core" (21 quarter credits = 14 semester credits) and "Electives" (12 quarter credits = 8 semester credits) . The Advanced Mathematics Core generally consists of sequences: e.g. a three course sequence (= one year) of abstract algebra, and students are required to complete 7 quarters including at least two two-quarter sequences. At this level, the UW curriculum exceeds the UAF curriculum in both breadth and depth. UW offers a year of abstract algebra, whereas we have a semester. UW offers a year of 400-level analysis beyond our highest level of undergraduate analysis. There is a year-long sequence in optimization, another in probability, and another in numerical analysis. In addition there are two-course sequences in combinatorics, dynamical systems, and stochastic processes. For these electives, UAF offers at most a semester class, and in some cases, no class at all.

2) Our students will master a core of mathematical concepts comparable with that of other institutions.	All majors will be required to take the ETS Major Fields Test in Mathematics.	Every spring, the instructor of Math 490, a required course for all math majors, will require all students to take the Major Fields Test in Mathematics. The results will be summarized by the assessment committee in the annual report the following spring.

Status: During MATH 490 in the spring semester five took the Math Fields Test in Mathematics. On a scale of 120 – 200, these students earned scores of 200, 196, 172, 161, 161. By looking online on the ETS website, it is possible to find comparative information for UAF student scores versus scores of all students taking the test. This comparative data from ETS is from February 2004-June 2009. A copy of the comparison table can be found at:
http://www.ets.org/Media/Tests/MFT/pdf/MFT%20PDFs%202007/Mathematics4AMF.pdf.

Our student scores were in the 95% (2), 80% (1), 60% (2). As three out of five students scored at or above the 80th percentile and all scored above the 50th percentile, this is confirmation that our program is successful and operating at or above national standards.

The table below summarizes the mean percent correct by topic.

Topic	Mean Percent Correct
Calculus	50
Algebra	55
Routine	59
Nonroutine	40
Applied	56

3) Our students will have the opportunity to develop the necessary skills to achieve their career goals in mathematics.	A) Exit survey B) Alumni survey	A) Every spring, the instructor of Math 490, a required course for all math majors, will give all students an exit survey at the end of the course. The results will be summarized by the assessment committee in the annual report the following spring. B) Every May, alumni surveys will be sent to all students who graduated with a degree in mathematics two years prior. The returned surveys will be summarized by the assessment committee in the annual report the following spring.

Status:
Outcomes Assessment Survey

The survey was completed by all five students enrolled in MATH 490 in Fall 2010. Some of the responses are summarized below.

Future Plans:

attend graduate school	1
teach high school	1
enter a non-math related field	2
unsure	1

Core Math Course Preparation (answers to):
I'm confident the UAF Math program adequately prepared me in:

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not applicable
Calculus	1	3	1			
Proofs	2	3				
Abstract Algebra	1	2	2			
Linear Algebra	1	1	2	1		
Real Analysis	3	1	1			

Department Logistics (answers to);
I am satisfied with _____ in the UAF Math program.

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Not applicable
Advising	2	2	1			
Availability of Math Electives	1	3		1		
Course Scheduling		4		1		
Instructional Quality	3	2				

There are four points of particular interest. First, 3 out of 5 of the students did not indicate specific post-graduate plans. Perhaps the questionnaire could be improved to obtain a little more information from such students. Second, Linear Algebra received slightly lower ratings than the other courses. Two students described not remembering any linear algebra. Students tend to take this course in the first two years with the result that they remember less upon graduation and perhaps are less able to recognize its relevance. Third, the perception of the availability of math electives and course scheduling has improved dramatically from near unanimous dissatisfaction to near unanimous satisfaction. Course offerings have increased over the past two years and this seems to have made a difference. Finally, it is worth noting that the department received highest marks for instructional quality. In the space for any additional comments, two students described the quality of instruction in the department as excellent.

The overall assessment is that the Department is training its majors well.

4) Students will gain a broad background in liberal arts, fine arts, science, and ethics.	University core requirement fulfilled	Checked automatically by graduation office. These classes are separately assessed at the University level.

Status: Graduates are necessarily fulfilling the core requirements and therefore gain exposure to a diverse collection of academic pursuits.

5) We will monitor the effectiveness and implementation of our program requirements.	Transcript check of recent graduates	Every Spring the chair of the department will review the transcripts of students graduating with degrees in Mathematics and communicate any problems or surprises to the assessment committee.

Status: After examining the transcripts of recent graduates, the chair of the department, Anthony Rickard, reports that there are no problems or surprises. Overall, student grades in mathematics seem to be in line with other UAF departments. Sometimes the Registrar's Office requires approval via memo of math major elective packages, even though they clearly conform to the catalog requirements for elective packages; the DMS Chair will continue to work with the Registrar's Office to make sure routine approvals of elective packages don't require additional/unnecessary paperwork.

UNIVERSITY OF ALASKA FAIRBANKS
Student Learning Outcomes Assessment Plan

Mathematics MS, MAT, and PhD
February 20, 2010

Expanded Statement of Institutional Purpose	Intended Objectives/Outcomes	Assessment Criteria and Procedures	Implementation (what, when, who)
MISSION STATEMENT: We shall provide a high-quality mathematics education responsive to the needs of individual students and the diverse population of Alaska. **GOAL STATEMENT:** To assure that our graduates attain a solid understanding of mathematics and are adequately prepared to succeed in the job market or advanced study.	1) Our curriculum will meet national standards.	Comparison of UAF program to University of Idaho, University of Wyoming, and University of North Dakota.	Every 3 years, the Graduate Mathematics Committee will compare our program to the three specified institutions and report their findings in its annual assessment report.
	2) Our students will master core mathematical concepts.	All students are required to pass four core courses and pass a collection of exams (which depend on the degree program) in core areas.	Every spring, comprehensive exams will be given, graded, and discussed by the math faculty. A summary of the results will be prepared by the Graduate Committee and included in its annual assessment report.
	3) Our students will have opportunities to develop the skills necessary to achieve their career goals in mathematics.	Alumni survey	Every 3 years, alumni surveys will be sent to all students who earned a graduate degree in mathematics 2,3, and 4 years prior. The Graduate Committee will summarize responses in its annual report.

Annual Report for Academic Year 2009-2010

Department of Mathematics and Statistics Student Learning Outcomes Assessment for MS, MAT, PhD Degrees in Mathematics

INTENDED OUTCOMES OBJECTIVES	ASSESSMENT CRITERIA	IMPLEMENTATION PROCEDURES (what, when, who)
1) Our curriculum will be comparable to national standards	Compare our program to University of Idaho, University of Wyoming, and University of North Dakota.	Every three years, the members of the Graduate Committee from mathematics will compare our program to the three specified institutions and give a report on their findings to the assessment committee to include in the annual report.

Status: The University of Idaho program has 16 math faculty, and around 20 graduate students. The M.S. program requires students take a similar number of courses to UAF, but has comprehensive examinations on 6 topics, and does not require a project or thesis. Course offerings are slightly more extensive than UAF's. As at UAF, there appear to be no true Ph.D. level courses. Ph.D. student must pass comprehensive exams in 3 topics, with specific books indicated for study (similar to our new Ph.D. requirements). The major difference from UAF is that UI has several courses designed specifically for the MAT program, as well as 3 faculty members in Mathematics Education.

The University of Wyoming has around 21 faculty members, and 30 graduate students (25 of whom are supported through TA-ships!). Graduate course offerings are approximately double UAF's. The MS program is similar to UAF's, requiring both a qualifying exam and a thesis/project. The Ph.D. program requires an additional qualifying exam, and specific coursework beyond what we have sufficient staff to offer at UAF.

The University of North Dakota has 17 faculty, and around 10-12 graduate students. It offers only M.S. and M.Ed. degrees, based entirely on course work, without qualifying exams or theses/projects. Although the UND catalog lists more courses than UAF offers, it appears that actual offerings are quite similar (3 or so graduate courses per semester).

UAF has had only 10.5 full-time math faculty members to contribute to the graduate math program. Given our smaller faculty size, we have done a good job of maintaining quality programs, but we are probably a bit over-extended. Of the comparison schools, only Wyoming has courses approaching a Ph.D. level, and it has twice the staffing and many more TA-ships. We are perhaps most similar to Idaho, though with many fewer graduate students. Our program is clearly within the range of these schools', and our requirement for an M.S. project is a strength over some of their programs. Our M.A.T. remains underdeveloped, but changes would require additional resources. Our new Ph.D. program rules represent a step forward, but some faculty have continuing doubts that we are large

enough to offer a strong program. We would benefit greatly from having a larger number of graduate students, but need additional TA-ships for that to be possible.

2) Our students will master a core of mathematical concepts.	All students are required to take and pass four core courses. In order to graduate, all students must take and pass a collection of exams on core subjects.	Every spring, comprehensive exams will be given, graded, and discussed by the majority of the math faculty. A summary of the results will be prepared by the members of the Graduate Committee from mathematics to be included in the yearly assessment report.

Two PhD students graduated in Fall 2009, namely A. Bulanova and V. Mikhailov. This successful and welcome outcome leaves the PhD program with no current students. There is no Department consensus that there should be active recruitment of new PhD students.

There are currently six MS students. Of these, two took their comprehensive exams in mathematics in Fall 2009, and both passed though one student retook one-third of the exam in order to pass (allowed under the published rules for MS Mathematics comprehensives). Of the remaining four students, three have scheduled MS comprehensive exams for the end of May 2010, and one who entered this year has chosen to put off the exams till next year. The two students who have passed their exams in the Fall have not yet completed projects/theses.

The four required MS-level core courses have, as stated in the catalog, been taught one-per-semester for several years, including the 2009/2010 academic year. (Specifically, MATH 641 was taught in Fall 2009 and MATH 645 in Spring 2010. MATH 631 was taught in Fall 2008 and will be taught in Fall 2010.) An additional five elective courses at the MS level were taught in 2009/2010.

A reasonably complete website for MS Mathematics advising is at www.dms.uaf.edu/math/msmath.html.

There are no current M.A.T students.

3) Our students will have the opportunity to develop the skills necessary to achieve their career goals in mathematics.	alumni survey	Every May, alumni surveys will be sent to all students who graduated with a degree in mathematics two years prior. The returned surveys will be summarized by the assessment committee in the annual report the following spring.

Status: Surveys were last sent out to all those earning MS degrees in 2004-05 and 2005-06. However, only 1 form was returned.

One of our PhD graduates is working as a grant-funded researcher in the institutes.

UNIVERSITY OF ALASKA FAIRBANKS
Student Learning Outcomes Assessment Plan

Statistics BS
February 20, 2010

Expanded Statement of Institutional Purpose	Intended Objectives/Outcomes	Assessment Criteria and Procedures	Implementation (what, when, who)
MISSION STATEMENT: We shall provide a thorough graduate education in statistical theory and methods. **GOAL STATEMENT:** To introduce students to fundamentals of theoretical and applied statistics, and to prepare them for employment as a statistical technician or for entrance into graduate school	1. Graduates shall be able to identify and use probability models for deriving and assessing the characteristics of estimators and deriving and assessing the quality of hypothesis tests.	Assessed by instructors of the upper division Probability and Mathematical Statistics courses (MATH371, MATH408).	The statistics faculty will meet at the end of each academic year to discuss the performance of all undergraduate statistics students.
	2. Graduates shall be able to perform basic statistical analyses including descriptive statistics, basic contingency table results, one-way ANOVA, simple and multiple regression analysis. They will also be able to use the SAS statistics package and the R programming environment.	Assessed by course instructors.	The statistics faculty will meet at the end of each academic year to discuss the performance of all undergraduate statistics students.
	3. Graduates shall be able to effectively communicate statistical concepts and results in written settings. They will also be able to pursue independent research in statistics.	Written presentation of Senior Project.	Assessed by mentor in the Statistics Project course.

Annual Report for Academic Year 2009-2010

ASSESSMENT REPORT: B.S. Statistics

General comments: Elimination of the B.S. in Statistics has been approved by the Curriculum Review Committee of the Faculty Senate and we expect it to cease taking new students this year. We have transformed the B.S. program in Statistics to the new version of the Statistics Option, B.S. Mathematics. The new program is almost identical to the old program (except we have included a course in Advanced Calculus in the new option program, and have shifted the Senior Project class to a new, Consulting Seminar). There will be one graduate from the B.S. Statistics program this year and perhaps two next year.

Assessment Criteria and comments:

Omnibus test addressing students' analytical and SAS programming abilities:
Not administered. (We have proposed dropping this from assessment).

Portfolio of SAS use from STAT401:
No portfolio was prepared. (We have proposed dropping this from assessment).

Senior Project Presentation:
One Senior Project was submitted this year, titled: Explorations in Geostatistical Simulation. It was also the student's Honor's thesis. The project, which involved simulation studies about the effect of varying sample sizes, model selection and location error on fitting variogram models, was excellent and was also accepted as satisfactory by the UAF Honor's Program.

Alumni Survey:
We maintain informal contact with former students, however we did not administer an alumni survey.

UNIVERSITY OF ALASKA FAIRBANKS
Student Learning Outcomes Assessment Plan

Statistics MS
February 20, 2010

Expanded Statement of Institutional Purpose	Intended Objectives/Outcomes	Assessment Criteria and Procedures	Implementation (what, when, who)
MISSION STATEMENT: We shall provide a thorough graduate education in statistical theory and methods. **GOAL STATEMENT:** To assure that our students have the skills to successfully compete for and excel in jobs in applied statistics. Our students will be highly qualified, in particular, as biometricians for government agencies. The students will also be well-prepared for additional education in statistics.	Students will master a wide variety of statistical tests, statistical procedures, sampling methodologies and will be able to design experiments and analyze data using software including SAS and R.	EXIT LEVEL: Evaluation of the students' research projects or theses ALUMNI: Follow the careers of Statistics Program graduates.	EXIT LEVEL: Examined by all members of the statistics faculty ALUMNI: Data compiled by statistics program coordinator
	Students will understand and be able to use statistical theory	EXIT LEVEL: 1) Written and oral part of the comprehensive exam. 2) Report by the student's advisor. ALUMNI: Follow the careers and further education of the graduates. Survey the graduates to see if their training was satisfactory.	EXIT LEVEL: Written assessed by the statistics faculty, oral assessed by graduate committee. ALUMNI: Contacts to be maintained by the statistics program coordinator.
	Students will have consulting skills.	EXIT LEVEL: Student's achievement in the statistical consulting seminar ALUMNI: Follow the careers of graduates.	EXIT LEVEL: Ascertained by the faculty member in charge of the seminar. ALUMNI: Contacts to be maintained by the statistics program coordinator.
	Students will display effective written communication skills.	EXIT LEVEL: 1) Statistics projects. 2) Oral portion of Comprehensive exam.	EXIT LEVEL: Assessed by the statistics faculty at time of graduation.

ASSESSMENT OF THE MASTERS PROGRAM IN STATISTICS
Academic Year 2009-2010

EXIT INTERVIEW: Since the assessment is due prior to graduation, we have not yet submitted exit surveys to the students (example survey attached). The set of surveys for this year will discussed in next year's assessment report.

POST-GRADUATE INTERVIEW/ EMPLOYER INTERVIEW:
Authorities from the Alaska Department of Fish and Game have been working with the Dept. of Mathematics and Statistics to formalize the internship program. During these sessions, we have discussed the Statistics Program. We discuss these in the Curriculum/Courses section below.

FACULTY EVALUATION OF EXAMS AND PROJECTS:
The 2010 comprehensive written exams were excellent for two of the students and marginal for three others. The two students with excellent written exams performed very well during the oral exam. One of the students with a mixed written comprehensive did an excellent job during the oral portion of the exam, showing that she did know the exam topics. The other two students with mixed written exams are still in the process of finishing or scheduling the oral portion of their comprehensive exams.

M.S. projects

PROECTS (planned Spring 2010 graduates)
Lisa Beattie: A Comparison of the Huggins Model to Post-stratification methods for two event Capture-recapture Analysis.
Anna-Marie Benson: Use of a gamma-shaped detection function for estimating abundance of animals: The importance of independent data.
Luosha Diou: Potential improvement for density estimation by deconvolution.
Feiran Jiou: Bayesian mixing model for stable isotope ratios applied to Alaska Natives' diet patterns.

All of the projects and their presentations were excellent. As many as three of them are likely to be submitted and published. All of them were useful - the first two have caused a stir in both state and federal wildlife agencies, the density estimation paper is very helpful for researchers within the statistics faculty, and the Bayesian mixing model paper is a nice application for the Center for Alaska Native Health Research.

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TIME TO COMPLETION: All students in the program seem to be on track to graduate at the end of their second year.

CURRICULUM/ COURSES: We have continued to deliver courses via distance delivery to Juneau. In the Fall we delivered the Statistical Theory course STAT651 and in the Spring we delivered STAT605 (Spatial Statistics) to both Juneau and Sitka. We continue to redesign courses, in particular debating whether to change the computer component of the Regression and Analysis of Variance (STAT401) class from SAS to R. Finally, representatives from the Alaska Department of Fish and Game have requested that we offer a course in Advanced Survey Sampling. We are discussing what form this course would take.
The recent approval of the Graduate Certificate in Statistics may increase the demand for statistics courses and we have been contacted by several students who are entering the program.

As part of UAF's outcomes assessment process we respectfully request that you complete the following survey. The results will be kept confidential and only summary statistics across respondents will be made public. The results are used to improve the quality of the program and to satisfy institutional accreditation requirements. If you have any concerns about the survey, please feel free to contact us.

UAF Statistics MS Program Graduate Survey Spring 2009

1. Please respond to each of the following statements with

1 = strongly agree 2 = agree 3 = neutral 4 = disagree 5 = strongly disagree

Please feel free to write comments on any of these questions.

a) I would recommend the statistics MS degree program to others. __

b) The quality of instruction by statistics faculty is excellent. __

c) The core MS statistics courses (STAT 651, 652, 653) provided a solid foundation. __

d) I had access to modern computing equipment and statistics software. __

e) Statistics faculty members were accessible and involved in my education. __

f) I learned a lot in completing the MS project. __

g) Sufficient elective courses were offered. __

h) Statistics elective courses were at an appropriately challenging level. __

i) Degree requirements were well communicated. __

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2. Please provide a narrative response to each of the following:

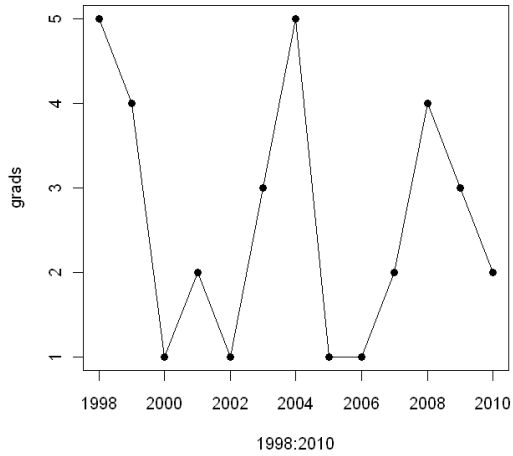
a) How should the statistics MS program be changed to improve it?

b) What components of the statistics MS program worked particularly well?

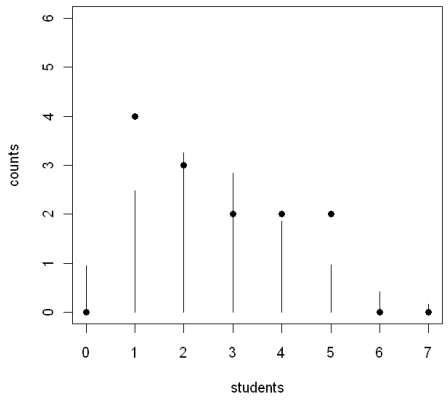
APPENDIX TWO: (list of graduates):

1998: Gordon Bower, Pam McNeley, Alex Prichard, Bob Sutherland, Brian Taras
1999: Arny Blanchard, Peter Dillingham, Julie McIntyre, Franz Mueter
2000: Gwen Gruenig
2001: Kelley Cadman, Xinxian Zhang
2002: Helen Nute
2003: Anton Antonovich, Colleen Ianuzzi, Randy Mullen
2004: Sherri Dressel, Xiang Fang, Joseph Liddle, Mark Olson, Yongmei Qin
2005: Randolph Phillips
2006: Xi Chen
2007: Shuo Jiao, Yingte Zhang
2008 [Summer 2007]: Kun Chen, Steve Houston, Alan Shay, Xian Yu
2008: John Bannister, Jim Jasper, Jennifer Kreinheder
2009: Jiaqi Huang, Hui Liu
2010: Anna-Marie Benson*, Lisa Beattie*, Luosha Diou*, Feiran Jiou*

*- Expected, as of April 29, 2010.
Due to graduate 2011: Matt Leonawicz, Jason Waite, Adam Watson



(A test of autocorrelation did not show significant lag 1 autocorrelation).
NOTE: A likelihood ratio test of Ho: Xi ~ Poisson(lambda) vs Ha: Xi ~ Poisson(lambda.i) failed to reject the null-hypothesis at the 0.05 significance level, so as far as we can tell the number of graduates follows a Poisson distribution with a constant mean estimated at 2.6 per year.



The vertical lines show the expected number of years in which 0, 1, 2, etc. students graduate (for instance, we expect roughly 1 in 13 years to have zero graduates) assuming the number of graduates each year are independent Poisson with mean 2.615. The solid dots show the actual number of years in which 0, 1, 2, etc. students graduated.

Department of Mathematics and Statistics
Program Review 2010
List of Publications for Years 2007 and 2008

The names of Department faculty members are underlined. Papers are listed in alphabetical order by the last name of the first author. Papers from 2007 are listed first, then those from 2008. Note that in mathematics, the tradition is that all co-authors on a paper are listed in alphabetical order and all have made significant contributions to the whole. In particular, mathematics does not have the primary author designation found in many of the natural sciences.

Allman, E. S. and J. A. Rhodes (2007). "The identifiability of tree topology for phylogenetic models, including covarion and mixture models." Journal of Computational Biology.

Allman, E. S. and J. A. Rhodes (2007). "Molecular phylogenetics from an algebraic viewpoint." Statistica Sinica, v. 17, no. 4, 1299-1316.

Allman, E. S. and J. A. Rhodes (2007). "Phylogenetic invariants." New Mathematical Models of Evolution.

Allman, E. S. and J. A. Rhodes (2007). "Phylogenetics." Modeling and Simulation of Biological Networks.

Avdonin, S., Bulanova, A., Moran (2007). "Construction of sampling and interpolating sequences for multi-band signal. The two-band case" W.Int. J. Appl. Math. Comput. Sci., v. 17, no. 2, p 101-113.

Avdonin, S., Mikhailov, V., Rybkin, A. (2007). "The boundary control approach to the Titchmarsh-Weyl m-function.I. The response operator and the A-amplitude." Comm. Math. Physics, v. 275, no. 3, 791-803.

Brown, J.A., Bueler, E., Lingle, C.S. (2007). "Exact solutions to the thermomechanically coupled shallow ice approximation: effective tools for verification." Journal of Glaciology, v. 53 (182), p. 499-516.

Brown, J.A., Bueler, E., Lingle, C.S., (2007). "Fast computation of a viscoelastic deformable earth model for ice flow simulations." Annals of Glaciology, v. 46, 97-105.

Bueler, E. (2007). "Error bounds for approximate eigenvalues of periodic-coefficient linear delay differential equations." SIAM Journal on Numerical Analysis, v. 45 (6), 2510-2536.

Higdon, D.M., Kronberg, P.P., Short, M.B. (2007). "Estimation of Faraday rotation measures of

the near galactic sky using Gaussian process models." Bayesian Analysis, v. 2, no. 4, 665-680.

Allman, E. S. and J. A. Rhodes (2008). "Identifying evolutionary trees and substitution parameters for the general Markov model with invariable sites." Mathematical Biosciences 211(1): 18-33.

Allman, E. S. and J. A. Rhodes (2008). "Phylogenetic ideals and varieties for the general Markov model." Advances in Applied Mathematics 40(2): 127-148.

Avdonin, S. and Ivanov, S.A. (2008). "Sampling and Interpolation Problems for Vector Valued Signals in the Paley-Wiener Spaces." Ieee Transactions on Signal Processing 56(11): 5435-5441.

Avdonin, S. and Kurasov, P. (2008). "Inverse problems for quantum trees." Inverse Problems and Imaging 2(1): 1-21.

Chappell, G. G., J. Gimbel, et al. (2008). "Bounds on the metric and partition dimensions of a graph." Ars Combinatoria 88: 349-366.

Faudree, J. R., R. J. Faudree, et al. (2008). "Forbidden subgraphs that imply 2-factors." Discrete Mathematics 308(9): 1571-1582.

Johnson, D. S., D. L. Thomas, et al. (2008). "A general framework for the analysis of animal resource selection from telemetry data." Biometrics 64(3): 968-976.

Maxwell, D., M. Truffer, et al. (2008). "An iterative scheme for determining glacier velocities and stresses." Journal of Glaciology 54(188): 888-898.

Rybkin, A. (2008). "On the evolution of a reflection coefficient under the Korteweg-de Vries flow." Journal of Mathematical Physics 49(7).

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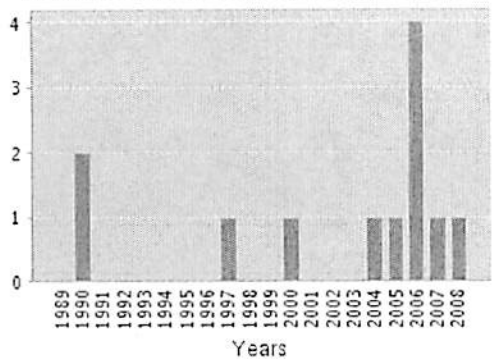

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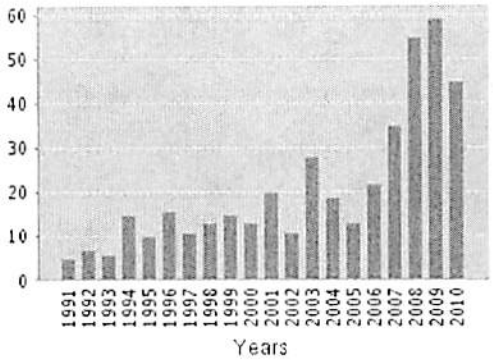

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	2006 ◄	2007	2008	2009	2010 ►	Total	Average Citations per Year
	22	35	55	59	45	421	16.84
☐ 1. Title: STUDY DESIGNS AND TESTS FOR COMPARING RESOURCE USE AND AVAILABILITY Author(s): THOMAS DL, TAYLOR EJ Source: **JOURNAL OF WILDLIFE MANAGEMENT** Volume: **54** Issue: **2** Pages: **322-330** Published: **APR 1990**	13	12	17	13	9	216	10.29
☐ 2. Title: ALTERNATIVE FORMULATIONS OF THE MIXED-MODEL ANOVA APPLIED TO QUANTITATIVE GENETICS Author(s): AYRES MP, THOMAS DL Source: **EVOLUTION** Volume: **44** Issue: **1** Pages: **221-226** Published: **FEB 1990**	0	1	2	1	1	35	1.67
☐ 3. Title: Study designs and tests for comparing resource use and availability II Author(s): Thomas DL, Taylor EJ Source: **JOURNAL OF WILDLIFE MANAGEMENT** Volume: **70** Issue: **2** Pages: **324-336** Published: **2006**	1	5	8	8	10	32	6.40
☐ 4. Title: Trophic relationships in an Arctic food web and implications for trace metal transfer Author(s): Dehn LA, Follmann EH, Thomas DL, et al. Source: **SCIENCE OF THE TOTAL ENVIRONMENT** Volume: **362** Issue: **1-3** Pages: **103-123** Published: **JUN 1 2006**	0	5	7	15	4	31	6.20

		2006 ◀	2007	2008	2009	2010 ▶	Total	Average Citations per Year
	Use the checkboxes to remove individual items from this Citation Report or restrict to items processed between 1980 and 2010 Go	22	35	55	59	45	421	16.84
☐ 5.	Title: Trace elements in tissues of phocid seals harvested in the Alaskan and Canadian Arctic: influence of age and feeding ecology Author(s): Dehn LA, Sheffield GG, Follmann EH, et al. Source: **CANADIAN JOURNAL OF ZOOLOGY-REVUE CANADIENNE DE ZOOLOGIE** Volume: **83** Issue: **5** Pages: **726-746** Published: **MAY 2005**	3	8	7	10	1	29	4.83
☐ 6.	Title: A Bayesian random effects discrete-choice model for resource selection: Population-level selection inference Author(s): Thomas DL, Johnson D, Griffith B Source: **JOURNAL OF WILDLIFE MANAGEMENT** Volume: **70** Issue: **2** Pages: **404-412** Published: **2006**	1	0	7	3	6	17	3.40
☐ 7.	Title: Stable isotope and trace element status of subsistence-hunted bowhead and beluga whales in Alaska and gray whales in Chukotka Author(s): Dehn LA, Follmann EH, Rosa C, et al. Source: **MARINE POLLUTION BULLETIN** Volume: **52** Issue: **3** Pages: **301-319** Published: **MAR 2006**	0	3	4	5	2	14	2.80
☐ 8.	Title: Feeding ecology of phocid seals and some walrus in the Alaskan and Canadian Arctic as determined by stomach contents and stable isotope analysis Author(s): Dehn LA, Sheffield GG, Follmann EH, et al. Source: **POLAR BIOLOGY** Volume: **30** Issue: **2** Pages: **167-181** Published: **JAN 2007**	0	0	2	4	7	13	3.25
☐ 9.	Title: The relative importance of nesting and foraging sites in selection of breeding territories by Townsend's Warblers Author(s): Matsuoka SM, Handel CM, Roby DD, et al. Source: **AUK** Volume: **114** Issue: **4** Pages: **657-667** Published: **OCT 1997**	1	0	1	0	0	11	0.79
☐ 10.	Title: COMMON LAMBSQUARTERS (CHENOPODIUM-ALBUM) INTERFERENCE IN SPRING BARLEY Author(s): CONN JS, THOMAS DL Source: **WEED TECHNOLOGY** Volume: **1** Issue: **4** Pages: **312-313** Published: **OCT 1987**	1	0	0	0	0	9	0.38

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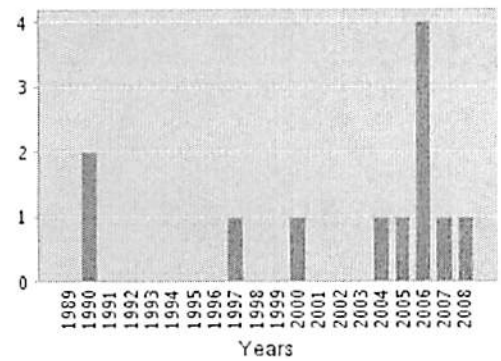

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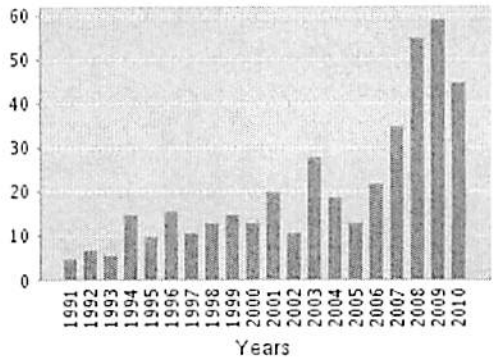

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	22	35	55	59	45	421	16.84
☐ 11. Title: A general framework for the analysis of animal resource selection from telemetry data Author(s): Johnson DS, Thomas DL, Hoef JMV, et al. Source: **BIOMETRICS** Volume: **64** Issue: **3** Pages: **968-976** Published: **SEP 2008**	0	0	0	0	5	5	1.67
☐ 12. Title: Temporal variability in abundance of Marbled Murrelets at sea in Southeast Alaska Author(s): Speckman SG, Springer AM, Piatt JF, et al. Source: **WATERBIRDS** Volume: **23** Issue: **3** Pages: **364-377** Published: **2000**	0	0	0	0	0	5	0.50
☐ 13. Title: A Bayesian multinomial model for analyzing categorical habitat selection data Author(s): Thomas DL, Ianuzzi C, Barry RP Source: **JOURNAL OF AGRICULTURAL BIOLOGICAL AND ENVIRONMENTAL STATISTICS** Volume: **9** Issue: **4** Pages: **432-442** Published: **DEC 2004**	2	1	0	0	0	3	0.50
☐ 14. Title: CONFIDENCE BANDS FOR PERCENTILES IN THE LINEAR-REGRESSION MODEL Author(s): THOMAS DL, THOMAS DR Source: **JOURNAL OF THE AMERICAN STATISTICAL ASSOCIATION** Volume: **81** Issue: **395** Pages: **705-708** Published: **SEP 1986**	0	0	0	0	0	1	0.04

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