

MATHEMATICS PH.D. REVITALIZATION PROPOSAL

The Department of Mathematics and Statistics proposes the following plan for revitalizing its Ph.D. Program. We outline a new path for students through the program, we present clear goals for a successful program, and we develop milestones for determining its viability and success.

CURRENT STATUS

In Spring 2013, the math graduate program has no enrolled or admitted Ph.D. students, and 9 enrolled M.S. students (3 of whom are expected to graduate this year; 1 of whom is expected to lose funding due to inadequate performance; 2 of whom are self-funded; 3 of whom are expected to graduate in 2014). Admission to the Ph.D. program is currently suspended, and M.S. admissions for Fall 2013 are underway. Thus, DMS is in the position of rebuilding the Ph.D. program from relatively low overall graduate enrollment.

Of the 10 full-time tripartite faculty in math, 6 are committed to rebuilding the Ph.D. (Allman, Avdonin, Berman, Rhodes, Rybkin, Williams); the others are either strongly opposed, or not interested. All, however, support the M.S. program and are interested in increasing its size. This plan is designed, therefore, to not require the participation of those faculty who wish to ‘opt out’ of Ph.D. involvement, but to try to use broad support for a larger program to support growth of the Ph.D.

VITALITY GOALS

In the long term, we want to admit 1 to 2 students each year who intend to pursue a Ph.D. at UAF. Some of these students may not yet have a M.S. degree, so following current departmental rules, they will be formally admitted into the M.S. program. However, they will be internally tracked as “M.S./Ph.D.” students, so that it is clear that they intend to pursue a Ph.D. There will, of course, be some attrition, so that we envision eventually graduating approximately 2 students every 3 years. This means that at any point, the number of Ph.D. students in the program who are post M.S. will be approximately 4, spread among the interested faculty. (This is based on an expected completion time of 4-6 years post M.S. ¹)

This will necessarily require that multiple faculty members are advising both Ph.D. students and masters students. Six faculty members are committed to both active recruiting and Ph.D. advising of students with interests in their research areas.

Given that the first admission to the program cannot be before Fall 2014, we can hope to graduate our first Ph.D. student no earlier than Spring 2018 (assuming the student enters with an M.S. degree and progresses quickly through the program). Graduating our first student in Spring 2019 or Spring 2020 is a more realistic expectation.

To have an effective program, we need to:

- (1) Recruit effectively;
- (2) Have a clear plan for allowing students to progress through the program, and for recognizing when students are not making adequate progress;
- (3) Be able to provide adequate funding to students for program completion;

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¹See 2003 NSF data, Tables 3 and 4 from <http://www.nsf.gov/statistics/infbrief/nsf06312/> which lists median Registered Time to Degree for Carnegie-classified research institutions as 6.8 - 7 years in mathematics, with average of 6.9 years for students who are primarily supported by teaching assistantships, which is the case in DMS. Aggregate median registered time to degree for all physical sciences, including mathematics, was 6.7 years in 2011, available at <http://www.nsf.gov/statistics/sed/2011/pdf/tab31.pdf>, but registered time to degree for mathematics specifically does not appear to be easily available.

- (4) Assess the effectiveness of the program.

RECRUITMENT

Graduate student recruitment has been difficult for DMS. Faculty have not broadly considered this an individual expectation, nor have we taken effective departmental actions. With the strong efforts of several faculty excepted, we have simply hoped applications would materialize. This needs to change, for both the M.S. and Ph.D. programs, and a sustained effort to draw good students must be made. While we will attempt to recruit Ph.D. students specifically, we will also focus on recruiting more M.S. students. We hope for a mix of students who apply committed to a Ph.D., and other students who decide to continue toward a Ph.D. after successful completion of a M.S.

Specific steps to recruit students to the Ph.D. program may include:

- (1) Use of e-mail list servers, such as those of Project NeXT list or MAA sections, to reach faculty with a strong teaching interests across the country. (A trial attempt at this, timed to reach students who may not have been admitted to their first choice programs, generated 3 M.S. applicants within a few days.)
- (2) Mailings to smaller liberal arts colleges, especially in the Pacific Northwest and other northern states like Minnesota and Maine, to attract applicants who might not have considered UAF, but might find a smaller program a better fit for them.
- (3) Letters to undergraduate universities of recent graduates, emphasizing the program's effectiveness with their former students, and encouraging new applications.
- (4) Improving the DMS Web page, focusing on the goal of recruitment of students.
- (5) Mailings and visits to US universities that have MS programs in mathematics, but no Ph.D., to recruit recent graduates.
- (6) Leveraging faculty contacts at individual foreign institutions (e.g., UNAM–Morelia, Mexico, University of New Brunswick–Fredericton, Canada, University of Tasmania, University of Canterbury, etc.) to encourage more well-prepared foreign applicants.
- (7) Have individual faculty members send targeted emails to colleagues who work in fields related to the faculty member's area of research, soliciting students who are interested in working in that field, and following up with calls to interested students who apply.
- (8) Meeting with personnel from the Office of Admissions and CNSM to discuss other ways to enhance recruiting.

REVISED PROGRAM FOR PH.D. STUDY

The current Ph.D. requirements, which were designed to reach an acceptable consensus across the full department (including those opposed to the program) are modeled more on those of much larger math departments, and are not practical for our size.

We propose two related paths, one for students who already have a M.S. and one for students who are entering the program directly, without a M.S.

M.S./Ph.D. students (admitted without an M.S. in mathematics).

Year 1: Take masters-level courses. Form interim program committee. Take a M.S. comprehensive exam at the end of the first year.

Year 2: Continue to take courses. Identify a broad proposed area of study through the Ph.D., and form M.S./Ph.D. program committee. Passing all required M.S. comprehensive exams by the end of year two is required. Take one (of two) Ph.D. subject exams, as designed by program committee,

and pass it to be guaranteed of funding for year three. (One exam should focus on the intended area of research, and one on either a broader or distinct area.) Typically, earn a M.S. degree.

Year 3: Pass both Ph.D. exams by the end of year three, and if not done already, earn a M.S. degree. Failure to meet these milestones results in withdrawal of funding.

Year 4: Develop a detailed proposal for dissertation research and present it to the committee, in order to advance to candidacy. If a student does not advance to candidacy by the end of the year 5, then funding will be withdrawn.

Years 4 – 6: Do individual research towards the dissertation, in consultation with the student’s advisor and committee. Defend the dissertation. Assuming available funding, students would be guaranteed support for years 4 and 5, and then must demonstrate adequate progress to be eligible for funding for a sixth year.

Ph.D. students admitted with an M.S. degree in mathematics.

Year 1: Take graduate courses in the student’s proposed area of study. Form Ph.D. program committee. Take a Ph.D. exam (one of two), and pass it to be guaranteed of funding for year two.

Year 2: Pass both Ph.D. exams by the end of year two. Failure to meet these milestones results in withdrawal of funding.

Year 3: Develop a detailed proposal for dissertation research and present it to the committee, in order to advance to candidacy. If a student does not advance to candidacy by the end of year 4, then funding will be withdrawn.

Years 3 – 5: Do individual research towards the dissertation, in consultation with the student’s advisor and committee. Defend the dissertation. Assuming available funding and adequate progress, students would be guaranteed support for years 3 and 4, and then must demonstrate adequate progress to be eligible for funding for a fifth year.

FUNDING

Expanding the mathematics graduate program at the M.S. level and revitalizing the Ph.D. program will require funding a larger number of students than in the past. Nationally, the overwhelming majority of mathematics graduate students are supported by TA-ships through their entire programs, and we must expect to do so as well. Despite a tightening budget at UAF, we believe we can expand student funding through the following mixture of approaches.

- (1) More active involvement of graduate students in teaching, including online and summer courses, and low level (precalculus) courses: DMS uses a very large number of adjunct faculty, and qualified individuals are difficult to find. With adequate training, and possibly reconfiguring some course delivery, we can use more advanced graduate students to offset some of the need, with salary savings partially offsetting TA costs. On-line courses have generally poor student success rates, and graduate student involvement in support may help us address this persistent problem.
- (2) Attracting graduate students from countries which provide financial support for study in the US: Many countries, especially those that are rapidly developing, (such as Kazakhstan, Mexico, Turkey and some others), are eager to send students to US universities, and provide full support.
- (3) Individual research grants: Although RA-ships tied to faculty grants are less common in mathematics than in the sciences, there is potential for some faculty to fund students in this way (as has been done in DMS in the past). For students working on interdisciplinary topics, there is also potential to tie support to grants to faculty outside of DMS.
- (4) External grants to the department to support graduate students: There are a number of federal programs to support graduate students that the department can apply for, e.g. GAANN (US Dept. of Education), S-STEM (NSF), and LSAMP (NSF). We know of other mathematics departments

that have successfully used these to expand their graduate programs. While we probably cannot be competitive until we have a few students in the Ph.D. program, in the longer term we can be.

- (5) Joint supervision of Ph.D. students with other universities: It is not uncommon nationally for students to study at several different universities during their graduate program. Under such an arrangement, students are usually supported by a TA-ship at each university during their time there. When appropriate for the student, this would both reduce our need to provide support, and give the student opportunities unavailable at UAF because of the size of our department.

MILESTONES AND ASSESSMENT

We propose the following goals:

Year 1:

- Recruit for Ph.D. students
- Admit 1 – 2 Ph.D. students (that is, students who have the intention of pursuing a Ph.D., although we may admit them into the M.S. program)

Year 2:

- Recruit for Ph.D. students
- Admit 1 – 2 Ph.D. students (that is, students who have the intention of pursuing a Ph.D., although we may admit them into the M.S. program)
- If possible, administer a Ph.D. exam

Year 3:

- Recruit for Ph.D. students
- Admit 1 – 2 Ph.D. students (that is, students who have the intention of pursuing a Ph.D., although we may admit them into the M.S. program)
- If possible, administer Ph.D. exams
- Ideally, approve a dissertation research proposal and advance a student to candidacy

Year 4:

- Recruit for Ph.D. students
- Admit 1 – 2 Ph.D. students (that is, students who have the intention of pursuing a Ph.D., although we may admit them into the M.S. program)
- Administer Ph.D. exams
- Advance a student to candidacy, if possible

Long-term: Graduate the equivalent of 2 Ph.D.s every 3 years.

Background and Information:

Mathematics is a foundational discipline that contributes to many fields, and an institutional strength in it is a resource for the entire university. Having a Ph.D. program in Mathematics realizes UAF’s vision of integrating teaching and research. Strong research universities that do not offer a Math Ph.D. are rare, or nonexistent, in the U.S. Of the 2012 UAF Equivalent Peer Group institutions, 9 of 11 have a Ph.D. program in Mathematics. All 9 of UAF’s Aspirational Peers have a Mathematics Ph.D. program. If the program were deleted, Alaska would be one of only 2 states (with Maine) with no institution offering a Math Ph.D.

The opportunity to train graduate students is important for recruiting and retaining a strong faculty. The department currently has a number of members with strong national and international reputations, and UAF should seek to preserve and build on this strength. DMS personnel collaborate with those in other departments and institutes, and a weakening of the math faculty will have impacts across the full university.

Other institutions maintain Math Ph.D. programs with enrollments similar to UAF’s in recent years. Figures for comparable institutions are given in the table below, and show UAF’s degree production compares favorably with many other low-population state institutions.

	Tenure-track faculty in Math Dept. (includes math/stats/math education in most cases)	Math Ph.D.s in most recent 3-year period	Annual math Ph.Ds/faculty
UAF	15	2	0.044
U. of Hawaii at Manoa	27	2	0.025
Idaho State*	17	2	0.039
University of Idaho*	17	2	0.039
Montana State*	27	5	0.062
U. of Nevada, Las Vegas	29	3	0.034
New Mexico State*	23	11	0.159
U. of New Mexico	27	2	0.025
North Dakota State*	17	6	0.118
Oregon State*	25	12	0.160
U. of South Dakota	20	1	0.017
Utah State*	26	3	0.038
U. of Vermont	24	4	0.056
U. of Wyoming*	25	4	0.05

*UA Equivalent Peer Group 2012 (All members for which data was available are shown.)