MATHEMATICS DEPARTMENT RATS PROPOSAL

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Summary

Earlham has by far the smallest Mathematics Department in the GLCA. We offer fewer courses for our majors than any of our competitors. We offer fewer service courses for the rest of the institution. We have fewer interdisciplinary programs involving math. These deficiencies have been noted repeatedly in accreditation reviews. Because of the minimal nature of our course offerings, mathematics faculty interviewing prospective students explicitly ask if the students' driving passion is mathematics and if they are interested in graduate school, and we encourage students who say yes to think very seriously about getting their undergraduate educations elsewhere.

Although even an added FTE in mathematics would not alter Earlham's last-place position in the GLCA, it would afford us the opportunity to improve our service to the school as a whole by offering more courses in statistics, by beginning to address the needs of students not ready for calculus, by regularizing ES/IP offerings, and by exploring more cross-disciplinary courses. It might also allow us to broaden slightly our offerings for majors, increasing the possibility of students moving from Earlham to graduate school in mathematics, something that we believe only one student has done in the last 20 years. For these reasons, we would ask, as we have before, that the College consider seriously whether the possibility exists now or at some point in the future to expand the math department not to a point where we are competitive within the GLCA (an unrealistic goal) but to a point where we are not frustrating our colleagues and students quite so often, and where we feel less need to act in good conscience to discourage new students.

Current Staffing Figures

The Mathematics Department currently consists of two people who are full time in Math (Tim McLarnan and Anand Pardhanani) and 5/6 of Mic Jackson. This year no Math courses are being taught by faculty outside the department. In other years, between 1 and 3 courses (Symbolic Logic, Differential Equations, and Applied Math) have been taught by Philosophy and Physics faculty. Two of those three courses are cross-listed in other departments. Mathematics also teaches Math Toolkit, which is cross-listed in Math and in CS, but whose enrollment is normally 100% CS majors. If one counts Toolkit and DE as math classes and Symbolic Logic and Applied Math as Philosophy and Physics, resp., and if one regards Mic's contribution to Environmental Programs as 1/6 FTE, then Math is exactly 3 FTEs. Other treatments of the cross-listed classes (which, to add a wrinkle, don't run every year) and of Mic would alter this staffing level slightly.

Date: February 15, 2009.

Assuming a size of 3 FTEs, our average course load has been 3.2 courses per semester per FTE, 10.0 credits per semester per FTE, 46 students per semester per FTE. The five-year averages of these numbers have varied by less than 10% from one faculty member to another.

The 96 courses taught in the Math Department over the past 5 years are listed in Table 1 and categorized in Table 2. Roughly a third of these courses (Elementary Statistics, Symbolic Logic, Calc A, Math Toolkit, and an Earlham Seminar) are lower level service courses almost devoid of math majors. These account for 39% of our credit hours, and 54% of our students. Another third of our courses (Math Modeling, Discrete Math, Calc B, Mathematical Statistics, Multivariate Calculus, Differential Equations, and Applied Math) are a mix of students from other departments with some representation of our majors. These amount to 30% of our credits and 27% of our students. The remaining third, (29% of the credits and 18% of the students) are courses primarily consisting of math majors (Algebra and Analysis A/B, Linear Algebra, Sophomore Seminar, Senior Seminar, and the Comprehensive Independent Study).

One thing to take away from these tables is the level of commitment of Mathematics to serving the needs of students across the College. Two-thirds of our courses are required for other majors and would need to be offered even if the Math major itself were to disappear. Given the student-run nature of the seminars and the Comps course, each faculty member teaches slightly over one upper-level class aimed at majors each year. By any measure, a half to two-thirds of our time goes into teaching courses for other people's students.

A typical annual schedule in the Mathematics Department is shown in Table 3. With current staffing, we would expect each of the next 3 years to look essentially like this. Enrollments are based on 5-year averages for these courses without trying to account for differential enrollments in spring and fall semesters. Our model has Mic doing one course for Environmental Science in the spring, with Tim and Anand full time in Mathematics.

Proposed Additions

The difficult piece of modeling the Mathematics Department with an additional faculty member is prioritizing competing desperate needs, many of which would continue to be unmet even with the increased staffing. Here are some of the services we would like to provide (and that our colleagues in other departments would like us to provide) in an imaginary world without constraints:

- Earlham desperately needs more classes in Statistics. Elementary Statistics sections have been as large as 44 during the past 5 years; 4 of the 11 sections in that time have been 33 students or more. This already is a serious problem for students and faculty alike. Further, the material we are able to cover in that first course, given the math-phobic character of many of our students, is very limited. Many of our client departments are disappointed that material their students need for applications is not addressed in Elementary Statistics. Some of those departments have begun offering their own classes in statistics, but this seems like an odd use of resources. Further, one of the things faculty making this experiment have learned is that the difficulties that prevent us from doing a better job with statistics also apply to them.

Ideally, we would add sections of Elementary Statistics and we would add perhaps 2 other courses—a continuation of Elementary Statistics aimed at allowing students with modest mathematical backgrounds to study statistics past the first course, and perhaps a second course continuing the Mathematical Statistics course and permitting students with some calculus background to go deeper in statistics and probability. Given the centrality of statistics for many of the sciences, we would expect these courses to be well-populated. In our dream world, we have now added roughly 3 courses a year to the department.

- Ideally, it would also be nice to add a section or two of Calculus. The average enrollment of 25 in Calc A is certainly manageable, but we have had sections as large as 33 and 42, which is not. Offering Calc B every semester would also be a useful service. I mention these needs, but think of them as rather low priority. The priority is raised, however, if we look at the cost of having only a single track for calculus. Students in Calc A range from very adept potential majors and students trained outside the US who are capable of really understanding the subject's full formal richness to students for whom elementary algebra is a struggle and who find even the rough ideas very elusive. Having to shoot for the middle of this wide distribution, we often end up failing to meet anybody's needs. Our good students are crippled and bored by not seeing the real richness and beauty of the fundamentals; our less experienced students find themselves desperately hanging on to pass the class without real understanding. Most of the GLCA schools have more than one track in calculus; Hope and Kalamazoo have three. It would be interesting to explore dividing calculus to add benefit to both communities of users. This could be done in a minimal way by adding two courses a year (one in Calc A and one in Calc B), or even one (just in Calc A).
- Earlham offers no courses of a College Algebra/Precalculus nature for students needing to shore up high school math skills and not yet ready for Calculus. This policy grows out of decisions made before any of the current faculty had come to the College—decisions that college-level mathematics begins at calculus and that Earlham should admit students ready to begin calculus, and correspondingly, that the Mathematics Department staffing could be based on the assumption that we did not need to teach classes that our students had already taken in high school. The current faculty arrived at the College accepting this decision, but aware that it was to greater or lesser degree an institutionally convenient fiction. It allowed us to allocate scarce resources places other than mathematics as long as we accepted the fact that there would be some ill-prepared students who would be closed out of opportunities to take mathematics (and majors requiring math) unless they remedied their weak backgrounds with external classes.

  Increasingly, however, our colleagues (most of whom know nothing about these antediluvian decisions preserved within the Math Department by oral tradition) have begun to complain to us and among themselves that Math is not meeting the needs of our weaker students by offering Precalculus. We aren't, and we know that; and with the staffing that the institution has agreed on, we can't. We would like to open doors for these students,

but we are frankly frightened by the level of pent-up demand we suspect is out there. It would not surprise us if the demand for a gen-ed fulfilling Precalculus class were at least as great as the demand for Statistics or for Calculus. Adding Precalculus therefore probably commits us to another 3 courses per year.

- In some ways, however, a 3-hour Precalculus or College Algebra class may be a terrible model for addressing the math needs of our weaker students. A student who arrives at Earlham, as many do, not understanding basic algebra or percentages or graphs has mastered the art of not learning from math classes. They've been hating and failing to engage mathematics for many years (and looking down on themselves as a result), and they are fully capable of hating and failing to engage mathematics and of looking down on themselves one last time. They're great at that. We are therefore not sanguine about what we can accomplish for these students with yet another math class disconnected from anything they care about.

  What we think might make a difference for these students would be to convince them that mathematics is directly relevant to courses in their majors. We would like to see one or more Math Department faculty given release time to function as peripatetic wandering minstrels for mathematics. Right now, when faculty in Eco Bio or P Chem or Micro Econ or Psych or whatever need mathematical tools, they teach them themselves (and probably dream secretly of sticking pins in mathematician dolls or of letting the air out of our tires). What if a member of the Math Department were actively polling colleagues in classes like this and offering to team-teach one day or one week units on mathematical topics within these courses when the need arose? Might this not only engage students in mathematics learned on a need-to-know basis, but also relieve our colleagues and help convince students that mathematics was less scary than they thought? Might it not build interesting synergy that could entice students to look on us as allies and to take some of our courses in order to become stronger biologists or chemists or economists or psychologists? We'd like to explore this model of itinerant mathematical sages (preferably looking as much as possible like Gandalf the Grey) who might bring words of healing as needed to students throughout the College before again disappearing mysteriously into their fastness of Dennis Hall (fastnesses we would hope some intrigued students might dare to explore). Initially, anyway, this might involve the equivalent of one course per year, but we'd be open to seeing that service evolve.
- Before the staffing and teaching load shuffle that accompanied the move to semesters, and before Peter Suber left the College, Earlham used to have a rather rich curriculum in logic, offering Symbolic Logic at least annually and Logical Systems every other year. Now, Logical Systems has disappeared, and Mathematics no longer has the resources to contribute to Symbolic Logic, which hangs by a thread on Marya's devotion. We think this is a tragedy. Logic lies at the foundations both of Mathematics and of CS. It's also one of the 7 liberal arts, having had a central position in European scholarship (and perhaps even more in Indian scholarship, though Indian and Western notions of logic diverge sharply) for two and a half millennia. The prospect of an institution calling itself a liberal arts college and not

even teaching all of the trivium seems vaguely shocking, but it may lie in our immediate future. We'd very much like to move back to having some Math Department involvement in logic, perhaps alternating Symbolic Logic with Philosophy, but more importantly offering at least a second course in logic or a deeper first course for more symbolically literate students (just as Mathematical Statistics offers an alternative starting point for statistics. The cost of this might be 1 course per year.

- The range of rich and beautiful topics in mathematics that could form the bases of Earlham Seminar or IP courses is large. Geometry, mathematical modeling, mathematics in the arts, number theory, logic, chaos and the mathematics of change, all of these are just a quick list of possibilities that come to mind in a moment. In the last 5 years, we have found space for one ES course. It would be lovely if we could find room for more. Cost: 1 course per year.
- Mathematics is increasingly deeply interwoven into all of the natural and social sciences. Exploring these cross-disciplinary links is particularly of interest to Anand, but all three current members of the department have worked or earned advanced degrees in fields other than mathematics. We think mathematics has ideas to contribute to biology, to economics, to chemistry, to geology, to computer science and to other areas on campus. Seeing cross-disciplinary courses develop in game theory or in mathematical biology or in computational chemistry or in geological modeling or in numerical analysis or symbolic and algebraic computation would be a wonderful thing. Right now, those can't grow because we cannot commit additional effort outside the core of our discipline. But one or two courses a year of this nature would be a huge asset both to our majors and to students in other disciplines who might be inspired to explore new areas of their own subjects.
- Finally, there is a need for additional courses for mathematics majors at Earlham. I'll document below just how minimal—frankly, how scandalously limited—our major offerings are. For the moment, let me just mention geometry, complex variables, topology, and the history of mathematics as important areas where we have no courses. Just taking these 4 fields and offering one course a semester on a two-year rotation would make a world of difference to our majors intellectually and competitively, and it would be a gigantic boost to the morale of faculty who would have a larger chance to teach the deep and exquisite things that led us to make our homes in this field. The cost of this is two courses a year.

In my dream world, Earlham is now offering roughly an additional 14 classes per year. We have added at least two members to the faculty. While that would still leave us with the smallest Mathematics Department in the GLCA, we accept that this is not a possible move for Earlham at this time. This means that even with an additional hire, we can do fewer than half the things mentioned above.

We don't think that the Mathematics Department has the wisdom by itself to prioritize the proposals above. We need guidance and wisdom from our students and colleagues in other departments and from CPC. If the College were do decide that the best use of our limited resources was to grow in mathematics, then the question of how to use our added quantitative strength should be a matter for broader faculty

consensus. We're therefore reluctant to presume to design a definitive new set of course offerings for a new 4-person department. Since you ask for such a model, though, here might be my personal starting thoughts:

I think that demand to for Precalculus is so great that attempting to meet it would simply swamp everything else we want to do. For right now, I would continue the previous consensus that students should arrive at Earlham ready to begin calculus. Admissions might perhaps be reminded of this understanding. Adding classes in statistics seems absolutely critical, though. I would spend 2 courses per year on this task. Links between mathematics and humanistic thought seem important enough to me that I would add an ES or IP in mathematics each year. I would act to preserve logic by adding a course per year in logic, probably an introductory class for an audience with at least one previous class in mathematics. Finally, I would add two upper-level classes a year, perhaps a mix of cross-disciplinary courses and courses for math majors.

Every detail of the previous paragraph is up for discussion. It's not a consensus proposal from the College. It's not even a consensus proposal from our department. It's what makes sense to me as an individual tonight. I expect that in later discussion, a great deal of it will change. The only pieces that seem to me to be critical are that a new hire should allow us to add both courses that benefit the College widely and courses that strengthen our major. Currently, roughly 2/3 of our energy goes into courses for other people and 1/3 goes into courses for our major. I would propose continuing that ratio by adding 4 service courses and 2 courses of interest primarily to mathematicians. A higher service load than that would be disheartening to math faculty, who would see their individual ability to teach courses for majors drop. A higher number of courses for majors is not justified by the number of math majors. Within that framework, though, the details would have to be sought through consensus. For instance, if Precalculus trumps statistics and an ES in the minds of the wider community, then so be it. That would be a decision that would be easy to live with. The only part of this proposal I would be reluctant to see us mess with would be the 2/3 service 1/3 major ratio; but again, that is my opinion, not our opinion.

Finally, the RATS process seems to ask us to discuss the budgetary implications of adding a mathematician. We think these are fairly obvious, and fairly minimal. For a while a couple of years back, Mathematics was having a feud with the folks in Housekeeping, who were suspicious about the amount of chalk we were using; but we think this is the only area in which mathematicians are unusually costly. In the old academic joke, mathematicians are only the second cheapest type of professors (we need a desk and a wastebasket, while philosophers need only the desk); but we are prepared to take up a collection in Dennis to cover the added expense. There are also underutilized offices in Dennis that could easily be appropriated for another mathematician, and it is rare that all the classrooms in our realm are simultaneously in use.

Rationale

Much of the case for expanding the size of the Math Department has already been made in our discussion of what courses we would propose to add. Students are frustrated that we can't help them by offering courses they need. Colleagues are frustrated that we are not better preparing their students, in significant degree

because we don't have the resources to offer courses to do that. Mathematics faculty are saddened to teach in a department whose offerings are so minimal that we could probably not drop a single course and continue to offer a credible major, where we must routinely discourage our better prospectives from attending Earlham, and from which we have sent only one student to graduate school in mathematics in the last 20 years.

When we have raised these concerns with CPC and with other colleagues in the past, the response has sometimes been that Earlham is small even by GLCA standards, that we have a plethora of idiosyncratic majors. As a result it is normal that every department here is tiny compared to our competitors, and that we cannot prepare students for graduate school. Every department here struggles in this way.

If this is the case, then Mathematics is content. We have no case to argue that we should receive special treatment over anyone else. If Earlham is across the board by far the weakest school in the GLCA, then we will accept our status, continuing to do the best we can with the resources available and to celebrate the wonderful non-academic things this community offers.

Our impression, however, is that this is not the case—that at least some other departments send students to grad school more than once every couple of decades, that some other departments at least approach the strength of some of our competitors, that some departments are actually able to encourage quite good applicants to attend Earlham. In fact, we think this is probably true of most departments at the College, and that Mathematics has been almost uniquely neglected, perhaps because of our vague other-worldliness and lack of political savvy. If this is so, then we would hope to encourage the College to consider the possibility of beginning to remedy this situation. We think this is particularly desirable because of the importance of mathematics as a tool in so many other disciplines and as an essential piece of modern society.

Of course, every department can put together a wonderful story of how they would serve the Earlham community given added resources. Probably almost no department would turn down the chance to hire another faculty member. (Though actually, Math did turn down this opportunity when Jim Rogers was hired, having had a new hire in mathematics approved, but believing that the need for an additional computer scientist was even more acute than the need for an additional mathematician.) How might one fairly determine an appropriate staffing level for mathematics?

One possible approach might be to try to compare Earlham with the other schools in our cohort. In fact, the small size of Earlham's Math Department has been a continuing theme of outside examiners. In 1982, the NCA described Earlham's Math Department as presenting a "puzzling picture," and commented, "The team advises that this department is apparently understaffed for the kind of liberal arts college Earlham professes to be. Clearly, the mathematics faculty is overworked and students probably benefit insufficiently from their mathematics training." Since 1982, the Department's staffing has dropped by about half an FTE, and more recent accreditation reviews have contained similar comments.

A natural cohort with which to compare Earlham might be the other colleges of the GLCA. This is done in summary form in Table 4, which shows roughly how many courses of various types each college offers, and how many faculty teach mathematics there.

One should admit from the outset that practically every cell of this table involves uncertainty and sometimes arbitrary judgments. For most colleges, we could not easily get listings of current classes; so we are limited to listing what courses turn up in course catalogues. Mostly these catalogues probably reflect actual course schedules fairly accurately, but one senses that both at Kenyon and at Oberlin, there may be some of the wishful thinking one used to find in menus at Soviet restaurants, which were not lists of what one could order tonight, but nostalgic historical records of everything that had at one time or another been served or dreamed of at the establishment.

We have not counted courses with titles like "Topics in Math" or "Senior Seminar", not being certain how often such courses occur or what their nature is. We have excluded some courses like "Theory of Computation" that appear in Mathematics Departments at other schools but in Computer Science at Earlham. In many, many cases, the decision of where to classify a given course based only on a course title is highly impressionistic. It is also unclear to us how many of the faculty listed by other institutions are full-time; so the total faculty counts probably overstate total FTEs by varying amounts.

On the plus side, tables similar to this one were assembled independently by different people for the Department's 2002 review, and these agree fairly closely with Table 4.

Whatever the uncertainties of Table 4, though, some conclusions are unmistakable. At 15 distinct courses in mathematics, Earlham is in last place in the GLCA, slightly more than 10 courses below the non-Earlham GLCA median and 5 courses below next-to-last place Albion. We offer just over half the non-Earlham GLCA average number of courses in elementary calculus and in statistics. Outside Earlham, the average GLCA school offers 1.3 courses in general mathematics before the calculus level; only Earlham, Hope, and Kalamazoo offer none. In the fields of Probability, Operations Research, Optimization, Modeling, Numerical Analysis, Geometry, History of Mathematics, Math Education, Topology, Complex Analysis, Number Theory and Combinatorics, the average GLCA school outside Earlham offers a total of 6.7 courses, and every school apart from Earlham offers at least 4. Earlham alone offers none.

Earlham has 3 faculty members in Mathematics. The non-Earlham average is 10.1, and no other GLCA school has fewer than 7—more than twice our size. While one must remember in interpreting these numbers that Earlham is the second-smallest school in the GLCA, ratios of students to math faculty tell the same story. Among schools with separate Math and CS Departments, Earlham has by far the highest student/math faculty ratio, at 400/1, just under twice the average of our competitors. Among schools with combined Math-Computer Science departments, Earlham's ratio of students to Math+CS faculty is tied with Albion for last place and is 30% above the non-Earlham average.

Even if Earlham were to hire a fourth mathematician, our number of distinct classes would remain in last place or next-to-last place in the GLCA, our ratio of students to math faculty would be at the bottom of the schools having separate Math and CS Departments, and our ratio of students to Math+CS faculty would be well above the average for schools having combined departments.

There are areas where Earlham still looks competitive. In the core fields of algebra and analysis without which neither we nor Physics could continue to offer

a major, we look about average in the GLCA. But these happy isles of golden mediocrity are surrounded by a great empty abyss.

The members of the Earlham Math Department have great and genuine enthusiasm for our students, for our colleagues inside and outside the Department, and for the environment and values of the Earlham community. We hope, however, that this table helps clarify why we feel morally obligated to make sure prospective students understand that a decision to attend Earlham is a decision to limit sharply the amount of mathematics to which they can be exposed as undergraduates and the degree to which they can grow mathematically. We hope it also clarifies why we think it so important that we attempt to address critical weaknesses in a discipline that is so central to so much of our world.

Of course Earlham cannot and should not dream of competing with Chicago and Princeton, nor even with St. Olaf and Macalester. It seems awfully sad, though, that we cannot even dream of competing with Allegheny or Kalamazoo or Ohio Wesleyan.

Closing

That's our situation, and that's our speech. We are realistic enough to be aware that there is little chance that now is the moment at which the College will be able to begin to address what we obviously think is a very serious problem for our department and for all the departments we serve. Still, we feel a need to continue to remind the College of an area in which it seems to us that our weakness is bringing a lot of pain to our students and to our colleagues.

May those of you tasked with sorting out and prioritizing a long list of urgent needs be blessed with clarity of mind and with peace and gentleness of heart.

	Table 1: Math Department Offerings, 2004/5 - 2008/9				
Term	Course	Title	Credits	Enrollment	Instructor
Spring, 2009	120	Elem Stats	3	27	Jackson
Spring, 2009	180	Calc A	5	16	Pardhanani
Spring, 2009	195	Math Toolkit	2	8	McLarnan
Spring, 2009	280	Calc B	5	24	McLarnan
Spring, 2009	288	Soph Seminar	3	7	Pardhanani
Spring, 2009	300	Math Stats	3	11	Jackson
Spring, 2009	350	Multivariate Calc	4	14	Jackson
Spring, 2009	425	Abstract Algebra B	3	4	McLarnan
Spring, 2009	486	Comprehensive Indep Study	1	7	Pardhanani
Fall, 2008	120	Elem Stats	3	26	Jackson
Fall, 2008	180	Calc A	5	22	Pardhanani
Fall, 2008	180	Calc A	5	15	McLarnan
Fall, 2008	190	Discrete Math	3	14	McLarnan
Fall, 2008	310	Linear Algebra	3	11	Jackson
Fall, 2008	320	DE	3	12	Pardhanani
Fall, 2008	420	Abstract Algebra A	3	6	McLarnan
Fall, 2008	430	Analysis A	3	7	Pardhanani
Fall, 2008	488	Senior Seminar	3	6	Jackson
Spring, 2008	120	Elem Stats	3	25	Jackson
Spring, 2008	120	Elem Stats	3	20	Jackson
Spring, 2008	180	Calc A	5	14	Pardhanani
Spring, 2008	195	Math Toolkit	2	8	McLarnan
Spring, 2008	280	Calc B	5	20	McLarnan
Spring, 2008	288	Soph Seminar	2	8	Jackson
Spring, 2008	300	Math Stats	3	11	Jackson
Spring, 2008	350	Multivariate Calc	4	6	McLarnan
Spring, 2008	360	Applied Math	3	4	Hively
Spring, 2008	425	Analysis B	3	5	Pardhanani
Spring, 2008	486	Comprehensive Indep Study	1	5	Jackson
Fall, 2007	120	Elem Stats	3	24	Jackson
Fall, 2007	130	Symbolic Logic	3	18	Bower
Fall, 2007	180	Calc A	5	16	Pardhanani
Fall, 2007	180	Calc A	5	42	McLarnan
Fall, 2007	190	Discrete Math	3	27	McLarnan
Fall, 2007	310	Linear Algebra	3	10	Jackson
Fall, 2007	320	DE	3	8	Guillaran
Fall, 2007	420	Abstract Algebra A	3	4	McLarnan
Fall, 2007	430	Analysis A	3	6	Pardhanani
Fall, 2007	488	Senior Seminar	1	5	McLarnan
Spring, 2007	120	Elem Stats	3	42	Jackson
Spring, 2007	180	Calc A	5	13	Smith
Spring, 2007	195	Math Toolkit	2	13	McLarnan
Spring, 2007	280	Calc B	5	14	Jackson
Spring, 2007	288	Soph Seminar	2	8	McLarnan
Spring, 2007	300	Math Stats	3	11	Jackson
Spring, 2007	350	Multivariate Calc	4	10	McLarnan
Spring, 2007	360	Applied Math	3	3	Howell
Spring, 2007	425	Abstract Algebra B	3	5	Smith

Spring, 2007	486	Comprehensive Indep Study	1	9	Smith
Fall, 2006		ES: Geometry and Space	4	14	McLarnan
Fall, 2006	120	Elem Stats	3	44	Jackson
Fall, 2006	130	Symbolic Logic	3	29	Bower
Fall, 2006	180	Calc A	5	23	Smith
Fall, 2006	190	Discrete Math	3	21	Staff
Fall, 2006	310	Linear Algebra	3	15	Jackson
Fall, 2006	320	DE	3	9	Guilaran
Fall, 2006	420	Abstract Algebra A	3	9	Smith
Fall, 2006	430	Analysis A	3	3	McLarnan
Fall, 2006	488	Senior Seminar	1	9	McLarnan
Spring, 2006	120	Elem Stats	3	38	Ziebarth
Spring, 2006	180	Calc A	5	24	Staff
Spring, 2006	195	Math Toolkit	2	6	McLarnan
Spring, 2006	280	Calc B	5	17	Ziebarth
Spring, 2006	288	Soph Seminar	2	7	Ziebarth
Spring, 2006	350	Multivariate Calc	4	14	McLarnan
Spring, 2006	360	Applied Math	3	6	Howell
Spring, 2006	425	Analysis B	3	10	McLarnan
Spring, 2006	486	Comprehensive Indep Study	1	5	Ziebarth
Fall, 2005	120	Elem Stats	3	25	Ziebarth
Fall, 2006	130	Symbolic Logic	3	29	Bower
Fall, 2005	180	Calc A	5	28	McLarnan
Fall, 2005	190	Discrete Math	3	23	McLarnan
Fall, 2005	300	Math Stats	3	7	Jackson
Fall, 2005	310	Linear Algebra	3	14	Jackson
Fall, 2005	320	DE	3	10	Guilaran
Fall, 2005	420	Abstract Algebra A	3	7	Ziebarth
Fall, 2005	430	Analysis A	3	10	McLarnan
Fall, 2005	488	Senior Seminar	1	4	Ziebarth
Spring, 2005	120	Elem Stats	3	23	Jackson
Spring, 2005	195	Math Toolkit	2	9	Jackson
Spring, 2005	280	Calc B	5	17	Ziebarth
Spring, 2005	288	Soph Seminar	2	9	Ziebarth
Spring, 2005	350	Multivariate Calc	4	20	Jackson
Spring, 2005	425	Abstract Algebra B	3	5	Ziebarth
Spring, 2005	482	Math Modeling	1	11	Jackson
Spring, 2005	486	Comprehensive Indep Study	1	3	Ziebarth
Fall, 2004	120	Elem Stats	3	33	Jackson
Fall, 2004	130	Symbolic Logic	3	27	Bower
Fall, 2004	180	Calc A	5	33	Ziebarth
Fall, 2004	180	Calc A	5	18	McLarnan
Fall, 2004	190	Discrete Math	3	20	McLarnan
Fall, 2004	310	Linear Algebra	3	10	Jackson
Fall, 2004	320	DE	3	16	Hively
Fall, 2004	420	Abstract Algebra A	3	9	Ziebarth
Fall, 2004	430	Analysis A	3	6	McLarnan
Fall, 2004	488	Senior Seminar	1	2	Ziebarth
Total	96		299	1382	
/FTE/semester	3.2		10.0	46.1	

	Table 3: Math Courses Classified, 2004/5 - 2008/9				
	Class	Sections	Credits	Enrollment	Avg Enrollment
Lower Level Service					
	Earlham Seminar	1	4	14	14.0
	Elem. Statistics	11	33	327	29.7
	Symbolic Logic	4	12	103	25.8
	Calculus A	12	60	264	22.0
	Math Toolkit	5	10	44	8.8
	Total	33	119	752	
Mixed Service/Major					
	Math Modeling	1	1	11	11.0
	Discrete Math	5	15	105	21.0
	Calculus B	5	25	92	18.4
	Mathematical Statistics	4	12	40	10.0
	Multivariate Calculus	5	20	64	12.8
	Differential Equations	5	15	55	11.0
	Applied Math	3	9	13	4.3
	Total	28	97	380	
Majors					
	Sophomore Sem	5	11	39	7.8
	Linear Algebra	5	15	60	12.0
	Algebra/Analysis A/B	15	45	96	6.4
	Senior Sem	5	7	26	5.2
	Comps Indep Study	5	5	29	5.8
	Total	35	83	250	

	Table 3: Math Department Typical year with current staffing			
	Fall term			
Course	Title	Credits	Enrollment	Instructor
120	Elem Stats	3	33	Jackson
130	Symbolic Logic	3	21	Bower
180	Calc A	5	26	Pardhanani
180	Calc A	5	25	McLarnan
190	Discrete Math	3	21	McLarnan
310	Linear Algebra	3	12	Jackson
320	DE	3	11	Pardhanani
420	Abstract Algebra A	3	7	McLarnan
430	Analysis A	3	7	Pardhanani
488	Senior Seminar	3	5	Jackson
	Spring Term			
Course	Title	Credits	Enrollment	Instructor
120	Elem Stats	3	33	Jackson
180	Calc A	5	25	Pardhanani
195	Math Toolkit	2	9	McLarnan
280	Calc B	5	18	McLarnan
288	Soph Seminar	2	8	Jackson
300	Math Stats	3	12	Jackson
350	Multivariate Calc	4	13	McLarnan
360	Applied Math	3	3	Hively
425	Algebra B or Analysis B	3	6	Pardhanani
486	Comprehensive Indep Study	1	6	Pardhanani

		Table 4: GLCA Comparisons											
	EC	non-EC avg	Alb	All	Den	DeP	Hop	Kal	Ken	Obe	OWU	Wab	Woo
Algebra, Precalculus	0	1.3	2	2	1	1	0	0	2	2	1	2	1
Elementary Calculus	2	3.5	2	4	3	4	4	5	4	4	2	2	5
Statistics	2	3.8	4	2	2	4	5	3	6	3	5	4	4
Logic, Foundations	1	0.4	0	2	0	0	0	0	1	0	1	0	0
Discrete, Proof	2	1.1	1	1	2	1	1	1	0	1	1	1	2
Probability, OR, Optimization, Modeling, Numerical Analysis	0	2.3	3	2	2	3	3	1	2	2	2	2	3
Multivariate, DE, Linear Algebra, Applied Math, Math Physics	4	3.7	4	2	3	3	4	5	3	4	5	5	3
Geometry, History	0	1.1	2	2	0	1	2	1	1	1	1	1	0
Math Education	0	0.6	0	0	0	2	5	0	0	0	0	0	0
Analysis	2	1.7	0	2	2	1	2	2	2	2	2	2	2
Abstract Algebra	2	2.1	1	2	2	1	2	3	3	3	2	2	2
Topology	0	0.6	1	1	0	0	1	0	1	1	0	1	1
Complex Variable	0	0.8	0	1	1	0	1	1	1	1	1	1	1
Number Theory, Combinatorics	0	1.3	0	3	1	1	0	1	1	3	0	3	1
"Earlham Seminars"	0	0.6	0	0	5	1	0	0	0	1	0	0	0
Math Econ, Math Biology	0	0.2	0	0	0	1	0	0	1	0	0	0	0
Lower Level total	6	13.1	10	11	15	13	12	11	15	12	10	16	19
Upper level total	9	12.1	10	15	9	11	18	12	13	16	13	10	6
Total Courses	15	25.2	20	26	24	24	30	23	28	28	23	26	25
Enrollment	1200	2000	1950	2100	2050	2298	3226	1340	1600	2800	1850	900	1882
Faculty Size	3	10.1	8	12	9	7	15	10	9	13	10	9	9
Dept includes CS?	N		Y	N	Y	N	N	Y	N	N	Y	Y	Y
Students/Math Faculty	400	222.3		175		328	215		178	215			
Students/(Math+CS) Faculty	240	183.3	244		228			134			185	100	209