April 11, 2012

PROPOSAL FOR A MERGER OF THE DEPARTMENTS
OF MATHEMATICS AND STATISTICS

We propose that the faculty members currently belonging to the Department of Mathematics and to the Department of Statistics be housed in a new merged department to be called the Department of Mathematics, Applied Mathematics, and Statistics.

This document addresses the following four questions from the College of Arts and Sciences' (2008) *Guidelines: Creating, Merging, or Splitting a Department*.

   1) Why should this proposal be approved?
   2) What resources will be needed and/or expected?
   3) What impact will approval of this proposal have on the department(s), the college, and the university?
   4) How should the proposed process and results be evaluated?

1) Why should this proposal be approved?

This merger would create multiple opportunities not currently possible. Like other departments within the College, the departments of Mathematics and Statistics are smaller than corresponding departments in comparable institutions. This is a challenge to both departments. The Mathematics department needs to support growing undergraduate and graduate programs in mathematics and applied mathematics. Part of the service burden of the department has been handled by having introductory courses taught in large lecture format.   Similarly, in Statistics, the small department size has presented challenges in course offerings, which have recently been met, in part, by the use of temporary faculty and graduate students. Due to the suspension of the statistics graduate program, there will be no more PhD students left who can teach by fall 2012. We believe that merging the two departments will allow the statistics graduate program to reopen, will facilitate cooperation and collaboration among members of the two departments, with respect to both education and research, will increase national visibility, and will create the best chance at the CWRU for national distinctiveness and educational and research opportunities in mathematics and statistics.

Disciplinary Rationale for Merging the Departments: The question of whether mathematics and statistics are different enough to necessitate the existence of two different departments, or have enough common points that can thrive in a single, inclusive department is not new, either nationally or at our own institution.   At

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CWRU, the departments of Mathematics and Statistics were once in one department.   Nationally, some universities have separate departments in mathematics and statistics, respectively, some have combined departments. Whether they are merged or separate depends on what is the best for each university.   An argument in support of joining forces and expertise beyond a university structure can be found by the way the National Science Foundation has addressed the issue, accounting for the two disciplines as belonging to the larger mathematical sciences division (DMS) and at the same time acknowledging the differences. An example of the potential for cooperation of the disciplines can be found at SAMSI (Statistical and Applied Mathematical Sciences Institute: see www.samsi.info), a part of the Mathematical Sciences Institutes program of DMS.

In the last decade there has been a shift in the mathematical community toward inclusion of interdisciplinary areas of research that had previously been the province of other departments.   Among them one which particularly stands out is modeling, organizing and interpreting data, traditionally a forte of statistics and also of applied mathematics. In recent years synergies between statistical, numerical, and mathematical modeling within the sciences has steadily increased. Modern information technology has radically changed the landscape of exact sciences, the traditional application area of mathematics. Nowadays the massive data streams in almost all experimental fields call for expertise in statistical methods, a challenge that no serious institute of higher mathematical research and education can overlook.   Indeed, the frontiers of sciences and national security desperately need expertise in mathematics and statistics. See, for example, "Mathematical and Statistical Challenges for Sustainability," published by NSF (http://dimacs.rutgers.edu/SustainabilityReport/SustainabilityReport_Final08-02.pdf). The Department of Mathematics at our institution has been part of this national trend: with the steep growth of applied mathematics at all levels, undergraduate, graduate and faculty, the use of probabilistic and statistical methods has become more and more commonplace, bringing the department de facto closer to the Department of Statistics. In fact, the training of graduate students in applied mathematics routinely includes anywhere from two to five graduate courses in statistics, and more than half of the most recent MS and PhD theses have contained significant elements of probability and statistics.

The present configuration of the mathematics department includes about half applied and half pure tenured or tenure track professors, with probability or stochastic processes being part of the research of several of them. Thus, in terms of research interests the two departments already have several points of contact,

which after a merger, could be the basis for new cooperative projects. The size of the Department of Mathematics, which currently has 18 tenured or tenure track faculty and one instructor, is small when compared to mathematics departments at peer institutions. This puts the department at a disadvantage when it comes to securing external funds, in particular for department-based programs as opposed to individual projects.   The Department of Statistics is very small by any standard. It currently consists of two full professors and one instructor. It is expected that with a merger and new resources, it will be easier to meet the requests for statistics courses not only to the major and in the College, but also in the Weatherhead School, the Case School of Engineering and other schools in the university.

Strategic Planning Rationale for Merging the Departments: A compelling argument for merging the departments at this point in time arises from recent strategic planning and a realistic assessment of the scope of investments that the College can currently make. This has been discussed by the relevant CAS committees, most notably during the strategic planning process, and it has been determined that the level of investment needed to bring both departments to nationally competitive size is not possible under current conditions, nor is it anticipated that this would be possible in the near future. However, a preliminary internal assessment suggests that the addition of six (6) tenure or tenure-track faculty in the first three to four years after the merger would stabilize and solidify the new department, enhancing its chances to reach high national ranking. The six hires should include several to rebuild the statistics program. This does not account for the replacement of faculty who might retire or move.

There are reasons to expect that uniting the two departments will positively impact both research and educational programs. A number of faculty members in the Department of Mathematics have an interest in statistics and probability, either at a theoretical level or from an applied and computational perspective. This is an excellent premise for joint research activities with the faculty members in the Department of Statistics, whose knowledge of the subject matters is from a different perspective, but whose research makes extensive use of mathematical and computational tools. Research projects sustained by multidisciplinary, complementary expertise have a much higher chance to be externally funded.

Because of its relatively small size, the Applied Mathematics program has wisely relied on specialization in order to be competitive in the field in which larger schools gain visibility simply by the volume and with that their program can offer. For a small program with limited resources, careful planning of the program and maximizing the synergy is essential. Our program offers a rather unique

combination of scientific computing, modeling and probabilistic methods, including computational statistics. A merger with the Department of Statistics would be beneficial for Applied Mathematics and, in turn, by increasing the mathematical expertise, for Statistics also.

The current trend towards inclusion rather than fragmentation has motivated the ongoing effort towards removing barriers and artificial divisions between pure and applied mathematics, encouraging students to explore areas of mathematics related, albeit not central, to their topic of research. While the details of the organizational plan will have to be worked out jointly by the faculty members of the new department, it can be envisioned that a new educational structure will bring in new areas of concentrations focused on statistics which take advantage of the existing pertinent mathematical courses. The department will have three programs: mathematics, applied mathematics, and statistics for the BS, MS, and Ph.D. degrees, and majors each of the three area for the BA degree.

The disciplinary differences among mathematics, applied mathematics and statistics will be addressed in the guidelines for promotion and tenure of the new department, which should be formulated by the end of the first academic year following the formation of the new department.

Curricular issues also will be addressed in a preliminary manner prior to the completion of the merger, and finalized by the end of the first academic year following the formation of the new department. We will use existing courses and programs, reduce redundancies, and create new educational opportunities. We anticipate that educational programs will fall under the new department's umbrella, at the undergraduate, MS, and Ph.D. levels, with concentrations in the three programs (mathematics, applied mathematics, and statistics) available to students.

In sum, then, there are both disciplinary and practical reasons for merging these two departments. A merger of these two departments would allow for a synergy in fields that have a relationship to one another, but more importantly in which the fields could complement and enhance one another's capacities. There is every indication that this merger will benefit the department faculty and students, and thereby the College and University.

2) What resources will be needed and/or expected?

As the Departments of Mathematics and Statistics become the Department of Mathematics, Applied Mathematics, and Statistics, it will be requested that the

College budget will not decrease the expenditures for the departments from their state as of 2006; the purpose of merger is to make both disciplines become more competitive. This would include faculty and graduate student funding (prior to the suspension in Statistics), support staff, adequate support for the computer lab for department programs, computer resources, and miscellaneous funding for department activities. It will be requested that the College consider increasing the faculty size commensurate with the responsibilities and needs of each component of the new department.   More specifically, it is anticipated that at least six new tenure or tenure-track faculty will be hired in the new department. Due to the small number of PhD degrees awarded in Mathematics and Applied Mathematics over the last two decades, the Department of Mathematics is currently not NRC ranked. The Department of Statistics has had a successful statistics graduate program and is NRC ranked, although the program was recently suspended. This is another reason in support of a larger department which can be more prominently present in the educational landscape. It will be important for the College to provide support for a graduate program large enough to have national and international visibility. The new department will request the addition of 10 graduate assistantships that would move the new department closer to this goal. The supported graduate students also will play an important role in helping with the teaching obligations of the new unit.

3) What impact will approval of this proposal have on the department(s), the college, and the university?

As discussed in response to Question 1, this proposal will:

•	Enhance the capacity of the faculty in both departments for collaborative research.
•	Improve the education of our students, both undergraduate and graduate, by consolidating the related expertise of the faculty, by increasing course offerings, and by creating new programs more in line with progress in the field. In connection with the merger, the guidelines of the applied mathematics curriculum will be revised, in particular in regard to what can constitute a professional core.
•	Allow the reinstatement of a graduate program in Statistics.
•	Enhance the reputation of the College and University by increasing research efforts and publications, and as reflected in national rankings.

4) How should the proposed process and results be evaluated?

This proposed merger will require an evaluation of both process and outcome.

Process will be monitored by means of:

- Yearly (semiannual in the first year) report by the chair to the dean
- Yearly (semiannual in the first year) faculty meeting with the dean

The outcome will be evaluated starting from the third year after the merger by (as compared with baseline data collected the year prior to the merger):

- Number of research proposals submitted and amount of research dollars secured from agencies and foundations;
- Number of undergraduate majors and minors proportional to majors and minors in the College
- Number of MS and PhD awarded and placement of graduates
- Inclusion in NRC ranking of graduate programs
- National and international visibility of the department educational and research activities as measured by publications, presentations media and professional society publications, mentioning the program and number of citations of publications
- Size of the regular faculty in comparison to 2006 level