UNIVERSITY FACULTY SENATE FORMS
UGSGRD0271
Academic Program Approval

This form is a routing document for the approval of new and revised academic programs. Proposing department should complete this form. For more information, call the Faculty Senate Office at 831-2921.

Submitted by: Steven Hastings phone number: 831-1318

Department: Applies Economics and Statistics email address: hastings@udel.edu

Date: November 14, 2012

Action: Revise Major
(Example: add major/minor/concentration, delete major/minor/concentration, revise major/minor/concentration, academic unit name change, request for permanent status, policy change, etc.)

Effective term: 13 F
(use format 04F, 05W)

Current degree: MS
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed change leads to the degree of: MS
(Example: BA, BACH, BACJ, HBA, EDD, MA, MBA, etc.)

Proposed name: 4+1 BS and MS STAT: Statistics
Proposed new name for revised or new major / minor / concentration / academic unit (if applicable)

Revising or Deleting:

Undergraduate major / Concentration:
(Example: Applied Music – Instrumental degree BMAS)

Undergraduate minor:
(Example: African Studies, Business Administration, English, Leadership, etc.)

Graduate Program Policy statement change:
(**Must attach** your Graduate Program Policy Statement)

Graduate Program of Study: MS STAT: Statistics
(Example: Animal Science: MS Animal Science: PHD Economics: MA Economics: PHD)

Graduate minor / concentration:

Note: all graduate studies proposals must include an electronic copy of the Graduate Program Policy Document, highlighting the changes made to the original policy document.

List new courses required for the new or revised curriculum. How do they support the overall program objectives of the major/minor/concentrations)?
(Be aware that approval of the curriculum is dependent upon these courses successfully passing through the Course Challenge list. If there are no new courses enter "None")

None.

Explain, when appropriate, how this new/revised curriculum supports the 10 goals of undergraduate education: http://www.ugs.udel.edu/gened/

The proposed 4+1 BS and MS STAT program satisfies many of the 10 goals of the undergraduate general education. For example, because the 4+1 BS and MS STAT program grants an advanced degree in an accelerated time period, the students must become mathematically mature and technically sound to solve complex problems in statistics, and hence the goal 1 (*Attain effective skills in (a) oral and (b) written communication, (c) quantitative reasoning, and (d) the use of information technology*), goal 2 (*Learn to think critically to solve problems*) and goal 3 (*Be able to work and learn both independently and collaboratively*) will be supported.

Outside of classroom setting, the students will be given the opportunities for the ancillary learning through internship or other forms of research. A strong internship program is already in place for the MS students, and by offering the 4+1 BS and MS option, the undergraduate student can take advantage of this valuable program. In addition, the faculty members with funded research projects may give priority to the 4+1 BS and MS students for assistantship, since many projects could demand more time commitment than the 2 years of normal MS students. Through these options, goal 6 (*Develop the intellectual curiosity, confidence, and engagement that will lead to lifelong learning*), goal 7 (*Develop the ability to integrate academic knowledge with experiences that extend the boundaries of the classroom*) and goal 8 (*Expand understanding and appreciation of human creativity and diverse forms of aesthetic and intellectual expression*) will be satisfied.

Furthermore, since many students in the MS program are international students, the students enrolled in the 4+1 BS and MS program will have an early opportunity to interact with students from other countries. The makeup of the student body in the MS program and the early exposure to different cultures will assist the 4+1 BS and MS students in achieving goal 9 (*Understand the foundations of United States society including the significance of its cultural diversity*) and goal 10 (*Develop an international perspective in order to live and work effectively in an increasingly global society*).

All in all, the proposed 4+1 BS and MS program supports the 10 general education goals in a concrete way. The program can also help fulfill the goals of UD's *Path to Prominence.* Many of the goals of *Path to Prominence* coincide with the goals of general education described above. In addition, by creating the 4+1 BS and MS program, the university will be in a unique place for students of statistics, since very few universities have the combined BS and MS programs in statistics. At UD, the existing BS and MS programs need not be tweaked much for the combined program to work (for example, no new courses are needed and the BS program is flexible enough to accommodate accelerated degree program such as 4+1). In this way, UD has a chance to become a leader in undergraduate statistics education, which aligns with goals of the *Path to Prominence*. There already exist a strong program for the BS statistics majors, the addition of 4+1 option will enhance the undergraduate learning experience and will create a unique program that may receive the nationwide recognition as a rigorous yet innovative, and thus placing UD at the forefront of statistics education.

Identify other units affected by the proposed changes:

(Attach permission from the affected units. If no other unit is affected, enter "None")

None.

Describe the rationale for the proposed program change(s):
(Explain your reasons for creating, revising, or deleting the curriculum or program.)

The rationale for revising the MS program in STAT - by creating the 4+1 combined BS and MS option - is to enhance both the undergraduate and graduate programs and to increase the enrollment of domestic students. The MS program has seen an explosive growth in recent years, in part because there exists an excellent internship program (in partnership with many local industries) for MS students and in part due to very high demand for our graduates in industry and academia. However, there are very few domestic students in the program; the program is relatively unknown to the domestic students and some misconceptions exist about the statistics discipline. Despite this, the foreign students with MS degree in statistics have found employment relatively easily in the difficult economic times, so that the prospects are even greater for qualified domestic students.

The BS program in statistics, while recently has achieved some growth, still lags behind the growth of the graduate program. The BS program is a very challenging major, because the department is committed to a quality program that produces well-qualified students in the discipline; thus, the students who complete the program are well positioned to obtain good employment and to attend graduate school. Nevertheless, the opportunities for undergraduate students are limited and not as abundant as that for our MS graduates.

By offering the 4+1 BS and MS option in STAT, the students can (1) take advantage of the excellent undergraduate program, (2) make full use of the available graduate internship program, and (3) earn an advanced degree in half the time, to make themselves very competitive and marketable. The undergraduate program benefits because the possibility of 4+1 program can aid in recruiting outstanding students from high school and on campus, and the students will benefit greatly by earning an advanced degree in an accelerated timetable.

The 4+1 BS and MS STAT program will also assist with achieving the university and nation wide goals. Statistics is defined as one of the disciplines in STEM (Science, Technology, Engineering and Mathematics), a nation-wide initiative that strives to increase the number of domestic students studying these fields. The STEM is widely recognized as one of the most needed areas in the national level, and the universities (including UD) are at the forefront of providing the appropriate programs to strengthen the economics and securities of our country. By offering an attractive and accelerated degree program like the 4+1 BS and MS STAT, it is hoped that an increase in statistics enrollment occurs and hence fulfill the critical need in our national agenda.

Program Requirements:
(Show the new or revised curriculum as it should appear in the Course Catalog. If this is a revision, be sure to indicate the changes being made to the current curriculum and **include a side-by-side comparison** of the credit distribution before and after the proposed change.)

Admission Requirement: Students are admitted to the 4+1 BS and MS STAT program in the spring of the junior year. Students must be enrolled in the Statistics degree program in the Department of Applied Economics and Statistics at the time of the application, with a minimum of 60 credits and minimum GPA of 3.2 (on a 4.0 scale). It is desired that the students have completed STAT 470, STAT 471 and MATH 349 at the time of the application with the GPA of at least 3.5 in these courses. The following application material must be submitted: GRE scores, 3 letters of recommendation and a personal statement. Admission to the 4+1 program is competitive. Those who meet the stated requirements are not guaranteed admission, nor are those

who fail to meet all of those requirements necessarily precluded from admission if they offer other appropriate strengths. Application deadlines: Review of applicants begins October 15th of the junior year and students are officially notified by November 1st. Students are admitted with provisional status until completion of the senior year and 124 credits, whereupon they are granted regular status as graduate students. Interested students are encouraged to make their intentions known as early as possible to develop the course structure suited for admission of the 4+1 program.

Course Requirement: Students in 4+1 BS and MS STAT program will complete all requirements for the undergraduate major in statistics. However, the four-year curriculum for the undergraduate major (BS STAT) in statistics, when taken as part of the 4+1 program, contains required graduate courses that prepare the student for completion of the MS curriculum. For example, regular undergraduate statistics majors must choose one of: STAT 611 Regression Analysis, STAT 615 Design and Analysis of Experiments, FREC 615 Advanced Prices and Statistics, or STAT 674 Applied Data Base Management, where the 600 STAT courses listed here will fulfill the MS degree course requirement. For students who are provisionally admitted to the 4+1 BS and MS STAT and subsequently admitted to the MS STAT program, they must take either STAT 615 Design and Analysis of Experiments, or STAT 674 Applied Data Base Management, which will satisfy both the BS requirement and the MS degree requirement. Additionally, undergraduate statistics majors who are provisionally admitted to the 4+1 BS and MS STAT and subsequently admitted to the MS STAT program may waive the undergraduate requirement to take STAT 409 Regression and Experimental Design, by completing STAT 611 Regression Analysis. All courses above are 3 credit courses.

In addition, undergraduate statistics majors who are provisionally admitted to the 4+1 BS and MS STAT and subsequently admitted to the MS STAT program must take an additional 3-credit graduate course toward the 33 credit MS requirement: STAT 601 Probability Theory for Operations Research and Statistics, which must be completed in order to successfully complete the MS program. Hence, the students must take STAT 601 for 3 credits, and these credits can count towards the Electives of the undergraduate degree.

In summary, undergraduate statistics majors who are provisionally admitted to the 4+1 BS and MS STAT and subsequently admitted to the MS STAT program must take:

- STAT 611 Regression Analysis (3 credits)

which can waive the undergraduate requirement to take STAT 409, and will count towards the MS degree requirement. Also, the students must take one of the following:

- STAT 615 Design and Analysis of Experiments I (3 credits)
- STAT 674 Applied Data Base Management (3 credits)

which will satisfy a 600-level course requirement for the BS degree, and also count towards the MS degree requirement. Additionally, to complete the 4+1 BS and MS STAT program in a timely manner, the undergraduate statistics majors who are provisionally admitted to the 4+1 BS and MS STAT and subsequently admitted to the MS STAT program must also take:

- STAT 601 Probability Theory for Operations Research and Statistics (3 credits)

which may be counted towards the Electives of the undergraduate degree, and also count towards the MS degree requirement. Thus, there are 9 graduate credits (3+3+3 credits) that students must take while provisionally admitted to the 4+1 BS and MS STAT program, and these credits may count toward fulfilling the required courses in both the BS and MS degrees in statistics. The students are encouraged to take additional 600-level STAT courses in their junior and senior years, which will count towards the MS degree only.

The student needs to earn a grade of B (3.0) or better in the STAT graduate course.

The students in the 4+1 BS and MS STAT program may choose from non-thesis options, internship option, or the thesis option. However, the decision analysis concentration for MS STAT degree will NOT be available for the students in the 4+1 BS and MS STAT program.

MS	4+1 BS and MS
Requirements for the Master's Degree in Statistics The total credits required for the degree are 33. 21 credits of core, 3 credits of Signature Courses, and 9 credits of Approved Optional Courses. Statistics M.S. Core requirements (21 credits) STAT 601 Probability Theory for Operations Research and Statistics STAT 602 Mathematical Statistics STAT 603 Vector Spaces and Optimization STAT 611 Regression Analysis STAT 615 Design and Analysis of Experiments I STAT 617 Multivariate Methods STAT 641 Statistical Laboratory In addition, students must take one elected course from this Approved List of Signature Courses (3 credits) STAT 612 Advanced Regression STAT 616 Advanced Design of Experiments STAT 620 Nonparametrics STAT 621 Survival Analysis Approved Optional Courses (9 Credits) Three STAT 600 level courses with the exception of: STAT 608, STAT 609, STAT 613, STAT 670, and STAT 671, which were designed for nonmajors. Key approved optional courses include: STAT 656 Biostatistics; STAT 674 Data Management; STAT 675 Logistic Regression; or One Optional Course and 6 Thesis Credits (STAT 669) (9 credits) or One Optional Course and 6 Internship Credits (STAT 664) (9 credits)	**Requirements for the Master's Degree in Statistics** The total credits required for the degree are 33. 21 credits of core, 3 credits of Signature Courses, and 9 credits of Approved Optional Courses. Statistics M.S. Core requirements (21 credits) STAT 601 Probability Theory for Operations Research and Statistics STAT 602 Mathematical Statistics STAT 603 Vector Spaces and Optimization STAT 611 Regression Analysis STAT 615 Design and Analysis of Experiments I STAT 617 Multivariate Methods STAT 641 Statistical Laboratory In addition, students must take one elected course from this Approved List of Signature Courses (3 credits) STAT 612 Advanced Regression STAT 616 Advanced Design of Experiments STAT 620 Nonparametrics STAT 621 Survival Analysis Approved Optional Courses (9 Credits) Three STAT 600 level courses with the exception of: STAT 608, STAT 609, STAT 613, STAT 670, and STAT 671, which were designed for nonmajors. Key approved optional courses include: STAT 656 Biostatistics; STAT 674 Data Management; STAT 675 Logistic Regression; or One Optional Course and 6 Thesis Credits (STAT 669) (9 credits) or One Optional Course and 6 Internship Credits (STAT 664) (9 credits) Undergraduate statistics majors who are provisionally admitted to the 4+1 BS and MS

	STAT and subsequently admitted to the MS STAT program must take: • STAT 611 Regression Analysis (3 credits) ~~which can waive the undergraduate requirement to take STAT 409, and they also must take one of the following:~~ • STAT 615 Design and Analysis of Experiments I (3 credits) or STAT 674 Applied Data Base Management (3 credits) which will satisfy a 600-level course requirement for BS degree. Additionally, to complete the 4+1 BS and MS STAT program in a timely manner, the undergraduate statistics majors who are provisionally admitted to the 4+1 BS and MS STAT and subsequently admitted to the MS STAT program must also take within their first 4 years (for 3 credits): • STAT 601 Probability Theory for Operations Research and Statistics (3 credits) which may be counted towards the Electives of the undergraduate degree. There are 9 graduate credits (3+3+3 credits) that students must take while provisionally admitted to the 4+1 BS and MS STAT program, and these credits may count toward fulfilling the required courses in both the BS and MS degrees in statistics.

ROUTING AND AUTHORIZATION: (Please do not remove supporting documentation.)

Department Chairperson _____ Date _____

Dean of College _____ Date _____

Chairperson, College Curriculum Committee _____ Date _____

Chairperson, Senate Com. on UG or GR Studies _____ Date _____

Chairperson, Senate Coordinating Com. _____ Date _____

Secretary, Faculty Senate _____ Date _____

Date of Senate Resolution _____ Date to be Effective _____

Registrar _____ Program Code _____ Date _____

Vice Provost for Academic Affairs & International Programs _____ Date _____

Provost _____ Date _____

Board of Trustee Notification _____ Date _____

Revised 02/09/2009 /khs