Report of the Committee on Educational Policy and the Curriculum

To be presented at the February 19, 2018 meeting of the Faculty of Arts and Sciences
(Information is from the February 06, 2018 CEPC meeting)

Recommendations for approval to the Faculty of Arts and Sciences

The full text of syllabi, program descriptions, Undergraduate Record, as well as other documentation for these recommendations, are available prior to the FAS meeting in the office of the College Registrar, 106 Monroe Hall. Changes approved by the FAS will appear and become effective in the Fall 2018-2019 Undergraduate Record, unless otherwise noted.

The Committee recommends adoption of the following new courses.

NEW COURSE PROPOSALS

EAST ASIAN LANGUAGE & LITERATURE DEPARTMENT

To add to the Undergraduate Record

CHIN 3060 Pre-Advanced Speaking & Reading in Chinese II
CHTR 3125 Winning the Argument: Disputation and Persuasion in Early China
JPTR 3700 Japanese Popular Culture

ENGLISH LANGUAGE & LITERATURE DEPARTMENT

To add to the Undergraduate Record

ENSP 3400 Deafness in Literature & Film
ENSP 3410 Contemporary Disability Theory
ENWR 2800 Public Speaking

ENVIRONMENTAL SCIENCES DEPARTMENT

To add to the Undergraduate Record

EVSC 4170 Spatial Ecology

HISTORY DEPARTMENT

To add to the Undergraduate Record

HIEU 3504 The Holocaust on Film

INTERDISCIPLINARY-GLOBAL STUDIES PROGRAM

To add to the Undergraduate Record

GSGS 3120 Engineering, Public Health & Development: An Interdisciplinary Exploration

MIDDLE EASTERN AND SOUTH ASIAN LANGUAGES AND CULTURES DEPARTMENT

To add to the Undergraduate Record

MESA 3111 Film Festivals and Global Media Cultures: ME/SA Spotlight

RELIGIOUS STUDIES DEPARTMENT

To add to the Undergraduate Record

RELJ 3355 Prophecy in Islam and Judaism
RELI 3355 Prophecy in Islam and Judaism

STATISTICS DEPARTMENT

To add to the Undergraduate Record

STAT 1601 Introduction to Data Science with R
STAT 1602 Introduction to Data Science with Python

The Committee recommends adoption of the following program changes.

PROGRAM CHANGE PROPOSALS

ENGLISH LANGUAGE & LITERATURE DEPARTMENT

Emended Record (changes highlighted):

Area Program in Poetry Writing requirements

Take 30 credits of courses in English. These must include:

1. ENGL 3810 and ENGL 3820.
2. 12 hours of upper-division (3000-level or above) ENCW poetry writing courses or independent studies.
3. Two Poetry Writing Area Program seminars (ENPW 4820).
4. One course in literature published before 1800 at the 3000-level or above (ENMD, ENRN, ENEC)
5. The Capstone Course (ENPW 4910), offered in the spring semester of the fourth year.

When offered, a prosody or other poetic forms class is also recommended.

Students may elect to apply, as well, to take part in the Distinguished Majors Program, a scholarly project that is separate from the APPW.

Poetry Writing (Area Program)

- ENPW 4820 - Poetry Program Poetics Credits: 3
- ENPW 4910 - Poetry Capstone Credits: 3

CHINESE LANAGUAGES AND LITERATURE DEPARTMENT
JAPANESE LANGUAGES AND LITERATURE DEPARTMENT

To propose changes to the major requirements for Chinese and Japanese
To add a minor in Chinese, Japanese, Korean and Tibetan

The Major in Chinese

The major in Chinese prepares students to handle a wide array of Chinese language materials and to communicate in Chinese on a broad array of topics with a robust of modern and classical Chinese language courses. The literature curriculum features many of the high points of China's literary past and present in English translation, from the ancient The Book of Odes to classic poems of Tang and Song dynasties, classic fiction like Journey to the West and Dream of the Red Chamber, to modern works like Mao Dun's Rainbow, Eileen Chang's Love in a Fallen City, and Yu Hua's To Live. Through extensive coverage of language and literary culture, the Chinese major aims to produce students with the skills of cultural literacy and interpretation as well as linguistic proficiency. Students are also encouraged to demonstrate the integration of their skills and knowledge through the translation of literary works into English.

Requirements: 31 credits courses with the following distribution:

- 3 credits in EAST 1010;
- 15 credits in CHIN courses at or above the 3000-level, 6 of these credits can come from CHTR courses at the advisor's discretion;
- 6 credits in the two-semester survey sequence CHTR 3010 & CHTR 3020;
- 3 credits in classical Chinese (CHIN 4830 or CHIN 4840);
- 4 credits consisting of CHTR 4991 and a 3-credit departmental seminar at the 3000-level or higher in which the final paper uses Chinese language materials.
- A maximum of 15 study abroad credits and domestic transfer credits are allowed at the discretion of the student's advisor.
- Students must maintain a grade of C or better in all courses that count toward the major.
- Students who wish to double major are reminded that only two courses may count towards both majors.

The Minor in Chinese

Students have the option of pursuing a minor focused on Chinese language study.

Requirements:

- 3 credits in EAST 1010;

- six CHIN courses of at least 3 credits each at or above the 2000-level.
- Students must maintain a grade of C or higher in all courses that count toward the minor.
- A maximum of 6 study abroad or domestic transfer credits may count towards the minor.

The Major in Japanese

The major in Japanese provides a distinctive combination of analytical, interpersonal, translingual and transcultural competencies that make students sophisticated and engaged global citizens able to move between languages and cultures in a thoughtful and nuanced manner. The major offers language courses from beginning to advanced levels that develop the ability to read, write, listen and speak effectively in Japanese, as well as connect students with more specialized knowledge in their individual areas of interest, giving them the skills needed to further explore such topics in their own subsequent research or self-study outside the classroom. Students also come to develop an appreciation for contemporary Japanese social and cultural values through their engagement with the language. Content courses on Japanese literature and culture in English provide thematic breadth and historical depth to this understanding by familiarizing students with texts representing more than a millennium of writings including some of the globe's earliest and most distinguished literary works, and by honing their appreciation of the ways in which the translation and interpretations of these texts are shaped by historical, cultural, social, and linguistic forms of difference.

Requirements: 31 credits with the following distribution:

- 3 credits in EAST 1010;
- 15 credits in JAPN courses at or above the 3000-level, 6 of these credits can come from JPTR courses at the advisor's discretion;
- 6 credits in the two-semester survey sequence JPTR 3010 & JPTR 3020;
- 3 credits in classical Japanese (JAPN 4710);
- 4 credits consisting of JPTR 4991 and a 3-credit departmental seminar at the 3000-level or higher in which the final paper uses Japanese language materials.
- A maximum of 15 study abroad credits and domestic transfer credits are allowed at the discretion of the student's advisor.
- Students must maintain a grade of C or better in all courses that count toward the major.
- Students who wish to double-major are reminded that only two courses may count towards both majors.

The Minor in Japanese

Students have the option of pursuing a minor focused on Japanese language study.

Requirements:

- 3 credits in EAST 1010;
- six JAPN courses of at least 3 credits each at or above the 2000-level.
- Students must maintain a grade of C or higher in all courses that count toward the minor.
- A maximum of 6 study abroad or domestic transfer credits may count towards the minor.

The Minor in Korean

Students have the option of pursuing a minor focused on Korean language study.

Requirements:

- 3 credits in EAST 1010;
- six KOR courses of at least 3 credits each at or above the 2000-level.
- Students must maintain a grade of C or higher in all courses that count toward the minor.
- A maximum of 6 study abroad or domestic transfer credits may count towards the minor.

The Minor in Tibetan

Students have the option of pursuing a minor focused on Tibetan language study.

Requirements:

- 3 credits in EAST 1010;
- six TBTN courses of at least 3 credits each at or above the 2000-level.
- Students must maintain a grade of C or higher in all courses that count toward the minor.
- A maximum of 6 study abroad or domestic transfer credits may count towards the minor.

MATHEMATICS DEPARTMENT

To propose changes in the requirements for the Mathematics major

Emended RECORD (Changes Highlighted):

The MATH 1210, 1220 sequence is unacceptable as a prerequisite for mathematics courses numbered 2310 and above.

Requirements for Major

Normally, the calculus sequence MATH 1310, 1320, and 2310 or its equivalent must be completed before a student can declare a major in mathematics. At least a 2.200 average in the calculus sequence and a minimum grade of C in MATH 2310 or its equivalent are required. However, the department may grant special permission to declare a major to a student who has only completed MATH 1310 and 1320 , and at least one mathematics course (other than MATH 2310 or its equivalent) which could be counted toward the major in mathematics, provided the student completes MATH 2310 or its equivalent in the semester following the declaration of a mathematics major.

To graduate with a major in mathematics the student must show computer proficiency by completing CS 1110, CS 1111, CS 1112, CS 1113, CS 1120, or PHYS 2660 , or an approved equivalent course with a grade of C- or higher. This should be done as early as possible.

To help guide the student through the major, the mathematics department offers five concentrations. Completion of one of these concentrations is required. Each concentration contains a set of nine required mathematics courses all at the 3000+ level (approximately 28 credits). To graduate, a student must obtain minimum grades of C in seven of these courses and C- in the other two. Up to two courses that are being counted for another College major can also be counted for the major in mathematics. Three courses may be allowed if the other major is interdisciplinary.

For students at U.Va. from the start, up to two courses that are taken from outside the University and which are equivalent to College mathematics courses may be offered for the College mathematics major. For transfer students, the allowed number of transferred mathematics courses toward mathematics majors is decided case-by-case by the Director of Undergraduate Programs with advice from the transfer credit advisor.

Certain substitutions are allowed in all options, for example, MATH 4310 for MATH 3310 , MATH 4651 for MATH 3351 , MATH 4652 for MATH 3354 , and PHYS 5630 for MATH 4300. MATH 3250 and MATH 3255 are two versions of the same course; a student may not take both for credit.

The Math major who has taken Math 2315 and Math 3315 and achieved a B- or better in both is not required to take Math 3351 or Math 3250 as is required in most concentrations. Math 3315 then counts as an elective but the total number of required courses is the same as in the concentration for which they are registered (Basic, Financial Math, etc.). Math 2315 is a substitute for Math 2310 as a requirement for

declaring a major. We encourage the student who completes Math 2315 and 3315 to take more advanced courses in Linear Algebra and Differential Equations, in particular Math 4651 instead of Math 3351 and Math 4250 instead of Math 3250. **At most three APMA courses can be offered for the math major. Exceptions may be granted upon request to the Director of Undergraduate Programs.**

A. The Basic Concentration

Students fulfilling the requirements for this option have a wide range of career opportunities, from law to business to any field that requires deductive, logical reasoning skills.

This traditional program for the mathematics major provides an overview of key areas:

MATH 3250 - Ordinary Differential Equations Credits: 4

MATH 3310 - Basic Real Analysis Credits: 3

MATH 3351 - Elementary Linear Algebra Credits: 3

MATH 3354 - Survey of Algebra Credits: 3

Five mathematics courses at the 3000 level or higher. Approved courses without a MATH prefix include those listed below in the Substitutions section or courses which are listed as requirements or electives for one of the other concentrations. However, the Economics and Commerce courses listed under the Financial Mathematics Concentration are not included as allowed electives in the Basic Concentration. At least two electives must be MATH courses.

B. The Graduate Preparatory Concentration

This concentration is for the student who plans to attend graduate school in mathematics or an allied field. The program emphasizes the fundamental ideas of mathematics with substantial work in proving and understanding the basic theorems. It consists of:

MATH 3250 - Ordinary Differential Equations Credits:4

MATH 3340 - Complex Variables with Applications Credits: 3

MATH 4310 - Introduction to Real Analysis Credits: 3

MATH 4651 - Advanced Linear Algebra Credits: 3

MATH 4652 - Introduction to Abstract Algebra Credits: 3

Four mathematics courses at the 3000 level or higher. Courses without a MATH prefix, and not listed below as an approved substitution or elective, are generally not allowed. At least two electives must be MATH courses.

(Students may wish to take MATH 3310 in preparation for MATH 4310 , MATH 3351 in preparation for MATH 4651 , and MATH 3354 in preparation for MATH 4652.)

This constitutes the minimum expected of an incoming graduate student in most programs nationwide. The department strongly recommends MATH 4330 (Advanced Multivariate Calculus), as well as courses in differential geometry (MATH 4720) or

topology (MATH 4770) or both. The department may recommend access to its 7000-level graduate courses for undergraduates with particularly strong capabilities.

C. The Probability and Statistics Concentration

This concentration is designed to give the student a good theoretical underpinning in probability and statistics, as well as the opportunity to go deeper in these fields. The program can lead to a Master of Science in Statistics with one additional year of course work, if additional courses in statistics are taken in the fourth year. (Those interested in the M.S. in Statistics should contact the graduate advisor in the Department of Statistics prior to the beginning of their fourth year.) The requirements for the concentration are the following:

- MATH 3100 - Introduction to Probability Credits: 3
- STAT 3120 - Introduction to Mathematical Statistics Credits: 3
- MATH 3250 - Ordinary Differential Equations 4
- MATH 3310 - Basic Real Analysis Credits: 3
- MATH 3351 - Elementary Linear Algebra Credits: 3
- MATH 3354 - Survey of Algebra Credits: 3
- MATH 4110 - Introduction to Stochastic Processes Credits: 3

Two additional course chosen from:

MATH 4310 - Introduction to Real Analysis Credits: 3

STAT 3130 - Design and Analysis of Sample Surveys Credits: 3 or STAT 5180

STAT 5120 - Applied Linear Models Credits: 3

~~STAT 5130 - Applied Multivariate Statistics Credits: 3~~ (DELETED)

STAT 5170 - Applied Time Series Credits: 3

~~STAT 5160 - Experimental Design Credits: 3~~ (DELETED)

~~STAT 5190 - Introduction to Mathematical Statistics Credits: 3~~ (DELETED)

D. The Financial Mathematics Concentration

This program provides the student with a broad background of basic mathematics, which is essential for an understanding of the mathematical models used in the financial markets. The mathematics of modern finance includes probability, statistics, regression, time series, partial differential equations, stochastic processes, stochastic calculus, numerical methods, and analysis. The program consists of:

- MATH 3100 - Introduction to Probability Credits: 3
- STAT 3120 - Introduction to Mathematical Statistics Credits: 3

- MATH 3250 - Ordinary Differential Equations 4
- MATH 3310 - Basic Real Analysis Credits: 3
- MATH 3351 - Elementary Linear Algebra Credits: 3
- MATH 3354 - Survey of Algebra Credits: 3
- MATH 4140 - Mathematics of Derivative Securities Credits: 3

Two additional courses chosen from:

- ~~APMA 3140 – Applied Partial Differential Equations Credits: 3~~ (DELTED)
- MATH 4220/APMA 3140 – Partial Differential Equations with Applied Mathematics Credits: 3
- APMA 5070 - Numerical Methods Credits: 3
- MATH 4110 - Introduction to Stochastic Processes Credits: 3
- STAT 5120 - Applied Linear Models Credits: 3
- STAT 5170 - Applied Time Series Credits: 3
- SYS 3021 - Deterministic Decision Models Credits: 3
- SYS 3060 - Stochastic Decision Models Credits: 3

In addition to the nine required MATH courses, choose two from:

(completing all four courses is recommended)

- COMM 2010 - Introduction to Financial Accounting Credits: 3
- COMM 2020 - Introduction to Management Accounting Credits: 3
- ECON 2010 - Principles of Economics: Microeconomics Credits: 3
- ECON 2020 - Principles of Economics: Macroeconomics Credits: 3

E. Five-year Teacher Education Program

This option leads to both Bachelor of Arts and Master of Teaching degrees after five years. The program is for both elementary and secondary teachers and is administered by the Curry School of Education.

The following are the required mathematics courses for this program (the Curry School has additional requirements):

- MATH 3100 - Introduction to Probability Credits: 3
- STAT 3120 - Introduction to Mathematical Statistics Credits: 3
- MATH 3250 - Ordinary Differential Equations 4
- MATH 3310 - Basic Real Analysis Credits: 3
- MATH 3351 - Elementary Linear Algebra Credits: 3
- MATH 3354 - Survey of Algebra Credits: 3
- MATH 4040 - Discrete Mathematics Credits: 3
- Math 5010 or MATH 5030 - The History of Mathematics Credits: 3
    - MATH 5700 - Introduction to Geometry Credits: 3

Distinguished Major Program in Mathematics

The Distinguished Major Program (DMP) is a special option within the math major that provides advanced training in mathematics by combining extensive course work (at the level of the Graduate Preparatory Track and beyond) with active involvement in various aspects of mathematical research. Successful completion of the DMP is required to receive high/highest honors. The centerpiece of the program that sets it apart from any track of the math major is the requirement/opportunity for a participating student to work on the Distinguished Major Thesis under the supervision of a faculty member (typically) in the 4th year of his/her undergraduate studies and then present the findings in a public defense of this work.
Students interested in the DMP should first declare a math major, choose a concentration, and have a
plan to fulfill all the requirements of this concentration (see additional course requirements below). Students apply for admission to the DMP no later than in the spring semester of their third year, and should have completed at least two of the required courses below by the time of application. Criteria for acceptance into the program include letters of recommendation from mathematics instructors, the GPA in mathematics, and the cumulative College GPA (3.400 or higher). Because of the importance of the research component in the program, the individual programs of studies of the students interested in the DMP should include the completion of Math 4840 Introduction to Mathematical Research at an early stage - typically, by the time of application and certainly no later than the Fall semester of the fourth year.
A complete application will include a letter of application addressed to the DUP (Director of Undergraduate Programs), a copy of the transcript, and two letters of recommendation. One of these letters should be from the prospective thesis advisor

confirming his or her readiness to supervise the project and outlining the general topic of the thesis. While the applicant could request one more letter of recommendation from a UVA math faculty member, another possibility might be, for example, the supervisor of an REU project (Research Experiences for Undergraduates) taken outside UVA. A letter from a Math 4840 instructor (if this course either has already been completed or is being taken by the student at the time of application) can also be helpful in the decision-making process (in addition to or as one of the two letters required for application).
The decision on admission to the DMP is made by the DUP in consultation with the prospective thesis advisor.
Students are expected to complete the following courses with a GPA of at least 3.4 and a minimum grade of B- in each course:

Math 3340 Complex Variables with Applications
Math 4310 Introduction to Real Analysis
Math 4651 Advanced Linear Algebra
Math 4652 Introduction to Abstract
Algebra Math 4770 General
Topology
Math 4330 Advanced Multivariable Calculus, or Math 4720 Introduction to Differential Geometry

In addition, students must complete at least two math electives at the 4000 level and above. Furthermore, Math 4840 Introduction to Mathematical Research, and the two semester sequence, Distinguished Major Thesis I and II, Math 4900 and 4901 (see below) are required. Certain substitutions such as graduate level versions of the courses listed above are possible at the discretion of the DUP.

All these courses assume the ability to understand and write proofs. So students potentially interested in the DMP but having insufficient prior exposure to proof-based mathematical instruction should discuss their situation with the DUP in order to determine the best way of acquiring the necessary skills before taking the courses required for the DMP. (This can be accomplished, for example, by taking the Advanced Calculus sequence Math 2315-3315 and/or some of the following courses: Math 3000, Math 3310 and Math 3354, but there are other possibilities).
Distinguished Major Thesis is an original essay containing an exposition of results in advanced mathematics. It is written by a student under the supervision of a faculty advisor who guides the student through all stages of the process, from formulating the topic and determining the scope of the project to putting the finishing touches on the final product and presenting it at the public defense. For bookkeeping purposes, all these activities will be framed as taking Math 4900 and Math 4901, Distinguished Major Thesis I and II, in the fall and spring of the 4th year; each semester will carry 3 credits.
In preparation for the work on the thesis, students are expected to acquire some initial skills of mathematical research through taking Math 4840, which is the reason why students interested in the DMP should consider enrolling in this class early on.
The work on the thesis is a multi-stage process, which should begin no later than the end of the third year, soon after the application for the DMP has been approved. At the initial stage the faculty advisor discusses with the student the general topic of the project, determines its parameters and recommends the materials for the student to work with over the summer to get introduced to the chosen area. The precise topic of the

thesis can be formulated in the beginning of the fourth year based on the student's report on the work done in the summer. Depending on the availability of funds, the department will try to help DMP students stay in residence at UVA for several weeks during the summer to facilitate an early start on the work on the thesis through frequent consultations with the advisor. As the project takes shape, the department may also help the DMP students to travel to suitable venues to present the results of their work if recommended by the faculty advisor.

The almost year-long process of preparation of the thesis culminates in a public defense of the work. The defense includes a presentation of the main findings in front of an audience consisting of undergraduate and graduate students, faculty and guests, open discussion of the results in a Q&A format, and a closed to the public examination with the defense committee (thesis advisor and two more faculty members). In the case of a successful defense, the student is awarded a special departmental certificate. This grade (in conjunction with the GPA in the required math classes) will be a major factor in nominating the student for high/highest honors.

While the Distinguished Major Thesis is a significant investment of time and effort, it has several important benefits for a student in addition to qualifying him/her for the high/highest honors. First and foremost, it creates a unique opportunity for a student to work one-on-one with a faculty advisor for a period of about one calendar year on a topic in advanced mathematics of mutual interest. This work will help to develop the student's analytical, research and expository skills, and can be expected to boost his/her application for graduate admission as well as for jobs in industry. It can also be a basis for the student's presentations at various venues and can sometimes lead to publications.

SEAS Students

Students in SEAS who wish to earn a bachelor's degree in mathematics must complete:

1. All courses required for a major in mathematics, in a chosen concentration, as listed in the undergraduate record and including minimum grade requirements.
2. At least 7 MATH courses (6 courses for Systems Engineering students) numbered 3000 or above, or approved electives from other departments, that are NOT listed as required courses by their SEAS specialization.

Echols Mathematics Club

Echols Mathematics Club is an undergraduate club for mathematics students that sponsors lectures, mathematics films, problem-solving sessions for the Putnam Mathematical Competition and other similar activities.

Additional Information

You can also find more information on the department web site: http://www.math.virginia.edu/.

Course Information

Elementary Courses in Mathematics

The entering College student has a variety of courses in mathematics from which to choose. Among those that may be counted toward the College area requirement in natural science and mathematics, are several options in calculus, elementary (non-calculus based) courses in probability and in statistics, and courses dealing with computer techniques in mathematics. Pre-commerce students are required to take a statistics course and one other mathematics course, usually MATH 1110, 1210, 1220, or 1310.

Students planning to major in the social sciences, arts, or humanities who wish to take a mathematics course but omit the study of calculus may choose from MATH 1110 (Elementary Probability Theory) and MATH 1140 (Financial Mathematics). Even though it is not a prerequisite, MATH 1110 is frequently taken prior to Introductory Statistics. MATH 1150 and 1160 are introductory courses that investigate familiar areas of elementary mathematics at a deeper level and are intended for first- and second-year nonmajors, especially those preparing to teach in elementary and middle schools.

In MATH 1140 the students learn the mathematics needed to understand and answer a variety of questions that arise in everyday financial dealings. The emphasis in this course will be on applications, including simple and compound interest, valuation of bonds, rates of return on investments, and more. Although the topics in this course are drawn primarily from business and economics, students of all majors are welcome and should find the applications interesting and relevant.

Calculus Sequence

The study of calculus is the foundation of college mathematics for students planning to major in mathematics or the physical sciences or anticipating a career or graduate study in any of the natural sciences, engineering, or applied social sciences (such as economics). There are three programs of study available in calculus:

- MATH 1210, 1220 is a terminal one-year sequence intended for business, biology, and social science majors;
- MATH 1310, 1320, 2310 is the traditional calculus sequence intended for students of mathematics and the natural sciences, as well as for students intending to pursue graduate work in the applied social sciences;
- MATH 2315 is the honors calculus program for advanced students, and it is usually offered in the Fall semester

The MATH 1210, 1220 sequence is unacceptable as a prerequisite for mathematics courses numbered 2310 and above. Students anticipating the need for higher mathematics courses such as MATH 3250 (Differential Equations), MATH 3100 (Probability) or STAT 3120 (Statistics) should instead elect the MATH 1310, 1320, 2310 sequence. Credit is not allowed for both MATH 1210 and 1310 (or its equivalent). MATH 2310 is the prerequisite for many advanced mathematics courses.

Students who need a remedial review of algebra and trigonometry may elect MATH 1190 Applied Calculus I with Algebra which is a 4-credit hour course and includes a review of algebra and trigonometry. Credit is not allowed for both MATH 1190 and 1210 (or its equivalent).

Advanced Placement

Students who have previously passed a calculus course in high school may elect MATH 1220, 1310, 1320, or 2310 as their first course, depending on placement, preparation, and interest. A strong high school calculus course is generally adequate preparation for MATH 1320 as a first calculus course, even if advanced placement credit has not been awarded for MATH 1310 . Students planning to take any advanced course in mathematics should not take MATH 1220, because credit for that course must be forfeited if the student takes MATH 1320 (or its equivalent). Well-prepared students (who place out of both MATH 1310 and 1320) may choose either MATH 2310 or 3250 (Differential Equations) as their first course. First and second year students have the option of taking MATH 3000 Transition to Higher Mathematics, which is offered in the Spring semester. MATH 3000 is designed for students who wish some preparation before taking MATH 3310 Basic Real Analysis and/or MATH 3354 Survey of Algebra. Students with a grade of B or better in MATH 3310, 3354, or any 5000-level Math course are not eligible to enroll in MATH 3000 .

Advanced placement credit in the calculus sequence is granted on the basis of the College Entrance Examination Board Advanced Placement Test (either AB or BC). A score of 4 or 5 on the AB test or on the AB subscore of the BC test gives the student credit for MATH 1310 . A score of 4 or 5 on the BC test gives the student credit for both MATH 1310 and 1320.

Substitutions

There are numerous instances of equivalent courses offered by the Department of Mathematics as well as by the Department of Applied Mathematics in the School of Engineering and Applied Science. A student may not offer for degree credit two equivalent courses (e.g., MATH 1310 and APMA 1090, or MATH 1210 and MATH 1310). The following are equivalent courses from the School of Engineering and Applied Sciences:

- APMA 1090 and MATH 1310 - Calculus I 4
- APMA 1110 and MATH 1320 - Calculus II 4
- APMA 2120 and MATH 2310 - Calculus III 4
- APMA 2130 and MATH 3250 - Ordinary Differential Equations 4
- APMA 3080 and MATH 3351 - Elementary Linear Algebra 3
- APMA 3100 and MATH 3100 - Introduction to Probability 3
- ~~APMA 3102/CS 3102 and MATH 5655 - Automata Theory Credits 3~~ (DELETED)

- APMA 3120 and STAT 3120 - Introduction to Mathematical Statistics 3
- APMA 3140 and MATH 4220 - Partial Differential Equations and Applied Mathematics 3
- APMA 3340 and MATH 3340 - Complex Variables with Applications 3
- APMA 5070 and MATH 4300 - Elementary Numerical Analysis 3

Standard Allowed Electives

- CS 3102 – Theory of Computation 3
- CS 4102 - Algorithms 3
- ECON 4010 - Game Theory 3
- PHIL 5420 - Advanced Logic Credit: 3
- PHIL 5470 - Philosophy of Mathematics Credits:3
- STAT 3120 - Introduction to Mathematical Statistics Credits: 3
- STAT 5265 Investment Science I Credit: 3
- SYS 3060 - Stochastic Decision Models 3
- SYS 3021 - Deterministic Decision Models 3

Course Descriptions

- MATH 1140 - Financial Mathematics
- MATH 1150 - The Shape of Space
- MATH 1160 - Algebra, Number Systems, and Number Theory
- MATH 1190 - Applied Calculus I with Algebra
- MATH 1210 - Applied Calculus I
- MATH 1220 - Applied Calculus II
- MATH 1310 - Calculus I
- MATH 1320 - Calculus II
- MATH 1330 - Calculus Workshop I
- MATH 1340 - Calculus Workshop II
- MATH 2310 - Calculus III
- MATH 2315 - Advanced Calculus and Linear Algebra I
- MATH 2700 - Euclidean and Noneuclidean Geometry
- MATH 3000 - Transition to Higher Mathematics
- MATH 3100 - Introduction to Probability
- MATH 3250 - Ordinary Differential Equations
- MATH 3255 - Ordinary Differential Equations
- MATH 3310 - Basic Real Analysis
- MATH 3315 - Advanced Calculus and Linear Algebra II
- MATH 3340 - Complex Variables with Applications
- MATH 3350 - Applied Linear Algebra
- MATH 3351 - Elementary Linear Algebra
- MATH 3354 - Survey of Algebra

- MATH 4040 - Discrete Mathematics
- MATH 4080 - Operations Research
- MATH 4110 - Introduction to Stochastic Processes
- MATH 4140 - Mathematics of Derivative Securities
- MATH 4210 - Advanced Calculus with Applied Mathematics
- MATH 4220 - Partial Differential Equations and Applied Mathematics
- MATH 4250 - Differential Equations and Dynamical Systems
- MATH 4300 - Elementary Numerical Analysis
- MATH 4310 - Introduction to Real Analysis
- MATH 4452 - Algebraic Coding Theory
- MATH 4595 - Undergraduate Research Seminar
- MATH 4651 - Advanced Linear Algebra
- MATH 4652 - Introduction to Abstract Algebra
- MATH 4657 - Bilinear Forms and Group Representations
- MATH 4658 - Galois Theory
- MATH 4660 - Algebraic Combinatorics
- MATH 4720 - Introduction to Differential Geometry
- MATH 4750 - Introduction to Knot Theory
- MATH 4770 - General Topology
- MATH 4830 - Seminar
- MATH 4840 - Introduction to Mathematical Research
- MATH 4993 - Independent Study

STATISTICS DEPARTMENT

To propose a Bachelor of Science in Statistics

Proposal: Bachelor of Science in Statistics

Listed below are the requirements for a proposed Bachelor of Science in Statistics. The BS is essentially an expanded version of the BA in Statistics, with requirements that align fairly closely with BS in Statistics degrees at other colleges and universities. The main differences between the BA and BS are that the BS requires more courses (10 for the BA versus 15 for the BS). The BS degree is created from existing courses, with no new courses required. Rationale and additional supporting information are included later.

Requirements: BS in Statistics

Prerequisite Courses to Declare:
1) Introductory statistics (one of STAT 1120, STAT 2020, STAT 2120)
2) Calculus II (MATH 1320)
3) Introductory programming (one of STAT 1601/1602, CS 1110/1111/1112/1113)

Required Courses:
1) STAT 3080: Data to Knowledge
2) STAT 3220: Introduction to Regression Analysis
3) STAT 3120: Mathematical Statistics
4) STAT 4996: Capstone
5) STAT 4120: Linear Models (currently STAT 5120, number change planned)
6) STAT 3130: Sample Surveys
7) MATH 3100: Probability
8) MATH 3351: Linear Algebra
9) STAT 4630: Statistical Machine Learning
10) 6 Electives from the Computational and Data Analysis lists, with at least three from the Data Analysis list.

Computational Electives

- STAT 3240: Programming in Matlab/Mathematica
- STAT 4260: Databases
- STAT 3430: Statistical Computing SAS/R
- STAT 3250: Data Analysis with Python
- STAT 4210: Big Data Tools
- CS 4750: Databases
- CS 4740: Cloud Computing
- CS 4444: Parallel Computing
- PHYS 2660: Fundamentals of Scientific Computing
- PHYS 5630: Computational Physics I
- PHYS 5640: Computational Physics II
- ASTR 4140: Research Methods in Astrophysics
- COMM 3220: Database Management Systems and Business Intelligence

Data Analysis Electives

- STAT 3220: Intro. to Regression Analysis
- STAT 3480: Nonparametric and Rank-Based Statistics
- STAT 4170: Financial Times Series and Forecasting
- STAT 5390: Exploratory Data Analysis
- STAT 5750: Data Visualization and Presentation
- STAT 4220: Applied Analytics for Business
- STAT 5170: Applied Time Series
- STAT 4440: Bayesian Statistical Analysis
- STAT 5740: Mining Unstructured Data
- STAT 5140: Survival Analysis and Reliability Theory
- STAT 5150: Actuarial Statistics
- STAT 5180: Design and Analysis of Sample Surveys
- STAT 5265: Investment Science I
- STAT 5330: Data Mining
- STAT 5340: Bootstrap and Other Resampling Methods
- MATH 4110: Stochastic Processes
- BIOL 4230: Bioinformatics and Functional Genomics
- PSYC 3006: Research Methods and Data Analysis II
- ECON 4710: Economic Forecasting
- ECON 4720: Econometric Methods
- SOC 5620: Social Demography
- SOC 5110: Survey Research Methods
- PLAD 2222: Research Methods
- PLCP 5550: Causal Inference in Comparative Politics
- SOC 3510: Topics in Applied Data Science

Restrictions on major courses:

- Only one of STAT 4170, STAT 5170, and ECON 4710 can count toward the major. (These are approximate versions of a time series course.)
- Only one of ECON 3720 and ECON 4720 can be counted toward the major. (These courses have overlapping material that also overlaps with STAT 3220.)
- Only one of ECON 3720, STAT 5120, and SYS 4021 can count toward the major. (These are all versions of a linear models course.)
- Only one of COMM 3220, STAT 4260, and CS 4750 can be counted toward the major. (These are all forms of a database course.)

Supporting Information

In 2005, the Department of Statistics established a Bachelor of Arts major in Statistics within the College's Interdisciplinary Major. This major draws courses from a variety of disciplines besides statistics, so has an interdisciplinary flavor. For the first five years the major existed, the number of students completing it was small, but starting in 2011-12 student interest begin to increase. The table below gives year-to-year counts for the number of students completing the major. (Students graduating during the summer are counted as part of the following academic year.)

Academic Year	Number of majors
2006-07	1
2007-08	8
2008-09	7
2009-10	5
2010-11	7
2011-12	27
2012-13	23
2013-14	41
2014-15	60
2015-16	93
2016-17	96

There are currently 97 students expected to graduate in Spring 2018, and 125 declared majors in the class of 2019. Many other Statistics programs have seen significant growth in recent years.

Recently there has been interest in reducing the number of programs under the Interdisciplinary Major, in particular those programs with a large number of students. In Fall 2016, the CEPC and College faculty approved a proposal from Statistics for a "stand alone" Bachelor of Arts in Statistics degree. (See Appendix A for the text of the proposal.) The new BA in Statistics draws on the existing Interdisciplinary Major, but has fewer concentrations and more constraints on the choice of electives. Since receiving College approval, Statistics faculty have been working off and on to compile the extensive materials required by SCHEV for approval.

During the summer of 2017, Associate Dean Rachel Most approached the Statistics faculty with a suggestion that a Bachelor of Science in Statistics be developed and offered. During summer orientation, she learned from a visiting parent that many federal contracts give significantly greater weight (in terms of years of experience) to Bachelor of Science degrees over Bachelor of Arts degrees in certain technical fields, including statistics. The Statistics faculty surveyed a sample of current 4th-years, and found that 30% reported that they would have opted to complete a BS instead of the BA if it was available. Based on the current number of majors, it seems likely that about 30 students per year would prefer a BS, enough to merit developing a major proposal.

Once the decision was made to develop a proposal for a BS in Statistics, it was decided to

wait to move the BA in Statistics proposal forward to the Provost and Faculty Senate until after the BS in Statistics is approved by the College faculty. After that happens, then both the BA and BS proposals will be taken forward together for the remaining approvals.

The resource impact of the BS in Statistics is expected to be relatively modest. As noted above, we expect about 30 students per year. We further assume that all such students would have otherwise completed the BA in Statistics, so the number of additional courses would be at most five per student. Many students who would opt for the BS over the BA are the sort that would take additional courses beyond the minimum required for the major, so the additional course demand generated by students in the BS is expected to be somewhat less than five per student. A rough estimate is that a total of 120 additional spaces in courses would be required annually, which is about 3% of the 3800 students per year currently taught by Statistics. The Department will be hiring two additional faculty in the next two years.

As noted above, the BS is an expanded version of the proposed BA, with the inclusion of more analytical breadth. One objective of the choice of curriculum is that students completing the BS should be well prepared for a PhD in Statistics program. Another was to follow recommendations of the American Statistical Association's *Curriculum Guidelines for Undergraduate Programs in Statistical Science*, available at

http://www.amstat.org/asa/files/pdfs/EDU-guidelines2014-11-15.pdf

A review of other undergraduate programs in Virginia was also conducted, including Virginia Tech, Virginia Commonwealth, James Madison, George Mason, and Old Dominion. There is variation from one program to the next, with the number of required credits ranging from 37 hours to as much as 57 hours, and different areas of emphasis. A summary of the program requirements for this schools is included in a separate spreadsheet BSMajors.xlsx.

The number of students at other Virginia school that are majoring in statistics is difficult to determine. In several cases, data for statistics students is combined with data for mathematics students, and there were also a few instances of clearly incorrect CIP codes, which further called into question the accuracy of published data. Because there is already an existing major in Statistics at UVA, we believe that there is ample evidence for interest in both Bachelor of Science and Bachelor of Arts major programs.

Appendix A: Bachelor of Arts in Statistics major proposal

The proposal below for a BA in Statistics was approved by the CEPC and College faculty in Fall 2016.

Undergraduate Major Proposal
Department of Statistics

The new major is a streamlined version of the existing interdisciplinary major, and will replace that major. It has three concentrations: Finance and Business, Biostatistics, and Data Science. There is also a generic major that has no concentration.

We have approximately 95 majors in the class of 2017. Interest in the major has been growing, but we also anticipate that some students who would have double majored in the past might opt out due to the increased requirements. Our best guess is that the number of majors will be about the same.

The current interdisciplinary major includes courses from other departments. This is still possible under the new major, but the number is reduced and we expect less "double counting" of courses with other majors. The new major also requires one more course than the current major. Taking all of this into account, we estimate that Statistics needs to provide space in about three additional courses for each student in the new major. Assuming about 100 majors per year, we estimate the need for approximately nine additional sections of courses when the new major reaches steady-state in 2018-19.

In 2016-17 the Department of Statistics is conducting searches for two tenure-track and one non-tenure-track faculty members. There is also an assistant professor who is arriving in 2017 after finishing a postdoc, and two additional tenure-track searches are planned for 2017-18 and 2018-19. There should be enough additional faculty to meet the increased requirements of the new major.

Summary of new courses

Listed below are the new courses required of some or all majors. Included are the number of sections to be offered when the new major reaches steady-state in 2018-19.

STAT 3110: "Foundations of Statistics" is a new 3-hour course designed to give students a focused introduction to probability and linear algebra. This course will replace MATH 3100 and MATH 3351 for many majors, and will be a prerequisite for STAT 3120.
Prerequisite: MATH 1220 or MATH 1320
Required of: All majors (3 sections per year)

STAT 4160: "Experimental Design" is a new 3-hour course in experimental design.
Prerequisite: STAT 3080 and STAT 3220
Required of: Biostatistics concentration (1 section per year)

STAT 4310: "Data Visualization and Presentation" is a new 3-hour course on data visualization and presentation. Various visualization tools will be used, and students will give presentations.
Prerequisite: STAT 3080 and STAT 3220

Required of: Biostatistics and Data Science concentrations (2 sections per year)

STAT 4995: "Capstone" is a new 3-hour project-based course. Students will work in teams on various types of projects, many that include an external client. Communication of results with be emphasized.
Prerequisite: STAT 3080, STAT 3220, and 4th year Statistics major
Required of: All majors (3 sections per year)

Major in Statistics
Concentration: Finance and Business (new)

This concentration is targeted at students who are interested in a statistics major slanted in the direction of finance and/or business. This will replace the existing concentrations in "Econometrics" and "Actuarial Finance" which had substantial overlap and a similar student audience.

Prerequisites to Declare:

1. Calculus 2 – MATH 1220, MATH 1320, or APMA 1110
2. Introductory statistics: STAT 1100, STAT 1120, STAT 2020, STAT 2120, APMA 3110, APMA 3120, PSYC 3005, or SOC 3130

Required Courses:

- STAT 3110: Foundations of Statistics OR
  (MATH 3100: Probability AND MATH 3351: Linear Algebra)
- STAT 3120: Mathematical Statistics
- STAT 3220: Introduction to Regression Analysis
- STAT 4170: Financial Time Series and Forecasting OR
  STAT 5170: Applied Time Series
- STAT 3080: Data to Knowledge
- STAT 4220: Applied Analytics for Business
- STAT 4995: Capstone
- Three electives, at least one from the Data Analysis list and one from the Computational list

Notes:

- Students considering graduate school in statistics are recommended to take MATH 3100, MATH 3351, and STAT 5120.
- Some courses have similar content. See the end of the proposal for restrictions on courses that can be counted toward the major.
- Suggested electives for this concentration include:
  - STAT 4260: Databases
  - STAT 3250: Data Analysis with Python
  - STAT 4210: Big Data Tools
  - STAT 4310: Data Visualization and Presentation
  - STAT 5390: Exploratory Data Analysis
  - STAT 5265: Investment Science I
  - STAT 5150: Actuarial Statistics

- STAT 3130: Sample Surveys
- COMM 3220: Database Management Systems and Business Intelligence

Major in Statistics
Concentration: Biostatistics

This concentration is targeted at students who are interested in a statistics major designed to complement biology and medicine. This concentration exists, below are the updated requirements. The significant changes are:

- BIOL 21000 & BIOL 2200 no longer part of major, they are prerequisites
- STAT 3080, 3220, 3130, 4160, and 4995 are now required.
- There is one fewer elective.

Prerequisites to Declare:

1. Calculus 2 – MATH 1220, MATH 1320, or APMA 1110
2. Introductory statistics: STAT 1100, STAT 1120, STAT 2020, STAT 2120, APMA 3110, APMA 3120, PSYC 3005, or SOC 3130
3. BIOL 2100 and BIOL 2200

Required Courses:

1. STAT 3110: Foundations of Statistics OR
   (MATH 3100: Probability AND MATH 3351: Linear Algebra)
2. STAT 3120: Mathematical Statistics OR
   APMA 3120: Statistics
3. STAT 3220: Introduction to Regression Analysis
4. STAT 3080: Data to Knowledge
5. STAT 3130: Sample Surveys
6. STAT 4310: Data Visualization and Presentation
7. STAT 4160: Experimental Design
8. STAT 4995: Capstone
9. Two electives, each from the Data Analysis or Computational electives lists.

Notes:

- Students considering graduate school in statistics are recommended to take MATH 3100, MATH 3351, and STAT 5120.
- Some courses have similar content. See the end of the proposal for restrictions on courses that can be counted toward the major.
- Suggested electives for this concentration include:
  - STAT 4260: Databases
  - STAT 4210: Big Data Tools
  - STAT 5390: Exploratory Data Analysis
  - STAT 3250: Data Analysis with Python

- BIOL 4230: Bioinformatics and Functional Genomics

Major in Statistics
Concentration: Data Science (new)

This concentration is targeted at students who are interested in data science. This concentration has more computation, and does not include STAT 3120 among the requirements.

Prerequisites to declare:

1. Calculus 2 – MATH 1220, MATH 1320, or APMA 1110
2. Introductory statistics: STAT 1100, STAT 2020, STAT 2120, APMA 3110, APMA 3120, PSYC 3005, or SOC 3130
3. Introductory programming, CS 111X or similar

Required Courses:

1. STAT 3110: Foundations of Statistics OR
   (MATH 3100: Probability AND MATH 3351: Linear Algebra)
2. CS 2110: Software Development Methods
3. STAT 3220: Introduction to Regression Analysis
4. STAT 3080: Data to Knowledge
5. STAT 3250: Data Analysis with Python
6. STAT 4310: Data Visualization and Presentation
7. STAT 4630: Statistical Machine Learning
8. STAT 4995: Capstone
9. Two Electives, at least one from the Data Analysis list

Notes:

- Students considering graduate school in statistics are recommended to take MATH 3100, MATH 3351, and STAT 5120.
- Some courses have similar content. See the end of the proposal for restrictions on courses that can be counted toward the major.
- Suggested electives for this concentration include:
  - STAT 4260: Databases
  - STAT 4210: Big Data Tools
  - STAT 5390: Exploratory Data Analysis
  - STAT 5330: Data Mining
  - STAT 5340: Bootstrap and Other Resampling Methods
  - STAT 5740: Mining Unstructured Data

Major in Statistics
(No concentration) (new)

This concentration is targeted at students who are interested in in a general statistics major with no concentration. It has more electives than the concentrations, allowing students to customize the major to their interests and needs.

Prerequisites to Declare:

1. Calculus 2 – MATH 1220, MATH 1320, or APMA 1110
2. Introductory statistics: STAT 1100, STAT 2020, STAT 2120, APMA 3110, APMA 3120, PSYC 3005, or SOC 3130

Required Courses:

1. STAT 3110: Foundations of Statistics OR
   (MATH 3100: Probability AND MATH 3351: Linear Algebra)
2. STAT 3120: Mathematical Statistics
3. STAT 3220: Introduction to Regression Analysis
4. STAT 3080: Data to Knowledge
5. STAT 4995: Capstone
6. Five Electives, at least three from the Data Analysis list

Notes:

- Students considering graduate school in statistics are recommended to take MATH 3100, MATH 3351, and STAT 5120.
- Some courses have similar content. See the end of the proposal for restrictions on courses that can be counted toward the major.
- Students will work with a major advisor to select electives that best meet the student's interests while also forming a coherent major program.

Computational Electives

- STAT 3240: Programming in Matlab/Mathematica
- STAT 4260: Databases
- STAT 3250: Data Analysis with Python
- STAT 4210: Big Data Tools
- CS 4750: Databases
- CS 4740: Cloud Computing
- CS 4444: Parallel Computing
- PHYS 2660: Fundamentals of Scientific Computing
- PHYS 5630: Computational Physics I
- PHYS 5640: Computational Physics II
- ASTR 4140: Research Methods in Astrophysics
- COMM 3220: Database Management Systems and Business Intelligence

Data Analysis Electives

- STAT 3120: Mathematical Statistics
- STAT 3130: Sample Surveys
- STAT 3480: Nonparametric and Rank-Based Statistics
- STAT 4170: Financial Times Series and Forecasting
- STAT 5120: Applied Linear Models
- STAT 5390: Exploratory Data Analysis

- STAT 4310: Data Visualization and Presentation
- STAT 4220: Applied Analytics for Business
- STAT 4630: Statistical Machine Learning
- STAT 5170: Applied Time Series
- STAT 4440: Bayesian Statistical Analysis
- STAT 5740: Mining Unstructured Data
- STAT 5140: Survival Analysis and Reliability Theory
- STAT 5150: Actuarial Statistics
- STAT 4160: Experimental Design
- STAT 5265: Investment Science I
- STAT 5330: Data Mining
- STAT 5340: Bootstrap and Other Resampling Methods
- BIOL 4230: Bioinformatics and Functional Genomics
- PSYC 3006: Research Methods and Data Analysis II
- ECON 3720: Econometrics
- ECON 4710: Economic Forecasting
- ECON 4720: Econometric Methods
- SOC 5620: Social Demography
- SOC 5110: Survey Research Methods
- PLAD 2222: Research Methods
- PLCP 5550: Causal Inference in Comparative Politics
- SOC 3510: Topics in Applied Data Science
- SYS 4021: Linear Statistical Models

Restrictions on major courses:

- Only one of STAT 4170 and ECON 4710 can count toward the major. (These are approximate versions of a time series course.)
- Only one of ECON 3720 and ECON 4720 can be counted toward the major. (These courses have overlapping material that also overlaps with STAT 3220.)
- Only one of ECON 3720, STAT 5120, and SYS 4021 can count toward the major. (These are all versions of a linear models course.)
- Only one of COMM 3220, STAT 4260, and CS 4750 can be counted toward the major. (These are all forms of a database course.

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