Department of Mathematics Computer Science and Statistics

University of South Carolina — A Guide for Undergraduate Majors

1978-1979

THE DEPARTMENT

The Department of Mathematics, Computer Science, and Statistics in the College of Science and Mathematics is one of the youngest departments on campus. It was formed by combining the traditional Department of Mathematics and the newer Department of Computer Science and then by adding "Statistics" to the name.

This booklet is designed to give you answers for the most common questions which come up about the Department and its courses and major programs. It begins with the general description of the General Curriculum of the College of Science and Mathematics as it applies to majors in Mathematics and Computer Science. Students interested in concentration in Statistics can do so by majoring in Mathematics. Following this is a statement of the various paths one can follow as a major, along with the cognate requirements. A suggested plan of study for eight semesters is included. These are supplemented by a suggested list for cognates, and a check list you can use to keep track of your progress. All course descriptions may be found in the USC Bulletin tabloid.

A major in mathematics or computer science should possess a reasonably high aptitude for mathematics. While a particularly high or low score on the math portion of the SAT may not prove anything at all, it does appear that those whose scores are high will do better in this Department than those whose scores are very low.

The curriculum presented in this booklet gives you a fair number of options which you must choose among as you progress toward your degree. It is therefore important that you give careful thought to these so that you may obtain a well-rounded education and maximize your employment potential after graduation. By the time you have reached your junior year, you should have given some thought to your activities after graduation, and you should therefore have been consulting with your advisor to prepare major and cognate programs consistent with your aims. While the program you prepare as you go along is never binding, the closer you get to graduation, the harder things are to change.

Most majors will find themselves in one of three careers following graduation: 1) graduate study in mathematics or computer science, leading to college-level teaching or work in industry or government at the Master or Ph.D. level; 2) work in government or industry at the Bachelor level; or 3) teaching at the secondary school level.

The facilities of this Department are extensive and are available to you as you need them for your study. The Department has a large and versatile faculty covering the areas of algebra, analysis, applied mathematics, combinatorics, computer science, education, graph theory, logic, number theory, probability, statistics, and topology. In addition, it has calculating equipment ranging from access to the University's IBM 370 digital computer through the Department's own PDP-11 systems to a collection of electronic desk calculators. The faculty and the equipment are available for your use, and if you wish to undertake a project, you should make your desires known to your advisor or another member of the faculty.

We hope that you will find this booklet useful, and we will be happy to answer any questions or receive comments.

WHOM TO SEE

When you become a major in the Department of Mathematics and Computer Science, you will be assigned an advisor to assist you with your plan of study, give you information about changes and developments in the Department, and see that you have a proper start toward the mechanics of registration each semester.

Plan to see your advisor during the regular advisement period which occurs during the end of each regular semester. During this visit, you and your advisor will plan your program for the following semester and will check your progress up to that point. But your advisor is also available to assist whenever you'd like, so feel free to consult with your advisor at any time, whether the problem is academic or personal.

When you have a special problem which is beyond your advisor's authority (such as variations on requirements, transfer courses), or when your advisor is unavailable and you need assistance with academic matters, see the Director of Undergraduate Studies for your degree program.

When you have questions about graduate programs or want information about other schools, or would like to know about qualifications for graduate study and graduate assistantships, see the Director of Graduate Studies:

Prof. George W. Johnson, LeConte 411, phone 4226.

In an emergency, or when you have a complaint, see the Chairman of the Department:

Prof. William T. Trotter, Jr., LeConte 409
phone 4225.

THE CURRICULUM IN THE COLLEGE OF SCIENCE AND MATHEMATICS

The following curriculum is required of all students in the College of Science and Mathematics. This list has been adjusted to correspond to the requirements for majors in Computer Science or Mathematics.

GENERAL EDUCATION REQUIREMENTS	53 hours
MAJOR	
General Major ..... 24 hours	
or	
Intensive Major ..... 36 hours	
Total Major	24 or 36
COGNATE	12 hours
ELECTIVES ..... (Any course except skill-building courses such as sports or typing)	31 or 19
TOTAL HOURS REQUIRED	120 hours

COURSES FOR GENERAL EDUCATION REQUIREMENTS OF CURRICULUM
(Modified to apply to Mathematics and Computer Science Majors)

GROUP	AREA	COMMENTS	SUGGESTED COURSES
I*	English		ENGL 101, 102
	Foreign Language		LANG 101, 102
	History		HIST 101-110 (any two)
	Math Sequence	Not 100, 101, 102	MATH 125, 141, 142**
II 6 hours	Math or Stat for CS majors	Not 100, 101, 102	MATH 241
	Comp. Sci for Math majors		CSCI 211 and 312
	Philosophy		PHIL 110, 111 only
III 6 hours	Afro Studies		AFRO 201, 202
	English	Not ENGL 101, 102, 245, 450, 459, 466	ENGL 281-295
	Fine Arts History	Art History	ARTH 101, 105, 106
		Music History & Literature	MUSC 110, 145
		Theatre History	THEA 161, 162, 561, 562
	Foreign Language	No language below the 201 level	
	History	Not HIST 101-110	HIST 201, 202
	Philosophy	Not 110, 111, 511	PHIL 102
	Religious Studies		RELG 101, 102, 103, 104
	University	Only UNIV 201	
IV 6 hours	Anthropology		ANTH 101
	Economics	Not ECON 291, 292	ECON 121, 122
	Geography		GEOG 103
	Govt./Int. Studies		GINT 100, 101, 102, 201, 202
	Psychology	Not PSYC 225, 396	PSYC 101, 103
	Sociology	Not SOCY 220	SOCY 101
V 7 hours (1 lab)	Astronomy		ASTR 111, 111A, 112, 112A
	Biology	Not BIOL 120	BIOL 101, 102
	Chemistry		CHEM 111, 112
	Geology		GEOL 101, 102, 103
	Marine Science		MSCI 101, 102
	Physics		PHYS 211, 212, 201, 202

*The Group I English, foreign language, and mathematics requirements are level of proficiency requirements. Students may exempt any part of these requirements by advanced placement.

**If a computer science major earns more than 9 credit hours of mathematics before he completes his Group I mathematics sequence, then the excess over 9 may, upon completion of the sequence, be used for Group II credit.

MAJOR PROGRAM IN MATHEMATICS

I. REQUIREMENTS

A. For a General Major (GM):

1. Each student must pass MATH 141, 142, 198.

2. Major Program Requirements*: MATH 241, 344, 351; 18 hours of approved MATH or STAT courses numbered above 351 including at least 6 hours of General Requirements (defined in C).

B. For an Intensive Major (IM):

1. Each student must pass MATH 141, 142, 198.

2. Major Program Requirements*: MATH 344, 351, 352; 30 hours of approved MATH or STAT courses numbered above 500 including at least 9 hours of General Requirements (defined in C).

C. General Requirements:

STAT 511 or 512	Probability or Statistics
MATH 520	Differential Equations
MATH 534	General Topology
MATH 543	Modern Algebra
MATH 554	Analysis

MATH 531 can be taken as a substitute for MATH 534 by Math Education majors only. MATH 552 may be substituted for MATH 554 with the consent of the advisor.

None of the courses MATH 360, 501, and 502 will be considered as an approved course for A or B above.

II. CATEGORIES OF MAJOR AND SAMPLE PROGRAMS:

A. General Graduate School Preparation:

(GM and IM)	534, 543, 554, (STAT) 511, 520
(IM)	545, 555, Electives

B. Applied Mathematics:

1. Graduate School Preparation:

(GM and IM)	534, 543, 554, 520, 521
(IM)	554, 525, 524, Directed Study

2. Professional Degrees:

(GM and IM)	552, 540, 520, 521, 524
(IM)	554, 525, 541, Directed Study

All Applied Mathematics students should take MATH 526, 527 as part of the Computer Science Cognate.

C. Math Education:

(GM and IM)	504, 531, 532, 543, 554
(IM)	Electives

*A grade of C or better must be obtained in all courses which are used to satisfy major program requirements.

D. Statistics:

1. Graduate School Preparation:

(GM and IM)	(STAT) 512, 513, MATH 554, 514, MATH 534 (or 543)
(IM)	MATH 555, (STAT) 515, (STAT) 516, MATH 520

2. Professional:

(GM and IM)	(STAT) 512, (STAT) 515, (STAT) 516, (STAT) 518, MATH 520
(IM)	(STAT) 513 (or 514), (STAT) 511, MATH 554 (or 552), 599E (Sampling)

E. General Purpose:

This category is for students who are not committed to one of categories A-D. Students who transfer to the department from another school or department will be assigned to this category until they select one of the other categories. While in this category, students should take courses from the General requirements in order to gain exposure to as broad a spectrum of mathematics as possible.

SAMPLE PROGRAM IN MATHEMTAICS

Semester 1		Semester 2	
Math 141	4	Math 142	4
Math 198	1	Engl 102	3
Engl 101	3	Lang 102	3
Lang 101*	4	Group V	4
Group V	4		
	16		14

Semester 3		Semester 4	
Math 241	4	Math 351	3
Hist 1xx	3	Math 344	3
CSCI 211	4	Hist 1yy	3
Group III**	3	CSCI 312	3
		Group III	3
	14		15

Semester 5		Semester 6	
Math/Stat	6	Math/Stat	3
Cognate	3	Cognate	3
Group IV	3	Group IV	3
Elective	3	Elective	6
	15		15

Semester 7		Semester 8	
Math/Stat	6	Math/Stat	3
Cognate	3	Cognate	3
Elective	6	Elective	10
	15		16

*French, German, Italian, and Russian are recommended for mathematics majors.

**Students thinking about graduate school should take Foreign Language in Group III.

MAJOR PROGRAM IN COMPUTER SCIENCE

I. REQUIREMENTS

A. While CSCI 211 is not required as part of the major, it is a prerequisite to most of the other courses and therefore must be taken first.

B. For a General Major:

1. Calculus through MATH 241, plus either MATH 242 or a MATH or STAT course numbered 503 or above.

2. Major Program Requirements*: CSCI 308, 312, 360, 411, 421, 574; one CSCI course numbered between 370 and 395 other than the language initially studied in CSCI 209 or 211; and at least 5 additional credits in CSCI courses numbered 500 or higher.

C. For an Intensive Major:

The requirements for the intensive major in Computer Science include all the requirements for the general major plus the following additional Major Program Requirements*: CSCI 576; and at least 9 additional credits in CSCI courses numbered 500 or higher.

Most courses of the major make use of the same computer language--PL/I. This language is chosen because it is a relatively broad language which permits not only numerical work but also string processing and file construction. PL/I is a reasonably universal language but is employed essentially only in IBM equipped installations. Hence the major requires the student to take, at the advanced level, at least one other language. A student planning immediate employment after graduation should choose a useful language. One planning to enter graduate school should choose a language that is more common to advanced study.

CSCI 308 is an advanced programming course designed to sharpen up the student's programming skills for further use in the rest of the major. While it is not a prerequisite to the rest of the major courses, it should be taken immediately after CSCI 211 for the most benefit.

*A grade of C or better must be obtained in all courses which are used to satisfy major program requirements.

II. SAMPLE PROGRAM IN COMPUTER SCIENCE

Semester 1		Semester 2	
Engl 101	3	CSCI 170	1
Lang 101	4	Engl 102	3
Math 125 (if needed)	4	Lang 102	3
Hist 1xx	3	Math 141	4
Group III or IV*	3	Hist 1yy	3
	17	Group III or IV*	3
			17

Semester 3		Semester 4	
Group III,IV or V	6-7	Group III,IV or V	6-7
Math 142	4	Math 241	4
CSCI 211	4	CSCI 308	2
	14-15	CSCI 312	3
			15-16

Semester 5		Semester 6	
Cognate	3	Group III,IV or V	3-4
Elective	3	Cognate	3
CSCI 411	3	Elective	3
CSCI 360	3	CSCI 421	3
CSCI 37x or 38x	2	CSCI 574	3
	14		15-16

Semester 7		Semester 8	
CSCI	3	CSCI	6
Cognate	3	Cognate	3
Math/Stat elective	3	Elective	3
Electives	6		
	15		12

*If any courses in the first year need to be delayed, these courses should be deferred to the fifth and sixth semesters.

AREAS OF STUDY

Beginning students are frequently unaware of the diversity of subjects available for study under the guise of the terms "modern mathematics" and "computer science." Furthermore, they may have a substantial misconception of exactly what is studied in a given subject area whose title happens to be within their vocabulary. Following are brief descriptions of some of the broader areas of study (all of which overlap to some extent) to reduce such misconceptions and expand the student's awareness of the scope of what is available.

ALGEBRA is essentially a study of the structure of systems which resemble the ordinary systems of numbers under the addition and multiplication operations. The subject in its present form is the outgrowth of centuries of systemization of arithmetical methods developed to solve increasingly subtle problems. Algebraic structures occur naturally in all areas of mathematics and are used both implicitly in sciences such as physics and electronics. Generally, undergraduate courses in the subject study the underlying principles and structures which are first encountered in pre-college as techniques for solving arithmetical problems. The knowledge gained by the student of the inner workings of these techniques then enables him to understand various applications and more complex extensions of the ideas involved. It is therefore important for students interested in mathematics to have exposure to some form of modern algebra in their coursework. The ideas of modern algebra are surveyed in 543 and 545 which explore a variety of algebraic structures. For uses in applied math, analysis, differential equations, etc., the part of modern algebra which deals with simultaneous equations, matrices, and the like (linear algebra) is taught as a separate course (344). Those topics in algebra with applications in computer programming, logic circuits, etc., are also presented as a separate course (540).

ANALYSIS deals with classes of functions on which a limit process is defined or understood. Using this limit process, and properties of the functions themselves, one solves equations, proves additional facts concerning the functions or studies transformations operating on the functions. A familiar example of such a transformation would be the map which associates a differentiable function with its derivative.

So called "modern" analysis, which has developed in the present century, is distinguished from "classical" analysis in that the former uses tools from algebra and topology and usually concentrates on large sets or "spaces" of functions, rather than a single function in an isolated problem. The undergraduate subject central to analysis is advanced calculus (351, 352, 554). Linear algebra is extremely important, as is experience with techniques of applied mathematics: differential equations, partial differential equations, and Fourier series.

APPLIED MATHEMATICS encompasses that mathematics which finds applications, particularly, in the physical and social sciences. As a result, the applied mathematician has many avenues along which to pursue his career. He may teach, but he may also choose to enter business or industry in one of many areas. No one can deny that technology today is changing at a rapidly increasing rate. Unemployment in engineering and other scientific professions is partly the result of too narrow a specialization in the tool subjects. On the other hand, there presently exists a demand for persons who are able to comprehend and resolve new and varied problems facing industry and business. A program in applied mathematics that will serve to meet the broadest requirements has, as essential ingredients, numerical analysis (360, 526, 527), differential equations (242, 520, 521), linear algebra (344), and probability and statistics (512, 513). These constitute the underlying tool subjects required to develop one's ability to analyze problems of applications. Furthermore, such a program should include electives in those areas of the sciences in which the student has particular career interests. Students interested in pursuing graduate training in applied mathematics should supplement this core program with courses as suggested in the outline for the intensive major.

COMPUTER SCIENCE deals with the representation, storage, manipulation, and presentation of information. This field is, in fact, known as "information Science" in some schools. Hence the undergraduate curriculum touches upon all of these areas of study and attempts to give the student a solid base in the entire field. Included in the curriculum is a considerable amount of computer usage. Practically every course makes use of the computer in some way. Most use the University's central computer system (an IBM 370) for assigned exercises and problems. The language PL/I is a common thread through most of the courses. In addition to the central computer, an extensive PDP-11 system is available for more advanced work. This equipment is well-provided with terminals and memory for undertaking interactive work, and is a general interactive facility for use of students and faculty.

GEOMETRY AND TOPOLOGY are both concerned with the study of various properties of "figures" or "spaces" and transformations between them. In plane geometry two "figures" are congruent if there is a rigid motion of the plane that transforms one of the figures into the other. Thus a certain group of transformations, the rigid motions, is used as a means of comparing different figures in the plane. In topology, the approach is the same, the difference from geometry being accounted for in the types of transformations allowed. In topology, continuity of these transformations is the main topic of study, but such exotic figures as the Mobius strip and the Klein bottle are discussed (533). Other topics for exploration are different types of goemetries (531, 532). General topology (534) is good preparatory material for graduate school.

LOGIC introduces a way of thinking that encourages carefulness and precision. This is accomplished by developing a formal language adequate to describe most mathematics but restricted by precise rules of grammar and syntax. The resulting theory is called mathematical logic and it has been used to examine the most basic concepts of mathematics. In recent years significant and astounding conclusions have been discovered about the power and the limitations of mathematical reasoning. For instance, it is now known that there are properties of the counting numbers (i.e., the natural numbers) that cannot be discovered by man. An introductory course (561) is available.

NUMBER THEORY is primarily concerned with the properties of the integers. Most of the problems deal with the divisibility of certain subsets of the integers. The primes, for example, are those positive integers greater than one which are divisible only by themselves and one. It has been known since the time of Euclid that there are an infinite number of primes but a more important question now is to find how many primes are less than a given number. A second import-