Department of Mathematics and Computing

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The Department of Mathematics and Computing endeavors (1) to contribute to the mathematical and computing competency of all students, (2) to help prepare students for graduate study in their chosen fields, (3) to provide sound preparation for those who intend to teach, and (4) to prepare students for mathematics and computing related careers in business, industry, and government.

Placement

Mathematics placement for entering students will be determined by SAT scores and/or placement test. academic record.

Requirements for a Major in Computer Information Systems (B.A. degree):

Math 107 must be taken to satisfy the mathematics core requirement for General Education. Major courses are 31 hours in Computer Information Systems (CIS) numbered 200 and above and must include CIS 200, 201, 202, 250, 340, 350, one of CIS 430 or 440 and at least three semester hours in CIS 470 or 498. In addition, the following courses must be taken: Math 140, Math 150, Economics 201 and 202, and Business 261, 262, and 401. These additional courses may be used to satisfy general education requirements, or requirements for a minor or a second degree.

Requirements for a Major in Computer Information Systems (B.S. degree):

Math 161 must be taken to satisfy the mathematics core requirement for General Education. Major courses are 31 hours in Computer Information Systems (CIS) numbered 200 and above and must include CIS 200, 201, 202, 250, 340, 350, one of CIS 430 or 440 and at least three semester hours from CIS 470 or 498. In addition, the following courses must be taken: Math 150, Math 353, Economics 201 and 202, and Business 261, 262, and 401. These additional courses may be used to satisfy general education requirements, or requirements for a minor or a second degree.

Requirements for a Major in Mathematics (B.A. degree):

The mathematics requirement for General Education must be met with Mathematics 161. Major courses are 35 hours in mathematics courses numbered 150 or above and must include Mathematics 263, 305, 353, 360, 405, 464, 480, and at least 3 semester hours in Mathematics 470A or 498. Computer Information Systems 201 may count toward these 35 hours. Honors 498 may be substituted for Mathematics 498 with the consent of the department. There are no restricted electives.

Requirements for a Major in Mathematics (B.A. degree, certifying to teach):

The mathematics requirement for General Education must be met with Mathematics 161. As part of the degree specific requirement, in addition to the core requirements, a student must take U.S. History, Political

Science 101, or History 345 for 3 semester hours; a second laboratory science from a different area (one must be biological and the other physical science.) for 4 semester hours; and a second fine arts from a different area. Major courses (33 hours) are Computer Information Systems 201, Mathematics 150, 162, 263, 305, 325, 353, 350 or 360, 405, and 480. The following 30 hours in professional education courses must also be taken: Education 230, 240, 260 (1 s.h.), 318, 360 (2 s.h.), 420M, and 485 and Special Education 332.

Requirements for a Major in Mathematics (B.S. degree):

The mathematics requirement for General Education must be met with Mathematics 161. At least one course in Physics must be used to meet the General Education distribution or degree-specific requirements. Major courses are 42 hours in mathematics courses numbered 150 or above and must include Mathematics 150, 263, 305, 353, 360, 405, 464, 480, and at least 3 semester hours in Mathematics 470A or 498. Computer Information Systems 201 must to taken and it counts towards these 42 hours. Computer Information Systems 202 may count towards these 42 hours. Honors 498 may be substituted for Mathematics 498 with the consent of the department. There are no restricted electives.

Requirements for a Major in Mathematics (B.S. degree, certifying to teach):

The math requirement for General Education must be met with Mathematics 161. In addition to the core requirements, a student must take U.S. History, Political Science 101, or History 345 for 3 semester hours; complete one of the following sequences from Biology 111 and 112, Chemistry 121 and 122, Chemistry 261 and 262, and Physics 221 and 222; (Both biological and physical science must be represented between the core requirements and these specific sequences.); and a second fine arts from a different area. Major courses (39 hours) are Computer Information Systems 201, Mathematics 150, 162, 263, 305, 325, 353, 350, 360, 405, and 480 and three additional hours chosen from Mathematics 450, 470A or Computer Information Systems 202 . The following 30 hours in professional education courses must also be taken: Education 230, 240, 260 (1 s.h.), 318, 360 (2 s.h.), 420M, and 485 and Special Education 332.

Requirements for a Minor in Mathematics:

18 semester hours in mathematics courses numbered 150 and higher.

Requirements for a Minor in Computer Systems and Applications:

18 hours including Computer Information Systems 200 and 201 and 11 semester hours of Computer Information Systems courses chosen from CIS 135, 136 and CIS courses numbered 140 and higher.

Note: The minor in Computer Systems and Applications is not open to students majoring in Computer Information Systems.

Computer Information Systems (CIS)

131. **An Introduction to Computers.** (Prerequisite: Keyboarding skills or Consent of Instructor.) A study of the Windows environment, e-mail, the internet, and basic word processing skills. This course will be offered on a pass/fail basis only. (Previously offered as Comp 131.) 1 s.h.

134. **Introduction to Word Processing.** (Prerequisite: Keyboarding skills or Consent of Instructor.) A study of word processing. Topics will include creating, editing, saving and printing documents; formatting; using spell check; managing blocks of text; changing the appearance of text; creating outlines; and merging files. This course will be offered on a pass/fail basis only. (Previously offered as Comp 134.) (Students may not receive credit for both CIS 134 and CIS 140 or Comp 133.) 1 s.h.

135. **Introduction to Spreadsheets.** (Prerequisite: CIS 131 and CIS 134 or Consent of Instructor.) A study of spreadsheets. Topics include creating, editing, saving, and printing spreadsheets; building graphs; and using built-in functions and formulas. This course will be offered on a pass/fail basis only. (Previously offered as Comp 135) (Students may not receive credit for both CIS 135 and CIS 140 or Comp 133.) 1 s.h.

136. **Introduction to Database Programs.** (Prerequisite: CIS 131 and CIS 134 or Consent of Instructor.) A study of database managers. Topics include creating, modifying, and printing a data file structure; entering and editing data records; organizing by sorting and indexing; using queries and views; creating, modifying and printing a report. This course will be offered on a pass/fail basis only. (Previously offered as Comp 136) (Students may not receive credit for both CIS 136 and CIS 140 or Comp 133.) 1 s.h.

137 **Introduction to Presentation Software**. (Prerequisite: CIS 131 or Consent of Instructor.) An introduction to presentation graphics software designed to help the student create effective visual presentations such as slide presentations, overhead transparencies, printed handouts and computer-based materials. This course will be offered on a pass/fail basis only. (Previously offered as Comp 137) (Students may not receive credit for both CIS 137 and CIS 140 or Comp 133.) 1 s.h.

138. **Introduction to Desktop Publishing.** (Prerequisite: CIS 134.) A study of page layout for the casual design of short publications for home, office, and school. Topics will include creating and editing a publication; designing a newsletter; preparing a tri-fold brochure; converting a brochure to a website; creating letterheads and business cards; and creating business forms and tables. This course will be offered on a pass/fail basis only. (Previously offered as Comp 191F.) 1 s.h.

139. **An Introduction to Microsoft FrontPage.** (Prerequisite: CIS 134 or Consent of Instructor.) An introduction to web page creation using Microsoft FrontPage. Topics include planning and creating a website; formatting and enhancing web pages; and using forms and frames on web pages. This course will be offered on a pass/fail basis only. (Previously offered as Comp 191J, Comp 191L, CIS 230.) 1 s.h.

140. **Introduction to Computers and Information Technology.** (Prerequisite: Keyboarding skills or Consent of Instructor.) Basic concepts of computer systems. Emphasis is based on specific software packages for word processing, electronic spreadsheet, database management and presentation software. (Previously offered as Comp 133.) 3 s.h.

190. **Special Problems.** A course not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

191, 192. **Independent Research and Study.** Research and reading. Open to qualified students. 1-6 s.h. each.

200**. Fundamentals of Computer Systems.** (Prerequisite: CIS 140 and Math 102 or Consent of Department.) An in-depth introduction to the main hardware and software components of computer systems. Topics include CPU, memory, input/output, and operating systems for both single and multi-user systems. 3 s.h.

201. **Programming I**. (Prerequisite: A grade of C or better in CIS 200 or Consent of Department.) An introduction to the principles and practices of computer programming using Java. Emphasis is placed in the object-oriented nature of the language. Topics include: problem-solving techniques, the design, implementation, and testing of programs, use of the Java library and documentation, and an introduction of Java data structures. 3 hours lecture and 2 hours lab. 4 s.h

202. **Programming II**. (Prerequisite: A grade of C or better in CIS 201.) A further study of object-oriented programming techniques. Topics include: abstraction, inheritance, polymorphism, error-handling, the use of Java data structures, and the design of complex applications. 3 s.h.

210. **Programming with Development Tools.** (Prerequisite: CIS 200 or Consent of Department.) An introduction to the development of computer applications using a programming system such as Microsoft Visual Basic. (Previously offered as Comp 310.) 3 s.h.

220. **Managing and Maintaining Your PC.** (Prerequisite: CIS 200.) A study of how microcomputers work, including how to troubleshoot, distinguish between hardware and software problems, install and upgrade components, best manage PC resources, protect from data loss, recover corrupted data and install software. This course would consist of two hours of lecture and a two-hour lab. (Previously offered as Comp 300.) 3 s.h.

230. **Introduction to Web Development.** (Prerequisite: CIS 200.) An introduction to Web development from design to implementation using Web tools and technologies such as HTML and other authoring and scripting languages. 3 s.h.

250. **Networks.** (Prerequisite: CIS 201.) An introduction to networks. Topics include: networking basics, installing a network operating system, organizing a network, managing a network, enhancing a network, and configuring applications to run on a network. This course would consist of two hours of lecture and a two-hour lab. (Previously offered as Comp 301.) 3 s.h.

270. **Practicum.** (Prerequisite: Consent of the Instructor.) Individual work under faculty supervision with evaluation based upon appropriate evidence of achievement. 1-4 s.h.

290. **Special Problems.** A course not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

291, 292. **Independent Research and Study.** Research and reading. Open to qualified students. 1-6 s.h. each.

330. **Multimedia Systems.** (Prerequisite: CIS 201.) An introduction to multimedia systems for information delivery. Topics include: networked multimedia, www, virtual reality, imaging, hypertext, hypermedia, data encoding and compression. 3 s.h.

340. **Systems Analysis and Design.** (Prerequisite: CIS 201.) A study of the processes, methodology and issues related to the analysis and design of information systems. Topics include: requirement analysis, system development life cycle, structured design, feasibility studies, installation and implementation. 3 s.h.

350. **Database Management Systems**. (Prerequisite: CIS 201.) A study of database management concepts and techniques. Topics include: data modeling using entity-relationship, relational, hierarchical and network models, use of SQL (structured query language) and other database software to develop databases. 3 s.h.

370A. **Applications of Computer Systems.** (Prerequisites: CIS 220 and 250.) Hands-on experience with the computer support staff at Columbia College. Activities will involve maintaining a network and a collection of hardware and software applications. 1-4 s.h.

390**. Special Problems.** A course in computer information systems not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

391, 392. **Independent Research and Study.** Research and reading. Open to qualified students 1-6 s.h. each.

430. **Advanced Web Development**. (Prerequisite: CIS 230.) This course introduces advanced web tools for designing, developing, implementing and maintaining web sties. Topics include interactivity, multimedia elements including animation, and linking to a database. 3 s.h.

440. **Management Information Systems**. (Prerequisite: CIS 350.) Analysis, design, and implementation of management information systems. 3 s.h.

450. **Artificial Intelligence.** (Prerequisite: CIS 202 or Consent of the Department.) An overview of the history of the development of artificial intelligence together with an in-depth study of current topics in artificial intelligence, including expert systems and robotics and the programming skills used in this field. (Previously offered as Comp 440.) 3 s.h.

470. **Internship in Computer Information Systems.** (Prerequisite: Permission of Department Chair.) Workstudy program with cooperating employers. May be repeated for a maximum of 4 hours. Pass/Fail only. 1-4 s.h.

490. **Special Problems.** A course not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

491, 492. **Independent Research and Study.** Research and reading. Open to qualified students. 1-6 s.h. each.

498. **Senior Project.** (Prerequisite: Senior CIS major or Consent of the Department.) The senior project may be an in-depth study of a topic in computer information systems or may consist of a significant application in the field. The department's approval of each student's proposed project must be secured during the semester before the student enrolls for credit in this course. 3 s.h.

Mathematics

001. **Developmental Mathematics.** A background for college-level mathematics. The focus is on basic algebraic concepts using technology to aid in symbolic manipulations. The course emphasizes problem solving, solving linear equations and inequalities, graphing linear functions, solving systems of equations, and linear programming. 3 s.h. Elective pass/fail credit only.

102. **College Algebra.** (Prerequisite: Math 001 or Consent of the Department.) A study of algebraic concepts and operations, problem-solving, and modeling. Linear, polynomial, exponential, and logarithmic functions are studied using technology. 3 s.h.

104. **Precalculus Algebra.** (Prerequisite: Placement by the department. May be taken concurrently with Math 106.) This course covers topics in algebra specifically needed for Business Calculus (Math 107) or Calculus I (Math 161). Topics include polynomial, rational, exponential, and logarithmic functions, graphs of functions, and solutions of equations and inequalities. The primary emphasis is the enhancement of algebraic manipulation skills. Other components include problem solving and the appropriate use of computational technology. (Not open to students who have credit for Math 105 or Math 130.) 3 s.h.

106. **Precalculus Trigonometry.** (Pre- or corequisite: Math 104 or placement by the department.) This course covers topics in trigonometry specifically needed for Calculus I (Math 161). Topics include trigonometric functions, applications of trigonometry, complex numbers, vectors, and polar coordinates. Algebraic manipulation skills, problem solving, and the appropriate use of compulational technology are covered (Not open to students who have credit for Math 105 or Math 130.) 2 s.h.

107. **Business Calculus.** (Prerequisite: A grade of C or better in Math 104 or placement by the department.) An introductory course of the calculus, including topics of the derivative and the definite integral with applications to business. Concepts are approached numerically, graphically, and analytically. This course is designed for Business Administration or Accounting majors. 3 s.h.

117. **Mathematics for Elementary Teachers.** (Prerequisite: Math 001 or placement by the department.) A conceptual approach to arithmetic, number theory, set theory and logic intended for education majors. Emphasis is placed on exploration and the use of manipulatives to enhance skills and concepts from the elementary curriculum. 3 s.h.

119. **Informal Geometry for Teachers.** (Prerequisite: Math 117 or Consent of the Department.) A conceptual approach to geometry and measurement intended for education majors. The basic definitions and properties of figures, transformations, and symmetry are explored. Measurement systems are also covered with an emphasis on length, area, and volume. Emphasis is placed on the use of manipulatives to demonstrate concepts. 3 s.h.

140. **Elementary Statistics**. (Prerequisite: Math 102, or Consent of the Department.) This is an introductory course in the fundamentals of modern statistical methods. Topics include descriptive statistics, probability, random sampling, hypothesis testing, estimation, linear regression, and correlation. (Not open to students with credit for Psy/Soc 300, Math 340 or Math 353.) 3 s.h.

150. **Discrete Mathematics.** (Prerequisite: A grade of C or better in Math 104 or placement by the department.) An introduction to discrete structures, algorithms and proof with an emphasis on problem-solving. Formal mathematics is introduced through logic, sets, and elementary number theory. Tools for mathematics and computer studies are given in the form of basic combinations and graph theory. 3 s.h.

161. **Calculus I.** (Prerequisite: A grade of C or better in Math 104 and Math 106 or placement by the department.) The first in a series of courses designed to introduce the student to the theory and applications of the calculus. The concepts of limit, derivative, and integral are explored from various perspectives including numerically, graphically, and analytically. The applications of the derivative are also studied from these points of view. 4 s.h.

162. **Calculus II.** (Prerequisite: A grade of C or better in Math 161.) The second in a series of courses on the theory and applications of the calculus. The emphasis shifts to integration with an exploration of techniques of integration and applications of the integral. Introductions to differential equations and series approximations of functions are also included. Concepts are approached numerically, graphically, and analytically. 4 s.h.

190. **Special Problems.** A course not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

191, 192. **Independent Research and Study.** Research and reading. Open to qualified students. 1-6 s.h. each.

240. **Probability.** (Prerequisite: Math 161.) The theory and applications of probability. An emphasis is placed on using technology for computation and for simulation of experimental data. Descriptive statistics and classical probability are used to introduce the subject. Discrete and continuous probability distributions, including binomial and normal distributions, and their applications are explored. (Students may not receive credit for both Math 240 and 353.) 3 s.h.

263. **Calculus III.** (Prerequisite: A grade of C or better in Math 162.) The third in the series of courses on theory and application of the calculus. The focus is on multivariable functions, their graphs, derivatives, integrals, and applications. Additional topics include vectors, parametric functions, and partial differential equations. Concepts are explored numerically, graphically, and analytically. 4 s.h.

270. **Practicum.** (Prerequisite: Consent of the Instructor.) Individual work under faculty supervision with evaluation based on appropriate evidence of achievement. 1-4 s.h.

290. **Special Problems.** A course not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

291, 292. **Independent Research and Study.** Research and reading. Open to qualified students. 1-6 s.h. each.

305. **Linear Algebra.** (Prerequisite: A grade of C or better in Math 150 and Math 161.) The theory and applications of matrices and vectors. Matrix solutions of systems of linear equations lead into a more abstract exploration of matrices, vector spaces, linear transformations, and eigenvalues. Technology-based problem solving is central. 3 s.h.

325. **Geometry.** (Prerequisite: A grade of C or better in Math 150 and Math 161.) A survey of topics in Euclidean and non-Euclidean geometry. Special emphasis is placed on proof-writing, axiomatic systems, and individual research focused on making connections between geometry and other areas of mathematics. 3 s.h.

340. **Statistics.** (Prerequisite: Math 240.) A continuation of Mathematics 240 into the theory and application of statistics. The emphasis is on analyzing experimental data using technology. Inferential statistics, hypothesis testing and linear and multiple regression analysis are used to inform conclusions concerning data sets. (Students may not receive credit for both Math 340 and 353.) 3 s.h.

350. **Numerical Analysis.** (Prerequisite: A grade of C or better in Math 162.) A study of numerical methods for solving problems. Appropriate algorithms for finding integrals, determining roots of equations, and fitting curves to data will be developed, analyzed and implemented. 3 s.h.

353. **Probability and Statistics.** (Prerequisite: A grade of C or better in Math 150 and Math 161.) A study of probability, discrete and continuous random variables, moments, special distributions, sampling, multivariate normal distributions, confidence intervals, testing hypothesis, statistical decision theory, regression, and design of experiments. (Students may not receive credit for both Math 340 and 353.) 3 s.h.

360. **Differential Equations.** (Prerequisite: A grade of C or better in Math 162.) A study of differential equations and their use in mathematical modeling. A wide scope of applications which can be modeled with differential equations is studied. Solutions of these equations are determined both analytically and technologically. 3 s.h.

390. **Special Problems.** A course not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

391, 392. **Independent Research and Study.** Research and reading. Open to qualified students. 1-6 s.h. each.

405. **Abstract Algebra.** (Prerequisite: A grade of C or better in Math 150 and Math 161.) A study of groups and rings. The algebraic structures groups and rings, their properties, and mappings between them are studied in a formal setting. Communicating mathematical ideas through proofs is a key concept. 3 s.h.

450. **Applied Algebra.** (Prerequisite: Math 150.) A study of algebraic structures and their relationship to machine theory. Logic circuits and abstract machines are designed and constructed. Computability and coding theory are examined. 3 s.h.

464. **Advanced Calculus.** (Prerequisite: A grade of C or better in Math 305, Math 325, or Math 405.) A theoretical examination of the calculus. The concepts of real number, sequence, continuity, and differentiation will be formalized. Rigor in mathematical exposition will be a major emphasis . 3 s.h.

470A. **Practicum in Applying Mathematics.** (Prerequisite: Junior or Senior Mathematics major and Consent of the Department.) This practicum is designed to provide the student with an opportunity for applying mathematics in a non-academic setting. 1-3 s.h.

480. **Historical Topics Seminar.** (Prerequisite: Senior mathematics major or Consent of the Department.) An historical survey of the major personalities, ideas and themes in the development of mathematics. An emphasis is placed on research and communications skills. Each student will complete a portfolio tracing the development of her mathematical ideas. 3 s.h.

490. **Special Problems.** A course not currently listed by the department and offered on an experimental basis. Prerequisites or special permission may be required as needed for admission to the course. 1-4 s.h.

491, 492. **Independent Research and Study.** Research and reading. Open to qualified students. 1-6 s.h. each

498. **Senior Project.** (Prerequisite: Senior Mathematics major or Consent of the Department.) The senior project is an in-depth individualized study of a mathematical topic or series of problems under the guidance of a mathematics faculty member. Students must prepare a written summary of their work and make a 30-minute oral presentation of their project. The department's approval of each student's proposed project must be secured during the semester before the student enrolls for credit in this course. 3 s.h.