College of Arts and Sciences

Department of Mathematics and Computer Science

Faculty

G. Jan Wilms (1992). Associate Professor of Computer Science and Department Chair. B.A., Katholieke Universiteit Leuven, Belgium; M.A. (English), University of Mississippi; M.S. (Computer Science), University of Mississippi; Ph.D. (Computer Science), Mississippi State University.

Richard Dehn (1969). Associate Professor of Mathematics. B.S., University of Memphis; M.A.T., Purdue University; M.S., University of Arkansas, Additional study, University of Wisconsin, University of Arkansas, University of Missouri-Rolla.

Emily Dunn (1996). Assistant Professor of Computer Science. B.S., Union University; M.S., University of Texas at Dallas.

Stephanie Edge (1996). Instructor of Computer Science. A.S., Middle Georgia College; B.S., West Georgia College; M.S., Georgia State University; Candidate for M.Div., Southern Baptist Theological Seminary.

Chris Hail (1995). Assistant Professor of Mathematics. B.S., Campbellsville College; M.A., Morehead State University; Candidate for Ph.D., University of Kentucky.

Dwayne Jennings (1981). Associate Professor of Mathematics and Computer Science. B.S., Union University; M.S. (Mathematics) and M.S. (Computer Science), University of Memphis.

Pat Laffoon (1986). Assistant Professor of Computer Science. B.A., Lindenwood College; M.S., University of Memphis.

Matt Lunsford (1993). Assistant Professor of Mathematics. B.G.S., Louisiana Tech University; M.S., University of Nebraska; Ph.D., Tulane University.

Don Rayburn Richard (1983). Associate Professor of Mathematics. B.S., University of Memphis; M.A., University of Missouri; M.B.A., University of Colorado.

Troy Riggs (1993). Assistant Professor of Mathematics. B.S., University of South Dakota; M.A. and Ph.D., University of Nebraska-Lincoln.

Part-Time Faculty

Timothy D. Britt (1997). Instructor of Mathematics. B.S., Union University; M.S., University of Memphis.

Mathematics

The mathematics curriculum provides study which leads to an undergraduate major in mathematics in either the B.S. or the B.A. degree program. The offerings for the major will provide a basic foundation for beginning graduate study in mathematics, for entry into work in fields relating to mathematics, and for teaching mathematics at the secondary level. The curriculum also provides courses in mathematics which support studies in the natural and the social sciences, in elementary school teacher preparation,
in business studies, and in computer science. Students with a four-year high school mathematics program, including trigonometry, should be able to begin the calculus sequence in their first semester. Placement in calculus is based on the ACT scores and the high school record. College Algebra assumes at least two years of high school algebra, and Intermediate Algebra requires one year of high school algebra and is offered for those people not ready for College Algebra. Students majoring or minoring in mathematics will begin their credit in the calculus courses. Algebra and trigonometry may be needed as background but do not satisfy requirements for the major or minor. Those majoring or minoring in mathematics must meet the following requirements:

I. Major in Mathematics — 34 hours
   A. MAT 205, 211, 212, 213 and 498 are required.
   B. At least 15 hours selected from: MAT 305, 314, 315, 320, 360, 411, 413, or 415.
   C. The remaining 3 hours may be taken from B, or MAT 114, or CSC 111.

II. Minor in Mathematics — 21 hours
   A. MAT 211 and 212 are required and one of the following: MAT 114, 205, 213, or CSC 111.
   B. At least 6 hours of upper-level work is required with no more than one departmental special study allowed and no independent study allowed.

III. Teacher Licensure (Grades 7-12)
    Consult the Mathematics Department or the Education Department for professional education requirements.

Assessment of Majors

All senior mathematics majors must take the Major Fields Achievement Test in mathematics as one requirement for MAT 498 (see MAT 498 for a complete course description). All senior mathematics majors completing a teacher licensure program are required to take the PRAXIS exam (formerly the National Teacher’s Examination).

Student Organizations

Kappa Mu Epsilon is a specialized honor society in Mathematics. The chapter’s members are selected from students of mathematics who have achieved standards of scholarship, professional merit, and academic distinction. A student must have completed three semesters and rank in the upper 35%, completed three courses in mathematics, one of which must be calculus, and have a “B” or better average on all mathematics courses.

Sigma Zeta is a national honorary science society for those who have completed fifteen hours in natural science and mathematics and who have a minimum grade point average of 3.0 in these courses. Membership advantages include recognition for academic achievements by the Sigma Zeta Honor Award, participation in nationally recognized research projects, and a means of cooperation in similar areas of interest by students of different colleges.

The ACM (Association for Computing Machinery) Student Chapter is composed of students who are interested in today’s world of computing. The club promotes an increased knowledge of the science, design, development, construction, languages, and applications of modern computing machinery. It provides a means of communication between persons interested in computing machinery and their applications.

Student Awards

Academic Excellence Medals. A medal is given for each major offered by the department. This award is given to the graduating major who has the highest academic average in each discipline, provided the average grade in the subject is not less than 3.5 and provided the student has completed, before Awards Day, a minimum of 15 credit hours in the major discipline at Union University in courses for which precise grades are computed (as distinguished from courses graded pass or fail). If there is no eligible major in the discipline, or a major is not offered in the discipline, the medal will be given to the minor with the highest average if the above qualifications are met.

Course Offerings in Mathematics (MAT)

() Hours Credit; F-Fall; W-Winter; S-Spring; Su-Summer

101. Fundamental Concepts I (3) F, S As Needed
   This course will develop the elementary con-
cept of sets, relations, and functions. A thorough discussion of the whole numbers, integers, rational numbers, and real numbers will be included. Does not apply toward the major or minor.

105. Intermediate Algebra (3) F, S, or As Needed
Topics include exponents, radicals, factoring, linear equations, quadratic equations, and systems of equations. This course is for the student who has taken only one year of high school algebra or its equivalent. The student with two years of high school algebra cannot enroll except with permission of the department. Does not apply toward the major or minor. Credit will not be given if the student has successfully completed a mathematics course numbered MAT 111 or above.

107. Fundamental Concepts II (3) S or As Needed
This course is a continuation of MAT 101. It will continue the study of the real number system. Also included will be an introduction to the elementary concepts of geometry and measurement, trigonometry, probability, and descriptive statistics. Does not apply toward the major or minor.

111. College Algebra (3) F, S
Topics include equations in two variables, functions, graphing techniques, systems of equations and inequalities, exponential and logarithmic functions, matrices, and the theory of polynomial equations. Prerequisite: Two years of high school algebra or MAT 105. Does not apply toward the major or minor.

112. Plane Trigonometry (3) S
Topics include the definition of the trigonometric functions, radian measure, linear and angular velocity, graphing techniques, trigonometric identities and equations, the inverse trigonometric functions, and solving triangles. Prerequisite: MAT 111 or consent of the department. Does not apply toward the major or minor.

114. Introduction to Statistics and Probability (3) F, S or As Needed
A basic study of descriptive statistics with introduction to inferential statistics. The topics include organization of data into frequency distribution tables and histograms, measures of central tendency, measures of dispersion (standard deviation), basic mathematical probability, continuous distributions through the normal distribution, introduction to sampling theory and hypothesis testing. Prerequisite: MAT 105 or 111, or consent of the department.

116. Precalculus (3) F
An introduction to polynomial, exponential, logarithmic, and trigonometric functions and basic analytic geometry. This course is intended for students planning to take MAT 211, and is not recommended for students who have taken MAT 111 and/or 112. Does not apply toward the major or minor. Prerequisites: Two years of high school algebra and one year of high school geometry.

201. Calculus for Business/Social Sciences (3) S as Needed
Topics include a review of algebra principles, the development of differential calculus with an emphasis on applications of the derivative to business and to the social sciences, and a brief introduction to integral calculus with some elementary applications of the definite integral. Does not apply toward a mathematics major or minor and is not recommended for students that have taken MAT 211 and 212. Prerequisite: MAT 111 or its equivalent.

205. Discrete Mathematics (3) S, W As Needed
Topics include elementary logic, sets, proof techniques including induction, relations and graphs, recurrence relations, basic counting techniques, equivalence relations, Boolean algebra, and algebraic structures. Prerequisite: MAT 111 or its equivalent.

211. Calculus and Analytic Geometry I (4) F, S
Topics include basic concepts of plane analytic geometry, functions, limits, differentiation of algebraic and trigonometric functions, applications of the derivative, the indefinite and the definite integral, and the fundamental theorem of calculus. Prerequisite: MAT 111 and 112 or consent of the department.

212. Calculus and Analytic Geometry II (4) F, S
Topics include integration by substitution, numerical integration, applications of the definite integral, the calculus of transcendental functions, techniques of integration, and the calculus of parametrized curves. Prerequisite: MAT 211.

213. Calculus and Analytic Geometry III (4) F or As Needed
Topics include infinite series, polar coordinates, vectors in three-space, functions of several variables, partial derivatives, multiple integrals, and line integrals. Prerequisite: MAT 212.

305. Statistics II (3) S or As Needed
The course will concentrate on topics in advanced elementary statistics and probability. Emphasis will be given to inferential aspects including Correlation and Regression, Analysis of Variance,
Chi-Square Distributions and Non-Parametric topics. Prerequisite: MAT 114.

314. Differential Equations (3) S or As Needed
Topics include linear first-order differential equations and applications, higher-order differential equations and applications. Prerequisite: MAT 213.

315. Linear Algebra (3) S or As Needed
Topics include systems of linear equations, matrices, determinants, linear transformations, and diagonalization of matrices. Topics will also include major applications to business and the sciences. Prerequisite: MAT 212. Corequisite: MAT 205.

320. Introduction to Complex Variables (3) F — Even Years
Topics include algebraic properties of the complex number system, complex transformations, analytic functions, complex integration, residues, and series representations of functions. Prerequisite: MAT 213.

360. Numerical Analysis (3) As Needed
Topics include numerical computations, roots of equations, simultaneous nonlinear equations, linear simultaneous equations, numerical integration and differentiation, and power series calculations. Prerequisite: CSC 111, MAT 205 and 213 or consent of the department.

411. Introduction to Analysis (3) F Odd Years or As Needed
This area of study is devoted to a rigorous inquiry into sequences, limits, continuity, differentiation, and integration. Prerequisite: MAT 205 and 213.

413. College Geometry (3) F — Odd Years
Topics include axiomatic foundations of Euclidean and non-Euclidean geometry, models for incidence geometries, and development of theorems in the geometries of the Euclidean plane and the hyperbolic plane. Prerequisite: MAT 205 and 212.

415. Abstract Algebra (3) F — Even Years
An introduction to number theory, group theory, and ring theory. Topics include divisibility in the integers, permutation groups, homomorphisms, normal subgroups and quotient groups. LaGrange’s Theorem, ideals, and polynomial rings. Prerequisite: MAT 205 and 213.

498. Mathematics Seminar (1) F
This course provides an appropriate setting for administering the Major Field Achievement Test, for addressing those areas of mathematics for which prior assessment indicates the need for improvement, for providing seniors an opportunity to demonstrate their awareness of the abstract nature of mathematics and its unifying principles through oral and written presentations, and for discussion of current mathematical research. The course may be modified at the discretion of the department. Prerequisite: 20 hours of MAT course work and Senior standing.

Computer Science

The department offers three separate plans of study: a Computer Science major, a Computer Science minor, and a Computer Information Systems minor.

Computer Science Major

Upon completion of the 37-hour requirement, the student will have an understanding of and an appreciation for the interrelation of the five main areas of study in Computer Science: computer elements and architecture, programming concepts and languages, algorithms, data structures, and computer theory. The major emphasizes the practical application of basic concepts from each area; therefore, the graduate will be able to continue study in Computer Science at the graduate level, or enter the job market immediately.

Computer Science Minor

The 21-hour requirement is intended for those students interested primarily in pursuing a career in computer science or in a related field immediately upon graduation.

Computer Information Systems Minor

The 21-hour requirement will provide the student with a general understanding of analysis, design, and implementation of applications via third- and fourth-generation programming languages and pre-written packages. This minor is intended for the student expecting to use computers in a job-supportive mode.

Those majoring or minoring in Computer Science must meet the following requirements:

I. Major in Computer Science — 37 hours
A. CSC 111, 112, 211, 215, 305, 325, 345, 365, 415, 425, 455, and 498 are required.
B. One elective from CSC 335 or CSC 395.

II. Minor in Computer Science — 21 hours
   A. CSC 111, 112, 211, 215, 325, and 345 are required.
   B. One elective from CSC 305, 335, 365, 415, 425, or 455.

III. Minor in Computer Information Systems — 21 hours
   A. CSC 111, 112, and 211 are required.
   B. Four courses from CSC 215, 315, 325, 365, and 411.

Assessment of Majors
All senior computer science majors must take the Major Field Achievement Test in computer science as one requirement for CSC 498 (see CSC 498 for a complete course description).

Course Offerings in Computer Science (CSC)

105. Survey of Microcomputing Applications (3) F, S
This course is designed to introduce the non-computer science major/minor to computers and their applications. The course will include a study of types of hardware associated with computer systems and how computers function, with an emphasis on the use of applications programs for microcomputers. Software packages will include a word processing package, an electronic spreadsheet package, and a database management system. Does not apply toward the major or minor.

111. Computer Science I (3) F, S
This is the introductory course for the Computer Science major/minor, the Computer Information Systems minor, or the student planning to take other programming courses. The course will emphasize basic concepts of computer systems, binary number systems, problem solving, algorithm development, data types, and program structures.

112. Computer Science II (3) F, S
A continuation of topics from CSC 111 to include the following topics: structured data types, an introduction to data structures, implementation of elementary data structures, and recursion. Programming methodology will be stressed throughout the course. Prerequisites: CSC 111 and MAT 111 (or permission of the department).

211. Computer Information Systems (3) F, W As Needed
An introduction to structured COBOL programming. Topics include input/output operations, arithmetic operations, IF statements, control break processing, and table processing. Prerequisite: CSC 111.

215. Assembly Language (3) S
An introduction to Assembly Language and Machine Language Programming. Arithmetic operations, loops, input/output, tables, and code conversions will be studied via programming exercises. Prerequisite: CSC 111 and MAT 111 (or permission of the department).

245. FORTRAN (3) As Needed
The structures of FORTRAN will be studied: statements, subprograms, simple variables, arrays, and files. Design, coding, and testing of scientific problems will emphasize these structures. In addition, various implementations of FORTRAN will be discussed. Prerequisite: CSC 111 and MAT 211 (Note: This course cannot be used for credit in a Computer Science major/minor or in the Computer Information Systems minor.)

305. Programming in C (3) F
The course will emphasize program structure, data typing, various I/O functions, and the C command set. Advanced structures of C such as unions, structures and pointers are discussed, and used in programming assignments. Prerequisite: CSC 112.

315. Data Base Applications (3) S — Odd Years, or As Needed
The course will emphasize relational data base models in the microcomputer environment. QBE, SQL, and data base programming experience will be enhanced by hands-on lab exercises and programming projects. Prerequisite: CSC 211.

325. Algorithms and Data Structures (3) F
A continuation of CSC 112. Topics include sorting, searching, analysis of algorithms, and advanced data structures. Prerequisite: CSC 112 and MAT 205.

335. Computer Graphics (3) As Needed
This course is designed to investigate a wide range of computer graphics via programming techniques. Topics included in the course will be graphic display theory, graphic techniques, applications, and hardware. Prerequisites: CSC 112 and CSC 215, and MAT 112 (or permission of the department).
345. Organization and Architecture (3) S
A study of digital logic (including the binary number system), digital systems (combinational and sequential circuits), and an introduction to memory organizations and I/O control. Theory is augmented by the functional design and implementation of a simple ALU and CU. Prerequisites: CSC 215.

365. Data Communications and Networking (3) S
This course introduces the student to the hardware and software components of computer data communications and networking. The emphasis is on practical, hands-on set-up, and administration of a LAN, peer-to-peer networking, and the TCP/IP protocol. Topics include routing, shared file and application access, remote printing, and security. Recommended: CSC 305.

411. Systems Analysis (3) F Odd Years or As Needed
The process of designing computer-based systems for business applications will be studied. Tools and techniques of systems development and management will be discussed, as well as advantages and disadvantages of conversion from existing systems to new systems. Prerequisite: CSC 315.

415. Data Base Design (3) S
The course will emphasize the network and relational data base models. Physical and logical data organization techniques will be discussed. Data definition and data manipulation languages will be enhanced by a programming project to implement topics discussed in the course. Prerequisite: CSC 325.

455. Programming Languages (3) S
A study of issues in programming language design, specification, and implementation: overview and comparison of major contemporary languages; analysis of translation process (interpreters and compilers) with focus on grammars and Chomsky hierarchy; investigation of data representation and binding, and of sequence control, including discussion of logic and object-oriented paradigms. Theory is augmented by the implementation of a tokenizer and parser for a simple language. Prerequisites: CSC 305 and 325.

425. Operating Systems (3) F
A study of systems resource management: brief historical overview and case studies; discussion of multi-tasking and related concepts of scheduling, interprocess communication and mutual exclusion/deadlock; overview of file management and memory management (virtual memory, paging, swapping, and segmentation). Theory is augmented by detailed study of implementation of an existing operating system. Prerequisites: CSC 325 and CSC 345. Recommended: CSC 305.

498. Computer Science Seminar (1) F
This course provides a setting for administering the Major Field Achievement Test and for addressing topics in Computer Science for which the department perceives the need for additional instruction. Students will have an opportunity to synthesize previously learned concepts by developing and implementing a solution to a real-world programming problem. Each project will culminate in a report, to be presented to the class at the end of the semester. The course may be modified at the discretion of the department. Prerequisite: 20 hours of CSC work and Senior standing.

195-6-7. Special Studies (1-4) On Demand
Lower-level group studies which do not appear in the regular departmental offerings.

395-6-7. Special Studies (1-4) On Demand
Upper-level group studies which do not appear in the regular departmental offerings.

495-6-7. Independent Study (1-4) On Demand
Individual research under the guidance of a faculty member.

499. Seminar (1-3)
To be used at the discretion of the department for majors only.