SIU Southern Illinois University
CARBONDALE

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Mathematics

The study of mathematics and statistics is the gateway to many of the most demanded careers in the world. Rankings of careers routinely list Data Scientist, Statistician, Mathematician, Operations Research Analyst, and Actuary as five of the top ten, and our programs have graduates in all of these. Positions in K-12 teaching and, after graduate school, in the academic world, are also highly desireable and we send people to those, as well.

The School of Mathematical and Statistical Sciences offers a Bachelor of Science Degree in Mathematics, which can be taken either on its own, or with a specialization in either Actuarial Mathematics or Data Science. We also offer a Bachelor of Science in Mathematics Education, which leads to licensure as a high school mathematics teacher.

Undergraduate mathematics majors at SIU Carbondale can enter an accelerated master's program in which 9 hours of mathematics courses will satisfy requirements in both the bachelor's degree and the master's degree, allowing for completion of both degrees after 5 (4+1) years. Because the master's degree requires 30 hours of coursework, students in the accelerated master's program only need 21 graduate hours after their senior year thereby making it possible to complete the master's degree in only one year. To enter this program, must have at least a 3.0 GPA in all coursework. Please see the Director of Graduate Studies in the School of Mathematical and Statistical Sciences for more information.

High school students who plan to major in Mathematics or Mathematics Education should get the strongest preparation possible in algebra, geometry, and trigonometry, including a substantial study of functions and graphing. Precalculus courses are often good preparation where available. AP credit in Calculus or Computer Science is certainly not necessary to be successful, but is helpful if a student has those opportunities. Transfer students should plan to complete three semesters of calculus (covering single- and multivariable calculus), linear algebra, and a computer programming course within the first two years. Additional courses, such as differential equations, are helpful.

Faculty advisors within the School of Mathematical and Statistical Sciences are skilled in helping students choose appropriate courses for their individual ambitions and interests, and in connecting students with additional opportunities. A student should meet with both an academic advisor and a faculty advisor every semester.

A grade of C or better is required in every mathematics course used to satisfy program requirements. A student cannot repeat a course or its equivalent in which a grade of B or better was earned without the consent of the school. A math major is required to obtain the permission of the school for a second repeat (third attempt) of a course that is required or elective for the major.

Double majors in mathematics and related fields

Special provisions are made for students to earn a double major in mathematics and a field in which mathematics is extensively applied. The courses MATH 447, MATH 449, MATH 471, MATH 472, and MATH 475 carry credit hours in both mathematics and computer science. See Bachelor of Science Degree, School of Mathematical and Statistical Sciences for specific requirements in mathematics for students who also earn a major or minor in computer science.

For students pursuing a double major in math and engineering, physics, or chemistry, the mathematics requirements are MATH 150 or MATH 151, MATH 221, MATH 250, MATH 251, MATH 305 and five additional mathematics courses numbered above 300, including at least three courses above 400, and including two of the three areas of algebra, analysis, probability and statistics. A School of Mathematical and Statistical Sciences advisor must approve the courses.

Students majoring in business may obtain a second major in Mathematics. The requirements are MATH 150 or MATH 151, MATH 221, MATH 250, MATH 251, and five approved mathematics courses at the 300-400 level, of which at least four are at the 400-level. Recommended courses for this program include: MATH 471, MATH 472, MATH 475, MATH 483, MATH 484.

Option in Statistics

A student majoring in Mathematics in the School of Mathematical and Statistical Sciences may choose to concentrate in statistics.
For this option, the 300- and 400-level course requirements include: MATH 302; either MATH 417 or MATH 421; either MATH 305 or MATH 472; one of MATH 352, MATH 450, or MATH 455; MATH 480; MATH 483; at least two of MATH 473, MATH 481, MATH 484, MATH 485 and one additional approved upper division Mathematics course.

Bachelor of Science (B.S.) in Mathematics (School of Mathematical and Statistical Sciences) Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements	39
Requirements for Major in Mathematics	48
MATH 150 or MATH 151, MATH 221, MATH 250, MATH 251 (Three credit hours included in UCC mathematics credit hours)	11
CS 202 or approved substitute	4
MATH 302	3
At least one course from each of the following groups:	12
(One group may be waived for students with a minor in CS) Group A: Algebra/Discrete Math/Linear Algebra: MATH 319, MATH 349, MATH 419, MATH 421 Group B: Analysis: MATH 352, MATH 450, MATH 455 At least two, from different groups, of the following: Group C: Applied Math/Numerical Analysis: MATH 305, MATH 471, MATH 472, MATH 475 Group D: Probability/Statistics: MATH 380, MATH 480, MATH 483 Group E: Geometry: MATH 335, MATH 433	
Six additional courses in mathematics numbered above MATH 299 (excluding MATH 300I, MATH 311A, MATH 311B, MATH 321, MATH 322, MATH 388, MATH 389, MATH 411, MATH 412)	18
A minimum of five 400-level math courses must be taken. Each student’s program must be approved by a	

Degree Requirements	Credit Hours
mathematics program advisor. Courses taken Pass/Fail will not count toward the major.	
Electives	33
Total	120
The student must work with the Advisement Office to ensure that SIU Carbondale'S 42 Senior-Credit-Hours requirement is met by appropriate choices of core, college, major and elective coursework.	

Actuarial Mathematics Specialization

Students pursuing the Bachelor of Science degree with a major in mathematics may choose to specialize in Actuarial Mathematics. Actuaries put a price on risk, and this career is often ranked as one of the most desireable. The actuarial program at Southern Illinois University Carbondale provides course work in mathematics to prepare students to work as actuaries.

Students become actuaries by taking three Validation by Educational Experience (VEE) course sequences and by passing professional examinations given by the Society of Actuaries (www.soa.org) and the Casualty Actuarial Society (www.casact.org). This program offers specific courses designed to prepare students to pass Exams P, FM, FAM, ASTAM, and ALTAM, and to complete the three VEE course sequences. Additional courses lay the groundwork for success on additional SOA and CAS exams.

B.S. Mathematics - Actuarial Mathematics Specialization Degree Requirements

Degree Requirements	Credit Hours
University Core Curriculum Requirements	39
Requirements for Actuarial Specialization	71
(MATH 150), MATH 221, MATH 250, MATH 251 (Three credit hours included in UCC mathematics credit hours)	11
CS 202 or approved substitute	4
MATH 302 and MATH 483	7
At least one course from each of the following groups:	9
Group A: Algebra/Discrete Math/Linear Algebra: MATH 319, MATH 349, MATH 421	
Group B: Analysis: MATH 352, MATH 450, MATH 455	

Degree Requirements		Credit Hours
Group C: Applied Math/Numerical Analysis: MATH 305, MATH 471, MATH 472, MATH 475		
MATH 400, and courses selected from MATH 473, MATH 474, MATH 480, MATH 484, MATH 485, or MATH 486	10	
Two courses selected from MATH 401 or MATH 402 or MATH 403 or MATH 404	6	
One additional course in mathematics numbered above MATH 299 (excluding MATH 300I, MATH 311A, MATH 311B, MATH 321, MATH 322, MATH 388, MATH 389, MATH 411, and MATH 412).	3	
Additional courses required for VEE examinations:		
ECON 240 (if not already included in Core) and ECON 241	6	
FIN 330 and FIN 361	6	
Accounting courses required as prerequisites for FIN 330		
ACCT 220, ACCT 230	9	
Electives if needed to make a total of 120 credit hours		10-13
Total		120

Data Science Specialization

Students pursuing the Bachelor of Science degree with a major in mathematics in the School of Mathematical and Statistical Sciences may choose to specialize in Data Science. Data scientists are among the most sought-after professionals in America, with the advent of ubiquitous data sources on all aspects of life. Business, industry, non-profits, and governments at all levels are being transformed by large data sets and their analysis.

B.S. Mathematics - Data Science Specialization Degree Requirements

Degree Requirements		Credit Hours
University Core Curriculum Requirements		39
Requirements for Math Major with Data Science Specialization		67
MATH 150, MATH 221, MATH 250, MATH 251	11	
(Three credit hours included in UCC mathematics)		

Degree Requirements	Credit Hours
CS 202	4
MATH 302, MATH 349, MATH 421, MATH 483, and MATH 492	16
At least one course from each of the following groups	6
Group B: Analysis: MATH 352, MATH 450, MATH 455	
Group C: Applied Math/Numerical Analysis: MATH 305, MATH 471, MATH 472, MATH 475	
At least two of MATH 473, MATH 474, MATH 480, MATH 484, MATH 485, MATH 486	6
Two additional courses in mathematics numbered above Math 299 (excluding MATH 300I, MATH 311A, MATH 311B, MATH 321, MATH 322, MATH 388, MATH 389, MATH 411, and MATH 412).	6
Eighteen additional credit hours selected from the following technical electives, at least twelve credit hours of which are at the 400-level. The courses counted toward this requirement must be approved by the mathematics program.	18
Technical Elective options are: CS 220, CS 330, CS 430, CS 434, CS 438, ECE 476, GEOG 401, GEOG 404, GEOG 406, GEOG 408, GEOG 417, GEOG 420, GEOG 458, IMAE 386, IMAE 465, IMAE 470A, IMAE 470B, IMAE 480, ITEC 334, ITEC 370, ITEC 470, ITEC 471, ITEC 472, ITEC 473, ITEC 474, PLB 471	
Electives, if needed to make a total of 120 credit hours	14
Total	120

Bachelor of Science (B.S.) in Mathematics (School of Education)

Admission into the Teacher Education Program requires a 2.5 average in MATH 150 or MATH 151, MATH 221, MATH 250; and MATH 251 or MATH 305 in addition to School of Education requirements for admission to the TEP.

Retention in the Teacher Education Program and approval for student teaching requires a 2.75 average in the major and school approval.

Mathematics majors are required to meet with a program advisor for approval of their courses prior to registering each semester.

B.S. Mathematics (School of Education) Degree Requirements

Degree Requirements	Credit Hours	
University Core Curriculum Requirements to include ENGL 101 & ENGL 102, PSYC 102, MATH 300I, EDUC 211, EDUC 214		39
Requirements for major in Mathematics		46
Content Courses	40	
MATH 150 or MATH 151, MATH 221, MATH 250, and MATH 251 or MATH 305 (Three credit hours included in UCC mathematics credit hours)	11	
CS 202 or approved substitute	4	
MATH 302, MATH 319, MATH 335 or MATH 433, MATH 349, MATH 352, MATH 483	19	
At least two additional approved 400-level mathematics courses excluding MATH 411, MATH 412	6	
Methods Course, MATH 311A, MATH 311B	6	
Professional Education and Licensure Requirements include: EDUC 301, EDUC 302, EDUC 303, EDUC 308, EDUC 313, EDUC 319, EDUC 401A Other requirements for licensure		24
Electives to make 120 credit hours		11
Total		120

Mathematics Minor

A minor in Mathematics consists of MATH 150 or MATH 151 and 12 credit hours of mathematics courses at the 200 level or above, including at least three credit hours at the 400 level (excluding MATH 220, MATH 257, MATH 282, MATH 300I, MATH 311A, MATH 311B, MATH 321, MATH 322, MATH 388, MATH 389, MATH 411, MATH 412). All courses used for the minor must be completed with a grade of C or better. The 400-level mathematics courses must be taken at SIU Carbondale.

The school advisor must approve the student's minor program.

Additional Educator Endorsements in Mathematics

Students pursuing a teaching license in another discipline and interested in adding an endorsement in Mathematics should see a School of Mathematical and Statistical Sciences advisor to obtain a list of specific requirements.

Placement

In addition to having taken the prerequisite mathematics courses, students are required to present a satisfactory placement score as a condition for registration in mathematics courses. Contact the School of Mathematical and Statistical Sciences for current information regarding placement.

Mathematics Courses

MATH101 - Introduction to Contemporary Mathematics (University Core Curriculum Course) [IAI Course: M1 904] Elementary mathematical principles as they relate to a variety of applications in contemporary society. Financial mathematics, probability and statistics, graph theory, voting, and other concepts. This course does not count towards the major in mathematics. Prerequisite: high school Geometry and Algebra 2 with a grade of C or better. Credit Hours: 3

MATH102 - Basics of Data Science (University Core Curriculum) This course addresses the fundamental challenge of how to extract information from data. It focuses on a set of problems from statistics and data science such as describing the relationship between observations, testing hypotheses, estimating confidence, and prediction. Prerequisite: High School Algebra, some computer experience. Credit Hours: 3

MATH105 - College Algebra and Mathematical Modeling for Teachers A course in college algebra designed for the pedagogical and content needs of K-8 teachers. Equations and inequalities involving linear, polynomial, rational, absolute value, exponential and logarithmic functions, and systems of linear equations; the algebra of functions (polynomials, rational, exponential, logarithmic), graphing functions; domain and range. Conic sections. Modeling and solving real-world problems and situations. Use of technology as appropriate to interpret data and create mathematical models. Core Standards Mathematical Practices will be infused throughout. No credit may be earned for MATH 105 if there is prior credit in MATH 106, 108 or 111. Prerequisite: Satisfactory placement score OR MATH 220 with a grade of C or better. Credit Hours: 3

MATH106 - College Algebra Enhanced (University Core Curriculum) The course guides students through an intensive review of foundational algebra concepts, followed by a detailed study of functions (polynomial, rational, exponential, and logarithmic), graphing, and solving equations, including systems. Credit is given for only one of MATH 108 and MATH 106. Prerequisite: Three years of college preparatory mathematics, including Algebra I, Geometry, and Algebra II, AND satisfactory placement score. A course fee of $90 is assessed to cover additional instruction. Additional supplemental software is required. The platform is used for assessment and provides online access to learning aids and the e-textbook. Credit Hours: 3

MATH108 - College Algebra (University Core Curriculum Course) This course covers the algebra of functions (polynomials, rational, exponential, and logarithmic), graphing, and solving equations, including systems. Credit is given for only one of MATH 108 and MATH 106. Prerequisite: Three years of college preparatory mathematics, including Algebra I, Geometry, and Algebra II, AND a satisfactory placement score. A course fee not to exceed $60 is assessed to residential students, which will cover additional instruction. Additional supplemental software is required. The platform is used for assessment and provides online access to learning aids and the e-textbook. Credit Hours: 3

MATH109 - Trigonometry and Analytic Geometry (University Core Curriculum Course) Trigonometric and inverse trigonometric functions, complex numbers, conic sections, polar coordinates. Credit is not given for both MATH 109 and 111. Prerequisites: MATH 108 or MATH 106 or equivalent, with C or better. New students must present satisfactory placement scores. Credit Hours: 3

MATH110 - Non-Technical Calculus (University Core Curriculum) The elements of differentiation and integration. The emphasis is on the concepts and the power of the calculus rather than on technique. It is intended to provide an introduction to calculus for non-technical students. Does not count towards the major in mathematics. No credit hours may be applied to fulfillment of any degree requirements if there is prior credit in Mathematics 140, 141, 150, or 151. Prerequisite: 3 years of college preparatory mathematics including algebra I, algebra II and geometry with C or better. Students must present satisfactory placement scores or obtain the permission of the Department of Mathematics. Credit Hours: 3

MATH111 - Precalculus (University Core Curriculum Course) Intensive review of advanced college algebra and trigonometry necessary for Calculus I. Algebra of rational and transcendental functions, graphing, trigonometric identities, laws of sines and cosines, conics, complex numbers, polar coordinates. Not open to students with credit in MATH 109. Prerequisites: High school advanced algebra and

trigonometry with at least C and satisfactory placement score OR MATH 108/106 with a grade of at least a C. Credit Hours: 4

MATH120 - Mathematics Content and Methods for Elementary School I (Same as CI 120) Modern approaches to mathematics instruction for the elementary grades. Mathematics content includes problem solving, intuitive set theory, development of whole numbers, integers and rational numbers and the fundamental arithmetic operations. Place value. Prime numbers and divisibility properties. Computation includes students' informal mathematics, mental computation and estimation, algorithms and the appropriate use of calculators. Emphasis is placed throughout on reasoning, multiple representations of mathematical concepts, making connections and communication. Three hours lecture/laboratory per week. Prerequisite: Three years of college preparatory mathematics including Algebra I, Algebra II and Geometry and satisfactory placement score. Credit Hours: 3

MATH125 - Technical Mathematics with Applications (University Core Curriculum) Emphasizes the applications of algebra, geometry, and trigonometry in technical fields. Topics in algebra include unit conversion, functions and graphs, systems of linear equations, quadratic equations, higher degree equations, and variation. Topics in geometry include Pythagorean Theorem and area and volume calculations. Topics in trigonometry include the trigonometric functions, laws of sines and cosines, radian angle measurement, and some vector operations. Meets University Core Curriculum requirement in quantitative reasoning for Applied Sciences and Arts students. Credit Hours: 4

MATH139 - Finite Mathematics (University Core Curriculum Course) Set concepts and operations, combinations, permutations, elementary probability theory including Bayes Formula, linear systems of equations, matrix algebra, row reduction, introduction to linear programming and simplex method. This course does not count toward the major in mathematics. Prerequisite: MATH 108 with grade of C or better or satisfactory placement score. Satisfies UCC Quantitative Reasoning in lieu of 110 or 101. Credit Hours: 3

MATH140 - Short Course in Calculus (University Core Curriculum Course) Techniques of differentiation, increasing and decreasing functions, curve sketching, max-min problems in business and social science; partial derivatives; LaGrange multipliers; elementary integration techniques. Not open to students with prior credit in 141, 150, or 151. Does not count toward the major in mathematics. Prerequisite: MATH 108 with grade of C or better or satisfactory placement score. Satisfies University Core Curriculum Quantitative Reasoning requirement in lieu of 110 or 101. Platform is used for assessment and online access to learning aids and e-textbook. Credit Hours: 4

MATH141 - Short Course in Calculus for Biological Sciences (University Core Curriculum Course) [IAI Course: M1 900-0] Techniques of differentiation and integration. Applications to population and organism growth and other biological science problems. Not open to students with prior credit in 150, 151 or 140. Does not count toward the major in mathematics. Prerequisite: High school advanced algebra and trig or MATH 111 or 108 plus 109 with C or better, AND satisfactory placement score. Satisfies University Core Curriculum Quantitative Reasoning requirement in lieu of 110 or 101. Credit Hours: 4

MATH150 - Calculus I (University Core Curriculum course) [IAI Course: MTH 901] [IAI Course: M1 900-1] Major concepts and techniques of single variable calculus with careful statements but few proofs. Differential and integral calculus of the elementary functions; analytic geometry. Only 2 hours credit toward graduation if there is prior credit in 140 or 141. Prerequisite: High school advanced algebra and trigonometry with satisfactory placement score, or MATH 111 with a grade of C or better. Special department approval required for students completing MATH 108 and MATH 109 with a C or better. Satisfies University Core Curriculum Quantitative Reasoning requirements in lieu of 110 or 101. Credit Hours: 4

MATH150H - Honors Calculus I Treatment of the major concepts and techniques of single variable calculus, with careful statements, detailed computations, various applications, and some proofs. Differential and integral calculus of the elementary functions with associated analytic geometry. Not open to students with prior credit in MATH 150. If there is prior credit in 140 or 141, only 2 hours credit for 150H may be applied to graduation requirements. Prerequisite: MATH 111 or equivalent with a grade of C or better. New students must present satisfactory placement score or obtain the permission of the School of Mathematical and Statistical Sciences. Credit Hours: 4

MATH151 - Calculus I Enhanced (University Core Curriculum) [IAI Course: MTH 901] This course reviews some foundational algebra and trigonometry concepts as needed in addition to a careful study of major concepts and techniques of single variable calculus with careful statements but few proofs. Differential and integral calculus of the elementary functions; analytic geometry. Only 2 hours credit toward graduation if there is prior credit in 140 or 141. Credit is given for only one of MATH 150, 151. Prerequisite: High school advanced algebra and trig or MATH 111 or 108 plus 109 with C or better, AND satisfactory placement score. Additional Instruction Lab fee: $90. Credit Hours: 4

MATH220 - Mathematics Content and Methods for the Elementary School II (University Core Curriculum Course) (Same as ELED 220) This course focuses on the foundational mathematics for elementary and middle school grades. Concent includes rational and irrational numbers, ratio and proportion, Pythagorean Theorem, elementary algebra and geometry, reflectional and rotational symmetry, congruence and similarity, geometric transformations, measurements, and mathematical literacies and problem-solving. Credit Hours: 3

MATH221 - Introduction to Linear Algebra Vector spaces, linear functions, systems of equations, dimensions, determinants, eigenvalues, quadratic forms. Prerequisite: MATH 111 or MATH 108 plus MATH 109 with C or better, or satisfactory placement score. Credit Hours: 3

MATH250 - Calculus II (University Core Curriculum Course) [IAI Course: MTH 902] [IAI Course: M1 900-2] Develops the techniques of single-variable calculus begun in Calculus I and extends the concepts of function, limit, derivative and integral to functions of more than one variable. The treatment is intuitive, as in Calculus I. Techniques of integration, introduction to multivariate calculus, elements of infinite series. Prerequisite: MATH 150 or MATH 151 with C or better. Satisfies University Core Curriculum Quantitative Reasoning requirement in lieu of 110 or 101. Credit Hours: 4

MATH251 - Calculus III (University Core Curriculum Course) [IAI Course: M1 900-3] [IAI Course: MTH 903] Further topics in calculus. Definite integrals over solid regions, applications of partial derivatives, vectors and vector operations, derivatives of vector functions, line integrals, Green's Theorem. Prerequisite: MATH 250 with C or better. Satisfies University Core Curriculum Quantitative Reasoning requirements in lieu of 110 or 101. Credit Hours: 3

MATH257 - Concurrent Work Experience As an instructional aide, the student will do tutoring under the direction of an established teacher and under the supervision of a representative of the Department of Mathematics. Special approval needed from the department. Mandatory Pass/Fail. Credit Hours: 1-12

MATH282 - Introduction to Statistics (University Core Curriculum Course) (Same as STAT 282) Designed to introduce beginning students to basic concepts, techniques, and applications of statistics. Topics include the following: organization and display of data, measures of location and dispersion, elementary probability, statistical estimation, and parametric and nonparametric tests of hypotheses. Prerequisite: MATH 108 with C or better. Satisfies University Core Curriculum Quantitative Reasoning requirement in lieu of 110 or 101. Credit Hours: 3

MATH300I - History of Mathematics (University Core Curriculum) This course examines how diverse cultures and history from the ancient past to the present have shaped the development of mathematical thought and how developing mathematical ideas have influenced history and society. Particular attention will be given to the evolution of the concepts of number and space; the emergence and applications of calculus, probability theory, non-Euclidean geometries and technology; and to the changes in the concept of mathematical rigor. Does not count towards the mathematics requirements of the mathematics major. Open to all students. Prerequisite: MATH 150 or MATH 151. Credit Hours: 3

MATH302 - Mathematical Communication and the Transition to Higher Mathematics A course in communicating mathematical ideas with a special emphasis on reading, writing, and critiquing mathematical proofs. Topics covered include logic, proofs, set theory, relations, functions. Additional illustratory topics will be drawn from linear algebra, number theory, complex variables, and geometry. Prerequisite: MATH 221 and MATH 250 with a grade of C or better. Credit Hours: 3

MATH305 - Introduction to Differential Equations [IAI Course: MTH 912] First-order equations (including initial value problems, basic numerical methods, existence and uniqueness of solutions, separable equations, linear equations, exact equations, substitution methods and applications). Higher-order equations (including the general solution to homogeneous linear equations, linear independence,

method of undetermined coefficients, the general solution to linear non-homogeneous equations, variation of parameters, and applications). Power series solutions. Partial differential equations and Fourier series. Prerequisite: MATH 250 with a grade of C or better. Credit Hours: 3

MATH311A - Teaching of Secondary Mathematics I The nature and objectives of the standards-based secondary mathematics curriculum, particularly the means of introducing new ideas into the high school program. An important focus will be state and national teaching and learning standards and the use of technology. Heavy emphasis will be placed on development of formative and summative assessment measures and the use of such assessments in planning future instruction and remediation. For students preparing to be secondary mathematics teachers. Does not count toward a mathematics major in the Colleges of Liberal Arts or Science. Prerequisites: EDUC 313, EDUC 301 and MATH 349, MATH 335 or MATH 433, and MATH 352 with grades of C or better. Concurrent enrollment in MATH 335 or MATH 433 and MATH 352 is permissible. Credit Hours: 3

MATH311B - Teaching of Secondary Mathematics II The nature and objectives of the standards-based secondary mathematics curriculum, particularly the means of introducing new ideas into the high school program. An important focus will be state and national teaching and learning standards and the use of technology. Emphasis in part II will be on the development of a complete curriculum, understanding the secondary curriculum as a dynamic system and the use of standardized testing to adjust curriculum and remediate students. Must be taken in A-B sequence. For students preparing to be secondary mathematics teachers. Does not count toward a mathematics major in the Colleges of Liberal Arts or Science. Prerequisite: MATH 311A with a grade of C or better and MATH 319. Concurrent enrollment in MATH 319 permissible. Credit Hours: 3

MATH319 - Introduction to Abstract Algebra I Basic properties of groups and rings: Binary operations, groups, subgroups, permutations, cyclic groups, isomorphisms, Cayley's theorem, direct products, cosets, normal subgroups, factor groups, homomorphisms, rings, integral domains. Prerequisite: MATH 302 with C or better. Credit Hours: 3

MATH321 - Mathematics Content and Methods for the Elementary School III (Same as CI 321) Modern approaches to mathematics instruction for the elementary grades. Mathematics content focuses on: straight-edge and compass constructions. Justification and proof of geometric properties. Three dimensional geometry. Coordinate geometry. Transformations expressed in coordinate notation. Analysis of linear relationships geometrically and algebraically. Modeling various "real-world" situations by linear equations and inequalities. Setting up and solving equations and inequalities. Exploration of statistical data. Representation of data, interpretation of data, misrepresentation of data. Introduction to the fundamental ideas of statistics; measures of spread and central tendency. Introduction to the fundamental concepts of probability. Counting techniques needed for calculating probabilities. Dependent and independent events. Conditional probability. Odds, expected value. Simulation. Emphasis is placed throughout on reasoning, multiple representations of mathematical concepts, making connections and communication. Prerequisite: MATH 220 or ELED 220 or equivalent with a grade of C or better. Credit Hours: 3

MATH322 - Mathematics Content and Methods for the Elementary School IV (Same as CI 322) Modern approaches to mathematics instruction for the elementary grades. Mathematics content focuses on: algebra and algebraic thinking, geometry, relations and functions and their applications to real-life problems. Emphasis is placed throughout on reasoning, multiple representations of mathematical concepts, making connections and communication. Prerequisite: MATH 321 or Curriculum and Instruction 321 with a grade of C or better. Credit Hours: 3

MATH335 - Concepts of Geometry Introduction to the foundations of Euclidean and non-Euclidean geometries. Topics include synthetic approach (Euclidean geometry, axiomatic systems, constructions, proofs), symmetries (similarly, congruence and various transformations and their invariants), metric approach (distance), vector space approach (transformations and matrices, inner product), inversive geometry, projective geometry (art and math) and non-Euclidean geometries. Some applications in modern science, such as Relativity Theory, may also be covered. Historical background and connections with other parts of mathematics, science and culture are important components of this course. Prerequisite: MATH 250 with C or better, or MATH 302 with C or better or concurrent enrollment in MATH 302. Credit Hours: 3

MATH349 - Introduction to Discrete Mathematics Numbers, sets, relations and functions; elementary enumeration; introduction to graph theory; logic, partially ordered sets and Boolean algebra; mathematical induction; recurrence relations. Prerequisite: MATH 221 and MATH 250 with C or better; Co-requisite: MATH 302 or prior completion of MATH 302. Credit Hours: 3

MATH352 - Theory of Calculus An introduction to understanding and writing proofs in mathematical analysis, through a careful study of limits, continuity, the derivative, and the integral. Prerequisite: MATH 302 with C or better. Credit Hours: 3

MATH380 - Elements of Probability Probability as a mathematical system. Axioms, permutations and combinations, random variables, generating functions, limit theorems, and Monte Carlo procedure. Prerequisite: MATH 250 and Computer Science 202. Credit Hours: 3

MATH388 - Integrated Math Content and Methods for Teachers (PreK-4th Grade) (Same as ECFS 388 and ELED 388) This course is designed for early childhood and elementary school teachers, focusing on Pre-K through 4th grade mathematics content and methods. Math content covers the developmental progression of concepts and skills in counting and cardinality, numbers and operations in base-ten system, algebraic thinking, fractional reasoning, measurement and data, and geometry. Methods of math teaching are integrated with the delivery of math content. The course showcases standards-based mathematical practices including problem solving, mathematical modeling, communication and justification, use of tools and technology, assessment and interventions, diverse learner support, supportive math environments, lesson planning, and interdisciplinary connections. Prerequisite: C or better in ELED/MATH 220 or equivalent. Credit Hours: 3

MATH389 - Integrated Math Content and Methods for Teachers (4th-8th Grade) (Same as ELED 389) This course is designed for elementary school and middle school teachers, focusing on 4th-8th grade mathematics content and methods. Math content covers the developmental sequence of grade-appropriate mathematical concepts and skills in number systems, operations and algebraic thinking, ratios and proportional relationships, expressions and equations, functions and applications, measurement and data analysis, statistics and probability, and geometry. Methods of math teaching are integrated with the delivery of math content. The course showcases standards-based mathematical practices including problem solving, mathematical modeling, communication and justification, use of tools and technology, informative assessment, meeting the needs of diverse learners, building supportive math environments, lesson planning, and making interdisciplinary connections. Prerequisite: ECFS 388 and ELED 388 or MATH 388 with a minimum grade of C. Co-requisites: EDUC 319 and EDUC 302. Credit Hours: 3

MATH400 - Interest Theory and Financial Derivatives This course examines financial mathematics and actuarial models for investments including interest, annuities, stocks, bonds, and mutual funds. Preparation for Exam FM. Prerequisite: MATH 250 with grade of C or better. Credit Hours: 4

MATH401 - Basic Long-Term Actuarial Mathematics This course examines actuarial models for life-contingent risks, primarily the insurance of life and long-term health. These models include liability calculations, annuities, and credit risk. Basic properties of survival models are covered. This course prepares students for Exam FAM-L. Prerequisites: MATH 400 and MATH 483 with C or better. Credit Hours: 3

MATH402 - Advanced Long-Term Actuarial Mathematics This course continues the examination of life-contingent risks begun in MATH 401, including multiple contingencies, multiple survivals, pensions, options, and the use of Markov models. This course prepares students for Exam ALTAM. Prerequisites: MATH 221 and MATH 401 with C or better. Credit Hours: 3

MATH403 - Basic Short-Term Actuarial Mathematics This course examines loss models including severity models, aggregate loss, estimation, ratemaking and reserving, and estimation. This course prepares students for Exam FAM-S. Prerequisite: MATH 483 with a grade of C or better. Credit Hours: 3

MATH404 - Advanced Short-Term Actuarial Mathematics This course continues the examination of short-term loss models begun in MATH 403, including estimation, credibility, and extremal value theory. This course prepares students for Exam ASTAM. Prerequisite: MATH 403 with C or better. Credit Hours: 3

MATH405 - Intermediate Differential Equations This course features the study of several sets of differential equations with the aid of computers. The equations are actual applications in biology, chemistry, economics, engineering, finance, medicine and physics. Where possible, problems will be chosen to match student's interests. Students from these areas are particularly welcome. Basic theory of differential equations is cited as needed. Prerequisite: MATH 305 with C or better. Credit Hours: 3

MATH407 - Partial Differential Equations Solution methods for linear partial differential equations arising in engineering and science. Topics include: the heat equation, the wave equation, Laplace's equation, separation of variables, boundary and initial value problems, uniqueness via the energy methods, the maximum principle and characteristics. Solutions to the vibrating string and dissipation of heat in a bar will be discussed. Prerequisite: MATH 251 and MATH 305 with C or better. Credit Hours: 3

MATH411 - Mathematical Topics for Teachers Variety of short courses in mathematical ideas useful in curriculum enrichment in elementary and secondary mathematics. May be repeated as topics vary. Does not count toward a mathematics major. Credit Hours: 1-6

MATH412 - Problem Solving Approaches to Basic Mathematical Skills Content of basic skills at all levels of education and the development of these skills from elementary school through college; emphasis on problem solving and problem solving techniques; determination of student skills and proficiency level. Credit may not be applied toward degree requirements in mathematics. Prerequisite: MATH 321 or CI 321. Credit Hours: 3

MATH417 - Applied Matrix Theory Selected applications of matrices to physics, chemistry and economics. This material is also useful for engineering and computer science. Topics include matrix representation of symmetry groups, non-negative matrices and the subsidy problem, location of eigenvalues. Prerequisite: MATH 221 with C or better. Credit Hours: 3

MATH419 - Introduction to Abstract Algebra II A detailed study of polynomial equations in one variable. Solvable groups and the Galois theory of field extensions are developed and applied to extensions of the quadratic formula, proving the impossibility of trisecting an angle with only a straight-edge and compass, and to the basic facts about finite fields as needed in coding theory and computer science. Prerequisite: MATH 319 with C or better. Credit Hours: 3

MATH421 - Linear Algebra The extension of basic linear algebra to arbitrary scalars. The theory and computation of Jordan forms of matrices (as needed e.g., for certain diffusion equations). Inner products, quadratic forms and Sylvester's Law of Inertia. Prerequisite: MATH 221 with C or better. Credit Hours: 3

MATH425 - Introduction to Number Theory Properties of integers, primes, divisibility, congruences, quadratic forms, diophantine equations, and other topics in number theory. Prerequisite: MATH 319 with C or better. Credit Hours: 3

MATH430 - Introduction to Topology Study of the real line and the plane, metric spaces, topological spaces, compactness, connectedness, continuity, products, quotients and fixed point theorems. This course will be particularly useful to students who intend to study analysis or applied mathematics. Prerequisite: MATH 352 with C or better. Credit Hours: 3

MATH433 - Classical and Modern Geometry Introduction to the foundations of Euclidean and non-Euclidean geometries. Topics include synthetic approach (Euclidean geometry, axiomatic systems, constructions, proofs), symmetries (similarity, congruence and various transformations and their invariants), metric approach (distance), vector space approach (transformations and matrices, inner product), inversive geometry, projective geometry (art and math) and non-Euclidean geometries. Some applications in modern science, like Relativity Theory, may also be covered. Historical background and connections with other parts of mathematics, science and culture are important components of this course. Prerequisite: MATH 250 and MATH 302 with grades of C or better. Credit Hours: 3

MATH435 - Elementary Differential Geometry Introduction to modern differential geometry through the study of curves in R3. Local curve theory with emphasis on the Serret-Frenet formulas; global curve theory including Fenchel's theorem; local surface theory motivated by curve theory; global surface theory including the Gauss-Bonnet theorem. Prerequisite: MATH 221 and MATH 251 with C or better. Credit Hours: 3

MATH447 - Introduction to Graph Theory (Same as CS 447) Graph theory is an area of mathematics which is fundamental to future problems such as computer security, parallel processing, the structure of the World Wide Web, traffic flow and scheduling problems. It also plays an increasingly important role within computer science. Topics include: trees, coverings, planarity, colorability, digraphs, depth-first and breadth-first searches. Prerequisite: MATH 349 with C or better. Credit Hours: 3

MATH449 - Introduction to Combinatorics (Same as CS 449) This course will introduce the student to various basic topics in combinatorics that are widely used throughout applicable mathematics. Possible topics include: elementary counting techniques, pigeonhole principle, multinomial principle, inclusion and exclusion, recurrence relations, generating functions, partitions, designs, graphs, finite geometry, codes and cryptography. Prerequisite: MATH 349 with C or better. Credit Hours: 3

MATH450 - Methods of Advanced Calculus Multivariable calculus fundamental to continuum mechanics, differential geometry, electromagnetism, relativity, thermodynamics, etc. Includes: parametric curves and surfaces, inverse and implicit function theorems, contraction mapping and fixed point theorems, differentials, convergence of multivariate integrals, coordinate systems in space, Jacobians, surfaces, volumes and Green's, Gauss', and Stokes' theorems. Prerequisite: MATH 251 with C or better. Credit Hours: 3

MATH452 - Introduction to Analysis A rigorous development of one-variable calculus providing the tools necessary for understanding all other advanced courses in analysis. Topics include: sets, axioms for the real numbers, continuity, limits, differentiation, the Riemann integral, infinite sequences and series of functions. Additional topics may include areas such as Riemann-Stieltjes integration or the analysis of multivariable functions. Prerequisite: MATH 352 with C or better. Credit Hours: 3

MATH455 - Complex Analysis with Applications Analysis of differentiable functions of a single complex variable. Introduces mathematical techniques used to analyze problems in the sciences and engineering that are inherently two dimensional. Topics include: the complex plane, analytic functions, the Cauchy-Riemann equations, line integrals, the Cauchy integral formula, Taylor and Laurent series, the residue theorem, conformal mappings, applications. Prerequisite: MATH 251 with C or better. Credit Hours: 3

MATH460 - Transformation Geometry Geometry viewed as the study of properties invariant under the action of a group. Topics include collineations, isometries, Frieze groups, Leonardo's Theorem, the classification of isometries of Euclidean and hyperbolic geometries. Recommended elective for secondary education majors in mathematics. Prerequisite: MATH 319 with C or better. Credit Hours: 3

MATH471 - Optimization Techniques (Same as CS 471) Introduction to algorithms for finding extreme values of nonlinear multivariable functions with or without constraints. Topics include: convex sets and functions; the arithmetic-geometric mean inequality; Taylor's theorem for multivariable functions; positive definite, negative definite, and indefinite matrices; iterative methods for unconstrained optimization. Prerequisite: MATH 221 and MATH 250 with C or better. Credit Hours: 3

MATH472 - Linear Programming (Same as CS 472) Introduction to finding extreme values of linear functionals subject to linear constraints. Topics include: recognition, formulation, and solution of real problems via the simplex algorithm; development of the simplex algorithm; artificial variables; the dual problem and duality theorem; complementary slackness; sensitivity analysis; and selected applications of linear programming. Prerequisite: MATH 221 with C or better. Credit Hours: 3

MATH473 - Reliability and Survival Models (Same as STAT 473) Introduction to statistical analysis of data on lifetime, including hazard functions and failure distributions; estimation and hypothesis testing in life testing experiments with complete as well as censored data. Prerequisite: MATH 480 or MATH 483 or STAT 483 with C or better. Credit Hours: 3

MATH474 - Time Series (Same as STAT 474) An introduction to time series: AR, MA and ARIMA models; estimation, time series models. Prerequisite: MATH 480 or STAT 480 or MATH 483 or STAT 483 with C or better. Credit Hours: 3

MATH475 - Numerical Analysis I (Same as CS 475) Introduction to theory & techniques for computation with digital computers. Topics include: solution of nonlinear equations; interpolation & approximation; solution of systems of linear equations; numerical integration. Students will use MATLAB to study the

numerical performance of the algorithms introduced in the course. Prerequisites: MATH 221 and MATH 250 with C or better. Credit Hours: 3

MATH476 - Numerical Analysis II Continuation of MATH 475. Topics include: solution of ordinary differential equations; computation of eigenvalues and eigenvectors; and solution of partial differential equations. Students will use MATLAB to study the numerical performance of the algorithms introduced in the course. Prerequisites: MATH 305 and MATH 475 with a C or better. Credit Hours: 3

MATH480 - Probability, Stochastic Processes and Applications I Introduction to the central topics of modern probability including elementary stochastic processes; random variables and their properties; sum of independent random variables and the Central Limit Theorem; random walks; discrete time finite state Markov chains; applications to random number generators and image and signal processing. Also generating functions, conditional probability, expectation, moments. Prerequisite: MATH 250 with C or better. Credit Hours: 3

MATH481 - Probability, Stochastic Processes and Applications II Continuation of MATH 480. Thorough introduction to Markov processes and Martingales, including the laws of large numbers, classification of states, recurrence, convergence to the stationary distribution in Markov chains, birth processes, Poisson processes, stopping times, and the Martingale convergence theorem. Important and current applications will be included. Prerequisite: MATH 251 and MATH 480 each with C or better. Credit Hours: 3

MATH483 - Mathematical Statistics in Engineering and the Sciences (Same as STAT 483) Develops the basic statistical techniques used in applied fields like engineering, and the physical and natural sciences. Principal topics include probability; random variables; expectations; moment generating functions; transformations of random variables; point and interval estimation; tests of hypotheses. Applications include one-way classification data and chi-square tests for cross classified data. Prerequisite: MATH 250 with C or better. Credit Hours: 4

MATH484 - Applied Regression Analysis and Experimental Design (Same as STAT 484) Introduction to linear models and experimental design widely used in applied statistical work. Topics include linear models; analysis of variance; analysis of residuals; regression diagnostics; randomized blocks; Latin squares; factorial designs. Applications include response surface methodology and model building. Computations will require the use of a statistical package such as SAS. Prerequisite: MATH 221 and either MATH 483 or STAT 483, with grades of C or better. Credit Hours: 3

MATH485 - Applied Statistical Methods (Same as STAT 485) Introduction to sampling methods and categorical data analysis widely used in applied areas such as a social and biomedical sciences and business. Sampling methods topics include: simple random and stratified sampling; ratio and regression estimators. Categorical data analysis topics include: contingency tables; loglinear models; logistic regression; model selection; use of a computer package. Prerequisite: MATH 483 or STAT 483 with C or better. Credit Hours: 3

MATH486 - Statistical Computing (Same as STAT 486) This course covers Statistical Computing Software packages such as R and SAS; helps prepare students for SAS certification. Topics include obtaining and analyzing output for regression, experimental design, and generalized linear models. Prerequisites: MATH 484 or STAT 484, and CS 202 both with C or better. Credit Hours: 3

MATH490 - Topics in Mathematics Selected topics in mathematics chosen from such areas as: (a) Financial Mathematics, Mathematical Biology or Actuarial Mathematics; (b) Probability, Statistics or Stochastic Processes; (c) Mathematical topics not including Statistics, such as Operations Research, Cryptography and High Dimensional computing in Numerical Analysis, etc. May be repeated up to 3 times as topics vary. Special approval needed from the instructor. Credit Hours: 3

MATH492 - Industrial and Applied Mathematics Clinic Students will participate in a semester-long project to apply their mathematical knowledge to a problem supplied by a business, industrial, or community partner. Students will work in teams, and will engage in client contact, including a final report of their results to the client. Mathematical modeling, research, communication, and project management skills will be developed, along with core mathematical competency needed to solve the client problem. Prerequisites: MATH 221, MATH 483, and CS 202 with grades of C or better. Credit Hours: 3

MATH495 - Special Topics in Mathematics Individual study or small group discussions in special areas of interest under the direction of a member of the faculty. Special approval needed from the director and instructor. Credit Hours: 1-6

Mathematics Faculty

Ban, Dubravka, Professor and Director, Mathematics, Ph.D., University of Zagreb, 1998; 2002. Algebra, representation theory, automorphic L-functions.

Bhatacharyya, Tumpa, Clinical Assistant Professor, PhD, Bowling Green State University, 2011; 2019.

Ceballos, Kristen, Lecturer, M.S. Mathematics, Southern Illinois University, 2011; 2012.

Calvert, Wesley, Professor, Mathematics, Ph.D., University of Notre Dame, 2005; 2010. Mathematical logic and theoretical computation.

Castelli, Vina, Lecturer, M.S. Mathematics, Southern Illinois University, 2015

Choiy, Kwangho, Associate Professor, Mathematics, Ph.D., Purdue University, 2012; 2015. Number theory, automorphic forms and representation theory.

Giritharan, Kathirave, Lecturer, M.S. Mathematics, Southern Illinois University, 1990; 2019.

Gluck, Mathew, Assistant Professor, Mathematics, Ph.D., University of Florida, ; 2022. Nonlinear elliptic partial differential and integral equations, extremal problems, calculus of variations, applied and computational mathematics and data science.

Kocik, Jerzy, Professor, Mathematics, Ph.D., Southern Illinois University, 1989; 2002. Differential geometry and lie algebras.

Lauderdale, Lindsey-Kay, Assistant Professor, Mathematics, Ph.D., University of Florida, 2014; 2022. Algebraic graph theory, enumerative combinatorics, extremal graph theory, group theory, and their applications.

Lowndes, Thara, Director Computer Based Learning, M.S. Mathematics, Southern Illinois University, 1996; 2004.

Nagrodski, Ron, Lecturer, M.S. Mathematics, Southern Illinois University, 1990; 2011.

Olive, David, Professor, Statistics, Ph.D., University of Minnesota, 1998; 1999. Applied robust statistics, regression graphics, applied probability.

Omar, Ghada, Clinical Assistant Professor, Ph.D. in Applied Mathematics, Time domain, electromagnetism, and scattering; 2012.

Rajan, Suri, Lecturer, M.S., University of Illinois, 2011; 2015.

Rathnayake, Rasanji. Clinical Associate Professor, Ph.D. Southern Illinois University Carbondale, 2019; 2015.

Samadi, S. Yaser, Associate Professor, Statistics, Ph.D., University of Georgia, 2014; 2014. Multivariate and matrix time series analysis.

Schurz, Henri U., Professor, Mathematics, Ph.D., Humboldt University, 1997; 2001. Stochastic analysis, stochastic dynamical systems, mathematical finance.

Summers, Oneal, Lecturer, M.S. Mathematics, Southern Illinois University; 2024

Xiao, Mingqing, Professor, Mathematics, Ph.D., University of Illinois at Urbana-Champaign, 1997; 1999. Partial differential equations, dynamical systems, control theory and applications.

Xu, Dashun, Professor, Mathematics, Ph.D., Memorial University of Newfoundland, 2004; 2006. Mathematical biology.

Xu, Jianhong, Professor, Mathematics, Ph.D., University of Connecticut, 2003; 2005. Numerical analysis, matrix computations, matrix theory and applications.

Emeriti Faculty

Bhattacharya, Bhaskar, Professor, Emeritus, Statistics, Ph.D., University of Iowa, 1993; 1993.

Burton, Theodore A., Professor, Emeritus, Mathematics, Ph.D., Washington State University, 1964; 1966.

Clark, Lane, Professor, Emeritus, Mathematics, Ph.D., University of New Mexico, 1980; 1981.

Crenshaw, James A., Associate Professor, Emeritus, Mathematics, Ph.D., University of Illinois, 1967; 1967.

Danhof, Kenneth, Professor, Emeritus, Mathematics, Ph.D., Purdue University, 1969; 1969.

Dharmadhikari, Sudhakar, Professor, Emeritus, Statistics, Ph.D., University of California, Berkeley, 1962; 1978.

Earnest, Andrew G., Professor, Emeritus, Mathematics, Ph.D., Ohio State University, 1975; 1981.

Feinsilver, Philip, Professor, Emeritus, Mathematics, Ph.D., New York University (Courant), 1975; 1978.

Foland, Neal E., Professor, Emeritus, Mathematics, Ph.D., University of Missouri, 1961; 1965.

Grimmer, Ronald C., Professor, Emeritus, Mathematics, Ph.D., University of Iowa, 1967; 1967.

Hooker, John W., Professor, Emeritus, Mathematics, Ph.D., University of Oklahoma, 1967; 1967.

Hughes, Harry R., Associate Professor, Emeritus, Mathematics, Ph.D., Northwestern University, 1988; 1989.

Jeyaratnam, Sakthivel, Professor, Emeritus, Statistics, Ph.D., Colorado State University, 1978; 1981.

Kammler, David W., Professor, Emeritus, Mathematics, Ph.D., University of Michigan, 1971; 1971.

Mark, Abraham M., Professor, Emeritus, Mathematics, Ph.D., Cornell University, 1947; 1950.

McSorley, John, Professor, Emeritus, Mathematics, Ph.D., University of Oxford, 1988; 2004.

Neuman, Edward, Professor, Emeritus, Mathematics, Ph.D., University of Wroclaw, Poland, 1972; 1984.

Paine, Thomas B., Assistant Professor, Emeritus, Mathematics, Ph.D., University of Oregon (Eugene), 1966; 1966.

Patula, William T., Professor, Emeritus, Mathematics, Ph.D., Carnegie Mellon University, 1971; 1972.

Pedersen, Franklin D., Associate Professor, Emeritus, Mathematics, Ph.D., Tulane University. 1967; 1965.

Pericak-Spector, Kathleen A., Professor and Distinguished Teacher, Emerita, Mathematics, Ph.D., Carnegie Mellon University, 1980; 1981.

Redmond, Donald, Associate Professor, Emeritus, Mathematics, Ph.D., University of Illinois, 1976; 1979.

Spector, Scott, Professor and Distinguished Scholar, Emeritus, Mathematics, Ph.D., Carnegie Mellon University, 1978; 1981.

Sullivan, Michael C., Professor Emeritus, Mathematics, Ph.D., University of Texas at Austin, 1992; 1996. Topological dynamics.

Wallis, Walter D., Professor, Emeritus, Mathematics, Ph.D., University of Sydney, 1968; 1985.

Wright, Mary H., Professor and Distinguished Teacher, Emerita, Mathematics, Ph.D., McGill University, Montreal, Quebec, 1977; 1980.

Yucas, Joseph, Professor, Emeritus, Mathematics, Ph.D., Pennsylvania State University, 1978; 1980.

Zeman, Marvin, Professor, Emeritus, Mathematics, Ph.D., New York University, 1974; 1979.

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