Quantitative Methods and Computer Science (QMCS)

Hansen (chair), Bagley, Chung, Heltne, Jarvis, Komar, Patton, Pliego, Raymond, Schwebel, Smith, Sturm, Werness

Quantitative Methods and Computer Science is part of the liberal arts curriculum at the University of St. Thomas. The QMCS program is concerned with the areas of today's society that involve the collection, organization, processing, storage, retrieval, communication and use of information. The department's emphasis is on the broad basic core of knowledge required to become an effective user of information; to design and implement system and application software; and to understand the concepts involved in areas such as computer graphics, telecommunication, artificial intelligence, database design, statistics and operations research.

Students who graduate with a major in quantitative methods and computer science will be prepared to work in business, industry, education, and government, as designers or users, or to pursue entrepreneurial interests in technologically supported areas or to continue study in graduate school.

Courses are arranged so that students from other disciplines may participate to whatever extent they wish. The department also strongly encourages its majors to obtain a minor in another field.

Students interested in teacher licensure should see the various science and mathematics programs in the Department of Teacher Education section of this catalog.

Major in Quantitative Methods and Computer Science

220 Statistics I
230 Software Design Using the JAVA Language*
281 Object-Oriented Design and Programming*
350 Data and File Structures

*A grade of C- or higher must be earned by majors in each of these courses chosen to fulfill the core requirement.

Plus (for all majors):
Eight credits numbered 300 through 450. Students should consult with their department adviser in choosing the most appropriate courses.

Plus (for all majors):
Four credits numbered 100 through 499

Plus:
A set of courses in one of three paths (CS, CIS, or QM):

Computer Science (CS)
A traditional computer-science path that emphasizes low-level computing fundamentals as well as high-level design issues.
420 Systems Analysis and Design I
450 Database Design

Plus one of:
300 Computer Organization
340 Digital Electronics and Microprocessors

Computer Information Systems (CIS)
A management information systems path emphasizing high-level design issues and designer/user interaction.
420 Systems Analysis and Design I
450 Database Design

Plus one of:
421 Systems Analysis and Design II
425 Information Resource Management

Quantitative Methods (QM)
A path emphasizing the role of statistics, mathematics and operations research as well as the use of computers in solving problems in organizations.
410 Operations Research I

Plus two of:
320 Statistics II
411 Operations Research II
420 Systems Analysis and Design I
450 Database Design

Allied requirements
MATH 128 Introduction to Discrete Mathematics

Plus one of:
MATH 109 Calculus with Review II
MATH 111 Calculus for Business and Social Science
MATH 113 Calculus I

Plus one of:
COMM 100 Public Speaking
COMM 105 Communication in the Workplace

Teacher Licensure

Elementary Education with a Co-major in Science and Mathematics for Elementary Education
See School of Education Department of Teacher Education

Minor in Quantitative Methods and Computer Science – for sciences

This minor is intended to support majors in biology, chemistry, environmental studies, geology, mathematics and physics.
230 Software Design Using the JAVA Language
281 Object-Oriented Design and Programming

Plus three of:
220 Statistics I
300 Computer Organization
320 Statistics II
330 Graphics and Numerical Methods
340 Digital Electronics and Microprocessors
342 Computer Applications in Experimental Sciences
350 Data and File Structures
380 Artificial Intelligence and Robotics
381 Expert Systems
410 Operations Research I
411 Operations Research II
450 Database Design

Minor in Quantitative Methods and Computer Science – for business

This minor is intended to support majors in any concentration of business administration, economics and other related disciplines.
110 Introduction to Information Processing

Plus one of:
230 Software Design Using the JAVA Language
238 Software Design using Business Languages

Plus three of:
215 Rapid Application Development
281 Object-Oriented Design and Programming
420 Systems Analysis and Design I
425 Information Resource Management
450 Database Design

Minor in Quantitative Methods and Computer Science – for mathematics

This minor is intended to support majors in mathematics and those interested in statistics and operations research.
230 Software Design Using the JAVA Language

Plus four of:
220 Statistics I
281 Object-Oriented Design and Programming
320 Statistics II
330 Graphics and Numerical Methods
410 Operations Research I
411 Operations Research II

110 Introduction to Information Processing (216)
Introduction to basic concepts of hardware, software and information processing systems. Introduction to computer programming concepts. Use of microcomputer application packages, including spreadsheets and database packages. Introduction to the Internet and World Wide Web. Investigation of the impact of the computer and future trends. This course fulfills the second-level Computer Competency requirement in the core curriculum.

120 Computers in Elementary Education
This course is intended for elementary education majors. Topics include the role of the computer in elementary and middle-school education, computer applications in science and mathematics, data analysis, software packages for use in elementary and middle-school classrooms, Computer-Assisted-Instruction (CAI), multimedia, telecommunication and software creation using MicroWorlds and HTML. This course fulfills the third course in the Natural Science and Mathematical and Quantitative Reasoning and the second-level Computer Competency requirements in the core curriculum.
Prerequisite: elementary education or SMEE major

201 Introductory Statistics II (220) **2 credits**
This course is for students desiring to satisfy the coverage of QMCS 220 (a full semester of statistics), but who have taken less than one full semester of statistics. Review of basic statistical techniques (confidence intervals, hypothesis testing, regression), multiple regression, contingency tables, analysis of variance, sampling, plus emphasis on use of statistical packages and design of a statistical study.
Prerequisite: 206 or at least .35 semester, but less than one semester, of statistics

215 Rapid Application Development
Introduction to user-friendly development tools. These tools allow non-programmers to create usable software without programmer assistance. Students will be exposed to developing systems using software packages emphasizing structured analysis techniques. These packages integrate spreadsheet software database management software and presentation software. Queries to the World Wide Web (WWW) and a variety of techniques to display data on the Web are included. Approximately half of the course deals with philosophical and foundational topics such as modeling or requirements. This course fulfills the second-level Computer Competency requirement of the core curriculum.
Prerequisite: 110

216 Quantitative Techniques in Business (110) **2 credits**
The use of microcomputer spreadsheet software to aid in solving quantitative business problems. This course is to be taken by students who have been given transfer credits for the equivalent of some part but not all of 110 and who are required to take 110.
Prerequisite: ACCT 205 or ACCT 216

220 Statistics I (201)
Introductory applied statistics: sampling, descriptive (exploratory) statistics, probability, sampling distributions, estimation and hypothesis testing, non-parametrics, simple and multiple linear regression, introduction to analysis of variance; use of statistical packages. This course fulfills the third course in the Natural Science and Mathematical and Quantitative Reasoning and the second-level Computer Competency requirements in the core curriculum.
Prerequisite: Math placement at level of MATH 111 or above; or MATH 100, 101, or 105, or 109, 111 or 113

230 Software Design Using the JAVA Language
Introduction to software development including procedural and object-oriented concepts. Topics include: algorithmic development, classes and methods, arrays, sorting and searching, recursion. This course fulfills the second-level Computer Competency requirement in the core curriculum.
Prerequisite: None in general. However, certain sections will be designated for science students. The prerequisite for those sections is MATH 109 or 111 or 113.

238 Software Design Using Business Languages
Introduction to software development using COBOL and other business languages. Topics include algorithm development, sequential and direct-access file processing, tables, sorting, structured programming and software validation. This course fulfills the second-level Computer Competency requirement in the core curriculum.

281 Object-Oriented Design and Programming
Continuation of object-oriented design and programming in JAVA, with emphasis on more advanced concepts. Topics include classes, inheritance, encapsulation, polymorphism, GUI interface design, exception handling and files. This course fulfills the second-level Computer Competency requirement in the core curriculum.
Prerequisite: 230; MATH 128 recommended

295, 296 Topics **2 credits**
297, 298 Topics
The subject matter of these courses will vary from year to year, but will not duplicate existing courses. Descriptions of these courses are available at www.stthomas.edu/registrar/onlineschedule.html.

300 Computer Organization
Concepts of computer system organization and programming. Instruction and data representations. Instruction set decoding, addressing modes, and fundamentals of assembly language. The organization and the operation of the central processing unit, instruction fetching and execution, hardwired and microprogrammed control, I/O structures, direct memory access, interrupts, bus protocols and I/O interfaces, multiple-module memory, caches,

memory, memory organization, registers, microprocessor families, pipelining, and RISC features. This course fulfills the second-level Computer Competency requirement in the core curriculum.
Prerequisites: 230 or 238 and MATH 128

320 Statistics II
Analysis of variance; regression with indicator variables; topics from: general linear model; design of experiments; further use of statistical packages, discriminant, cluster analysis, time series.
Prerequisite: 201 or 220 or MATH 333

330 Graphics and Numerical Methods
An integrated approach to using the computer to solve numerical problems and to present information in graphical form. Includes: non-linear equations, systems of linear equations, interpolation, approximation, differential equations, two and three-dimensional picture transformations plus viewing and rendering of graphical images.
Prerequisites: 230 and MATH 109 or 111 or 113

340 Digital Electronics and Microprocessors
Digital electronics techniques: semiconductor devices, digital logic, counters, clocks, shift registers, combinatorial and sequential logic circuits and minimization. Microprocessor organization, programming, device addressing, buffering and enabling. Microprocessor interfacing with switches, A to D, D to A, and communications.
Prerequisites: 230 and MATH 128

342 Computer Applications in Experimental Sciences
Introduction to the use of computers in the collection and analysis of scientific information. The course is designed to meet the needs of both natural science majors with an interest in scientific computing and computer science majors with an interest in laboratory science. Emphasis is placed on application of concepts and techniques in addition to LabVIEW programming. Topics include laboratory device interfacing, analog-signal acquisition and processing, frequency transformations, data analysis, and math modeling and simulation. This course fulfills the second-level Computer Competency requirement in the core curriculum.
Prerequisites: 230 or 238; MATH 109 or 111 or 113; one course in a laboratory science

350 Data and File Structures
An introduction to data structures and abstract data types using an object-oriented language. Includes arrays and linked lists, stacks and queues, recursion, searching and sorting, trees, heaps, files, hashing and graphs. Measures of algorithmic efficiency are developed for S/B algorithms processing these data structures.
Prerequisites: 281 and MATH 128

360 Operating Systems Design
The basic principles of designing and building operating systems. Sequential versus concurrent processes, synchronization and mutual exclusion, memory management techniques, CPU scheduling, input/output device handling, file systems design, security and protection. Primary focus on uniprocessors, with some coverage of multiprocessor operating systems.
Prerequisite: 281; Recommended: 300

370 Telecommunications and Teleprocessing
The fundamental concepts of telecommunications and networking for voice, data and video, including hardware, media, signaling and digital switching, open-system interconnection model, standards and protocols, local and wide-area networks and inter-networking.
Prerequisites: 230 or 238 and MATH 128

371 Advanced Voice and Data Communications
Analysis of voice, data and video telecommunication requirements, network configuration, network operations, network monitoring and optimization, documentation and legal issues.
Prerequisite: 370

380 Artificial Intelligence and Robotics
Theory and implementation techniques using computers to solve problems, play games, prove theorems, recognize patterns, create artwork and musical scores, translate languages, read handwriting, speak and perform mechanical assembly. Emphasis placed on implementation of these techniques in robots.
Prerequisites: 220 and 281

381 Expert Systems
Emphasis on a practical understanding of artificial intelligence, LISP, and the expert system-building process. Course goals include understanding what expert systems are, how they operate, techniques used to build expert systems, and evaluating commercially available expert systems packages.
Prerequisites: 281 and junior standing

410 Operations Research I
Utilization of computer and analytic techniques to support the decision-making process in both the public and private sectors. Topics include linear programming, simulation, PERT, inventory control, goal programming and queuing theory. This course fulfills the second-level Computer Competency requirement in the core curriculum.
Prerequisites: 220 and MATH 109 or 111 or 113

411 Operations Research II
Advanced modeling techniques. Techniques include: decision theory, Markov chains, integer programming, dynamic programming, forecasting, game theory, transportation problems and decision theory.
Prerequisites: 410 and MATH 114

419 Accounting Information Systems
This course will provide an understanding of the conceptual framework and practices of accounting information systems and the ability to work effectively with computer specialists and management to design, implement and audit such systems. Examples of subjects included are: systems development life cycle (SDLC), systems analysis phase of the SDLC, data and process models, operations of a corporate data center, including internal controls, database integrity, audit considerations for both internal and external auditors, unit integration, and system testing.
Prerequisites: 110 plus ACCT 316 or concurrent registration with ACCT 316

420 Systems Analysis and Design I
A study of process, data, and object models for the analysis and design of information systems. Includes enterprise models, data-flow diagrams, structure charts, entity-relationship models, normalization and state transition diagrams. Alternative system development life cycles are discussed, as well as testing, quality and installation strategies.
Prerequisites: 230 or 238 and junior standing

421 Systems Analysis and Design II
Continuation of 420. Concentration on implementation problems, software and hardware limitations. Emphasis on managerial problems in an information-processing system. Continued use of computer-based analysis and design and project-management tools. A "real world" project is an integral part of this course.
Prerequisite: 420

425 Information Resource Management
A study of relevant technologies and how they are used in today's modern organizations to help manage the information resource of the organization. Emphasis is placed on the use of the Internet and World Wide Web and how they have changed organizational operations and strategies. This is an "active learning" course in which students will be researching current information systems technologies (such as Electronic Commerce [e-commerce]) and will be participating in the design and development of an e-commerce website for a fictitious organization.
Prerequisite: 230 or 238; junior standing

450 Database Design
Introduction to database management systems design philosophy. Design considerations for satisfying both availability and integrity requirements. Data models used to structure the logical view of the database. Schema, subschemas, and database administration. Emphasis on general purpose relational database management s/B systems using SQL.
Prerequisite: 281 or 420 or 425

460 Senior Project
Work on a software analysis, design, and implementation project under the direction of a faculty member.
Prerequisite: Senior standing and permission of the instructor

475, 476 Experiential Learning **2 credits**
477, 478 Experiential Learning
See the description of these courses at the beginning of the "Curricula" section of this catalog.

483, 484 Seminar **2 credits**
485, 486 Seminar
See the description of these courses at the beginning of the "Curricula" section of this catalog.

487, 488 Topics **2 credits**
489, 490 Topics
The subject matter of these courses will vary from year to year, but will not duplicate existing courses. Descriptions of these courses are available at www.stthomas.edu/registrar/onlineschedule.html.

491, 492 Research **2 credits**
493, 494 Research
See the description of these courses at the beginning of the "Curricula" section of this catalog.

495, 496 Individual Study **2 credits**
497, 498 Individual Study
See the description of these courses at the beginning of the "Curricula" section of this catalog.

Sociology and Criminal Justice (SOC)

Karraker (chair), Kinney, Smith-Cunnien, Waldner; Bruton, Caldie, Davis, Kennedy, Parilla, Peterson, Plesha, Schuth

Sociology is the scientific study of society and social relations. A major in Sociology provides knowledge and skills applicable to careers in business, education, government, law, public health, public policy, and social service. Additionally, an undergraduate degree prepares students for graduate study in sociology and other closely related fields.

Students who graduate with a major in Sociology will understand the methodological and theoretical foundations of sociology and possess skills to apply this knowledge in a practical way. They will have the opportunity to specialize in crime and criminology, family and the life course, inequalities and stratification, and work and organizations, as well as individual course work in other areas such as anthropology, health, and urban sociology. The department also offers courses with comparative perspectives on global issues such as crime, gender, immigration, and religion. The sociology curriculum reflects the breadth of the discipline, its place in the liberal arts tradition, and the application of sociological theories and methods to the critical issues and problems facing societies today.

Students who graduate with a major in Criminal Justice will know the main components of the criminal and juvenile justice systems and will know the basics of criminal law and criminal procedure in the U.S. system of justice. They will have the tools to understand the long standing and current dilemmas faced by society in trying to develop and maintain an effective and just criminal justice system. They will be prepared for employment in the field of criminal justice, including corrections or law enforcement.

Sociology and Criminal Justice majors pursue graduate and professional degrees in sociology and criminology, as well as business, law, public health, public policy, social work, and other fields. The sociology department and sociology faculty also provide intensive support for students who wish to engage in individual research and preparation for graduate and professional school, as well as internships and career development.

A Sociology major or minor is a strong complement to studies in American cultural studies, business (especially human resources, management, marketing), Catholic studies, family studies, international studies, journalism, justice and peace studies, legal studies, psychology, social sciences, social work, urban studies, and women's studies. The sociology program supports study abroad and participation in the HECUA, MUST, and other innovative courses of study.

Sociology Honor Society
The *Iota* Chapter of Minnesota of *Alpha Kappa Delta,* the international sociology honor society, was chartered at the University of St. Thomas in 1991. The purpose of the society is to promote an interest in the study of sociology, research of social problems, and such other social and intellectual activities as will lead to improvement in the human condition. Membership is open to juniors and seniors who have completed at least sixteen credits in sociology registered through the university, who are officially declared majors or minors in sociology, criminal justice, the sociology concentration of social science, or social studies and who have a minimum overall grade point average in the top 30th percentile.

Major in Sociology

100 Introduction to Sociology
210 Research Methods in Sociology
220 Sociological Analysis
470 Sociological Theory

Plus one of:
365 Social Psychology
366 Self and Society

Plus:
Sixteen additional credits in Sociology (eight of which must be 300-level or higher)

Strongly recommended:
MATH 101 Finite Mathematics
In addition, it is recommended that students take the following courses in this order:
MATH 101 (or adequate substitute)
SOC 210 Research Methods in Sociology
SOC 220 Sociological Analysis
Finally, it is recommended that students begin the SOC 210/220 sequence during their sophomore year. This sequence must be completed by the end of the junior year. Students who have a double major in sociology and psychology and complete SOC 210, PSY 212, and QMCS 220 do not need to take SOC 220.