INDIANA UNIVERSITY SOUTH BEND
COLLEGE OF LIBERAL ARTS AND SCIENCES

DEPARTMENT OF COMPUTER AND INFORMATION SCIENCES

Northside Hall
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Computer and Information Sciences
Northside Hall (301-A)
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www.cs.iusb.edu
www.informatics.iusb.edu

INTRODUCTION

The department began offering degrees in computer science in 1983. Currently the department has eight full-time faculty members and a number of part-time instructors. It offers a full range of courses in computer science and information technology. Today we have over 240 declared majors in computer science. We offer degree programs in both Computer Science and Informatics. Our programs include a Bachelor of Science in Computer Science, Bachelor of Science in Informatics, an Associate of Science in Computer Science, four certificate programs, a minor in computer science, a minor in cognitive science, and a minor in informatics. In addition, our department offers a Master of Science degree in Applied Mathematics and Computer Science jointly with the Department of Mathematical Sciences. We also provide computing courses for the Master of Science degree in Management of Information Technology (MS-MIT), offered by the School of Business and Economics.

MESSAGE FROM THE FACULTY

Our mission is to provide the highest quality education in the most enjoyable and friendly atmosphere possible. In pursuing this mission we work hard to attract the most highly qualified faculty to our program. Our faculty play an essential role in our ability to develop and maintain a high quality computer science program at IUSB. Accordingly, we seek to attract faculty with strong applied research potential, instructional ability and communication skills necessary for the mutual benefit of the university, business, scientific and engineering communities. Our goal is to bridge the gap between theories and concepts presented in the classroom and real life business and industry needs and practices.

We have charted a course to develop and refine many exciting and

challenging projects over the next five years. Some of these are given below:

- Development of a masters program in computer science.
- Refinement of the new B.S. program in Informatics.
- Refinement of our joint masters program with the Department of Mathematics Sciences (M.S. in Applied Mathematics and Computer Science).
- Refinement and expansion of our joint masters program with School of Business and Economics (MS-MIT).

In addition to the above, we will continue to

- Improve our teaching and research environment for our students and faculty, and aggressively recruit the best and brightest faculty to our department.
- Improve our laboratories.
- Expand our community outreach program.
- Mentor our students, and support their learning, research and creative activities.

If you are considering majoring in computer science or informatics, we would be pleased to hear from you. Members of the department are happy to answer questions about our programs at any time. Drop by the department or give us a call at (574) 237-6521. Alternatively, you may browse our department's web sites at http://www.cs.iusb.edu or http://www.informatics.iusb.edu

EQUAL OPPORTUNITY

The department recruits majors without regard to race, sex, religion, nationality, or physical disability, and seeks to provide every student equal access to all its facilities and degree programs. Indeed, we welcome diversity among our students as a positive factor in learning.

COMPUTER SCIENCE FACULTY

FULL-TIME FACULTY

Gao, Dengfeng, Computer Science (University of Arizona, 2004). Research interests: database management systems; Temporal Query Processing in XML databases.

Hakimzadeh, Hossein, Ph.D. in Computer Science (North Dakota State University, 1993). Research interests: database management systems; operating systems; distributed systems, object-oriented software engineering.

Knight, William, Ph.D. in Mathematics (University of California, Berkeley, 1969), M.Sc. in Statistics (Pennsylvania State University, 1977), M.Sc. in Computer Science (University of Illinois, Urbana, 1986). Research interests: analysis of algorithms; data structures.

Rus, **Vasile,** Ph.D. in Computer Science, (Southern Methodist University, 2002). Research interests: intelligent systems; software engineering; artificial intelligence; natural language processing; knowledge representation based on natural language; and question answering.

Russo, John, Associate Professor, Emeritus. Ph.D. in Mathematics (Florida State University, 1965). Research interests: program efficiency; software engineering.

Scheessele, Mike, Ph.D. in Quantitative and Mathematical Psychology (Purdue University). Research interests: Cognitive science and artificial intelligence, especially psychologically plausible artificial vision and problem-solving systems.

Schwartz, Ruth, Ph.D. in Business Administration with a double

major in Computer Information Systems and Operations Research (Temple University), M.S. degree in Computer Science (University of California, Los Angeles), BA degree in Liberal Arts with a major in mathematics (Northwestern University). Teaching and research interests: Curriculum development, database systems, enterprise resource planning, and programming languages.

Surma, Dave, Ph.D. in Computer Science and Engineering (University of Notre Dame 1998). Research interests: Parallel and Distributed Computing, Multimedia applications, Computer Architectures, High-Performance Networks, and Software tools for parallel and distributed computing systems.

Vrajitoru, Dana, D.Sci. in Computer Science (University of Neuchâtel, 1997). Research interests: genetic algorithms; scientific visualization; parallel computation; information retrieval; artificial intelligence.

Wolfer, James, Ph.D. in Computer Science (Illinois Institute of Technology, 1993). Research interests: harnessing the power of naturally inspired computation to solve real-world problems, visualization in science and medicine, cognitive science and computer science education.

PART-TIME ASSOCIATE FACULTY

James Champaigne
Terri L. Demmon
Rebecca Hartman
Judith Hoffacker
Matthew D. Holloway
Robert Lewandowski
John Madigan
Eric Sparks
Kurt Traxler
Bill Wolf
Debra Wright

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Haroun Rababaah

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COMPUTER SCIENCE & INFORMATICS PROGRAMS

Currently, IUSB offers a Master of Science degree in Applied Mathematics and Computer Science, a Bachelor of Science degree in Computer Science, a Bachelor of Science degree in Informatics, and a two-year Associate of Science degree in computer science.

Students majoring in computer science at IUSB will take a course of study modeled after the joint recommendations of the IEEE (Institute of Electrical and Electronic Engineering) and ACM (Association for Computing Machinery). C++ is the principal programming language at IUSB, but Scheme, Java, Visual BASIC, and other languages are offered. All computer science majors must complete a core curriculum of courses that build an overall understanding of the computer, computing environments, and theoretical and ethical issues important in the computer related professions.

Students majoring in informatics would begin with a core curriculum in informatics, and then proceed to choose a complementary area of specialization, hereafter to be called “the cognate area”. Currently eight cognate disciplines are being developed.

Computer Science and Informatics students work in a variety of computing environments at IUSB. In the first two programming courses (CSCI C101 and C201) and similarly in (INFO I210 and I211) students work on Windows based microcomputers. Many subsequent courses involve working in a UNIX environment available in departmental laboratories. The departmental UNIX machines are also available over phone lines for students who wish to have remote access. The IUSB campus is an Internet site, so students have access to electronic mail and the World Wide Web.

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

The degree requires a total of **122** credit hours including the following:

Area 1 (English Composition)
W131, or equivalent.

Area 2 (Foreign Language)
Six credit hours in a single foreign language, or equivalent (e.g., 3 years of a single foreign language in high school with at least a C average).

Area 3 (Business / Foreign Language)
Completion of *one* of the following three options:

a) Five courses in Business and Economics, including Accounting A201, A202, and courses from at least two other departments in Business and Economics. K201 and E270 are excluded from the list of five courses. Economics courses fulfill this requirement and requirement 5a below simultaneously. Students who complete ECON E103, ECON E104, BUS A201, and BUS A202 may wish to consider BUS F301 Financial Management as a fifth course in this area.

b) Six credit hours at the second year level in a foreign language.

c) Six credit hours at the first year level in a second foreign language.

Area 4 (Arts and Humanities)
One course from each of the following three areas, plus a fourth course in any one area.

a) Fine Arts; Music M174; Communication Arts (except S160).

b) English (except W130, and W131); Foreign Languages (only advanced courses of a literary nature).

c) History, Philosophy, Religious Studies. (Computer Ethics is recommended)

Area 5 (Social and Behavioral Sciences)
Four courses from the following areas, to include at most two in any one area.

a) Economics; Geography; Political Science.

b) Psychology.

c) Sociology/Anthropology; Linguistics. (Sociology S260/I202 is recommended)

Area 6 (Natural Sciences)
Thirteen credit hours in courses selected from chemistry, physics, geology, biology, and astronomy. At least two disciplines must be selected. At least one of the courses must have a laboratory component. Physics P303 Digital Electronics is required.

Area 7 (Mathematics)
Thirteen credits to include:
a) at least 6 credits of calculus: M208 and M209, or M215 and M216.
b) 3 credit of linear algebra: M301.
c) at least 4 credits of probability and statistics: M260 and M261.

Area 8 (Computing)
Forty-four credit hours in computer science, to be satisfied with the following courses:
Core: C101, C151, C201, C243, C251, C308, C311, C335, C435, C455, and
Electives: at least three additional computer science courses at or above the 300 level offered by the department. Possible choices for these three courses include the internship course (Y398), parallel and distributed programming (B424), information organization and retrieval (C441), database systems (C442), artificial intelligence (C463), computer networks (B438), graphics (C481), and object oriented programming in Java (C490). Numerical analysis (M471) may be counted as an elective in computer science.

NOTE: At least 22 of the 44 credit hours must be taken at IUSB.

A POSSIBLE PROGRAM FOR COMPUTER SCIENCE MAJORS

	FALL	SPRING
1st. YEAR	C101 (4) M208 (3) Calc.1 W131 Eng. Comp. (3) Foreign Language (3)	C151 (2) C201 (4) M209 (3) Calc 2 Arts & Humanities (3) Foreign Language (3)
2nd. YEAR	C243 (4) M301 (3) Social Science (3) Foreign Language (3) Arts & Humanities (3)	C335 (4) C308 (4) P303 (4) Physics Foreign Language (3)
3rd. YEAR	C251 (3) C311 (3) Arts & Humanities (3) M260 Probability (2) Natural Science (5)	C455 (3) C.S. Elective (3) Social Science (3) M266 Statistics (2) Elective (3)
4th. YEAR	C.S. Elective (3) C.S. Elective (3) Social Science (3) Elective (3) Natural Science (5)	C435 (4) Arts & Humanities (3) Elective (3) Elective (3) Social Science (3)

ASSOCIATE OF SCIENCE IN COMPUTER SCIENCE

This degree requires a total of **61** credit hours. These are broken into Concentration Requirements and General Requirements.

Concentration Requirements: C101, C151, C201, C243, and at least three more courses in computer science offered by the department above the level of C201. (The word "course" here means at least 3 credit hours) A minimum of 23 credit hours total are required. At least 12 of these credits must be taken at IUSB.

Basic requirements: English Composition W131 or equivalent (3 credit hours); arts and humanities (6 credit hours); social and behavioral sciences (6 credit hours); natural sciences (8 credit hours); foreign language (6 credit hours); and Mathematics M208 (3 credit hours) or M215 (5 credit hours).

A POSSIBLE PROGRAM FOR THE ASSOCIATE OF SCIENCE IN COMPUTER SCIENCE

	FALL	SPRING
1st. YEAR	C101 (4) M208 (3) Calc. 1 W131 (3) Eng. Comp Natural Science (5)	C151 (2) C201 (4) Social Science (3) Arts and Humanities (3) Social Sciences (3)
2nd. YEAR	C243 (4) C335 (4) Foreign Language (3) P303 (4) Physics	C308 (4) C.S. Elective (3) Foreign Language (3) Arts and Humanities (3) Elective (3)

CERTIFICATES IN PROGRAMMING

The department offers two separate undergraduate level certificate programs: a ***Certificate in Computer Programming*** and a ***Certificate in Advanced Computer Programming***. These certificates are intended primarily for students who are seeking or already hold a degree in some other subject but who wish to acquire some of the skills practiced by well-trained professional programmers.

Certificate in Computer Programming	Certificate in Advanced Computer Programming
This certificate requires completion of the following four courses at IUSB with a grade of C or better: C101 Computer Programming I C151 Multiuser Operating Systems C201 Computer Programming II C243 Introduction to Data Structures	This certificate requires completion of the following eight courses with a grade of C or better. At least six of these courses must be taken at IUSB. C101 Computer Programming I C151 Multiuser Operating Systems C201 Computer Programming II C243 Introduction to Data Structures C308 System Analysis and Design C311 Org. of Prog.. Languages C335 Computer Structures One additional computer science course at or above the 300-level.

In addition, the student must take and pass ENG W130 Principles of Composition with a grade of C or better, or else must score at a level that would permit them to take ENG W131 Elementary Composition on the IUSB placement examination in composition.

A student who has earned the Certificate in Computer Programming may afterwards take the remaining courses required to earn the Certificate in Advanced Computer Programming.

NOTE:

**** The College of Liberal Arts and Sciences does not allow a student to obtain a certificate and an A.S. or B.S. degree in computer science in the same semester.**

CERTIFICATE IN TECHNOLOGY FOR ADMINISTRATION

The department offers a graduate level ***Certificate in Technology for Administration***. The goal of this certificate is to provide the necessary technical expertise to those who are already in technology management positions but feel a gap in their knowledge or those who are considering such positions in the future and need solid technical/computer expertise. **Candidates for this certificate program must have a bachelors degree prior to enrolling in the program.**

Certificate in Technology For Administration
This certificate requires completion of the following 4 courses at IUSB. CSCI A505 - Object Oriented Programming (4 cr.) BUSB K506 - Web Site Development Techniques (3 cr.) CSCI A510 - Database Systems (3 cr.) CSCI A515 - Telecommunications and Computer Networks (4 cr.) Depending on prior academic experience, a student may be exempted from one of the above courses. In such cases, the student must consult the department chair to make an appropriate substitution.

In addition, the student may be required to take additional courses to satisfy possible deficiencies. Prospective students are encouraged to consult with the chair of the department for additional information.

MINOR IN COMPUTER SCIENCE

This requires a minimum of 23 credit hours of computer science consisting of seven courses, to include C101, C151, C201, C243, and three more courses in computer science offered by the department, above the level of C201.

MINOR IN COGNITIVE SCIENCE

This consists of at least 15 credit hours of courses chosen from the following:

Computer Science:	A201, C101, C201, C243, C251, C463
Mathematics:	M343, M344, M365, M447, M463, M466
Philosophy:	X100*, X200, X220*, X303, P250, P312, P313, P320, P360, P366, P383*
Psychology:	P325, P326, P329, P335, P390*, P423, P438, P443 P459, P495*
Cognitive Science:	P200(Phil), P383 (Phil), P390(Psy)

The Cognitive Science courses may be used in the cognitive science minor only when offered with the subtitle "Introduction to Cognitive Science". When so offered, the course content will be interdisciplinary, drawing from some or all of these areas: philosophy, psychology, computer science, linguistics, neuroscience, anthropology, and/or mathematics. The primary goal of the course is to survey cognitive science as a whole and to demonstrate both its unity and its eclectic nature. A seminar format will be used.

In addition, the following conditions must be met:

1. One of the Cognitive Science courses must be included in the program.
2. At least 3 credit hours from each of the areas of computer science, philosophy, and psychology must be included in the program. Students majoring in computer science must take an additional course in one of the other areas (none of the courses listed in Computer Science can count toward both a major and a minor).

A minor program in Cognitive Science requires approval by the Cognitive Science Committee. In particular, courses marked with an asterisk in the above list have greatly varying content, so their acceptability in a minor program will be determined by the committee. Credit cannot be earned for both C297 and C463 when the former is offered under the title "Introduction to Artificial Intelligence". Also, credit cannot be earned for both X355 and X410. Courses not listed above may be included with permission of the committee. Such courses are not restricted to the areas of computer science, psychology, and philosophy; they may also be appropriate courses from anthropology, linguistics, or neuroscience.

Consult the cognitive science web site for additional details:
http://www.iusb.edu/~cogsci/minor.html

BACHELOR OF SCIENCE IN INFORMATICS

The objective of this program is to address the needs of those students seeking a broad understanding of information technology, its social and psychological dimensions, and its application to specific disciplines. The major in Informatics will prepare students with tools to become skilled professionals. Students in this program are expected to acquire applied technical and analytical skills that can be applied to other disciplines, such as biology, chemistry, psychology, cognitive science, physics, library sciences and decision sciences.

The degree requires a total of **122** credit hours including the following:

Area 1 (English Composition)
W131, or equivalent.

Area 2 (Foreign Language)
Six credit hours in a single foreign language, or equivalent (e.g., 3 years of a single foreign language in high school with at least a C average).

Area 3 (Business / Foreign Language)
Completion of *one* of the following three options:

a) Five courses in Business and Economics, including Accounting A201, A202, and courses from at least two other departments in Business and Economics. K201 and E270 are excluded from the list of five courses. Economics courses fulfill this requirement and requirement 5a below simultaneously. Students who complete ECON E103, ECON E104, BUS A201, and BUS A202 may wish to consider BUS F301 Financial Management as a fifth course in this area.

b) Six credit hours at the second year level in a foreign language.

c) Six credit hours at the first year level in a second foreign language.

Area 4 (Arts and Humanities)
One course from each of the following three areas, plus a fourth course in any one area.

a) Fine Arts; Music M174; Communication Arts (except S160).

b) English (except W130, and W131); Foreign Languages (only advanced courses of a literary nature).

c) History, Philosophy, Religious Studies.

Area 5 (Social and Behavioral Sciences)
Four courses from the following areas, to include at most two in any one area.

a) Economics; Geography; Political Science.

b) Psychology.

c) Sociology/Anthropology; Linguistics.

Area 6 (Natural Sciences)
Thirteen credit hours in courses selected from chemistry, physics, geology, biology, and astronomy.

At least two disciplines must be selected. At least one of the courses must have a laboratory component.

Area 7 (Mathematics)
Six credits of mathematics including finite mathematics (e.g. M118), and statistics (e.g. K300).

Area 8 (Informatics)

Thirty-four credit hours in Informatics, to be satisfied with the following core and elective courses:

Core: I101, I201 or CSCI C251, I202 or SOC S260, I210 or CSCI C101, I211 or CSCI C201 and I308.

Two of the following four courses:

I300 Human-Computer Interaction
I303 Organizational Informatics
I310 Multimedia Arts and Technology
I320 Distributed Systems and Collaborative Computing

One of the following capstone options:

I450/I451 Design & Development of an Information System
or (CSCI C308/ CSCI C442)
OR
I460/461 Thesis / Senior Project

Electives: at least 6 credits chosen from Informatics electives (300 level or higher). Prerequisite courses may be required.

BIOL L311 Genetics (3 cr.)
BIOL LXXX Bioinformatics (3 cr.)
BUS K301 Enterprise Resource Planning (3)
BUS K321 Management Information Systems (3 cr.)
CHEM C371 Chemical Informatics I (3 cr.)
CSCI A340 Introduction to Web Programming (3)
CSCI C335 Computer Structures (3 cr.)
CSCI B424 Parallel and Distributed Programming (3 cr.)
CSCI C441 Information Org. and Retrieval (3 cr.)
CSCI C442 Database Systems (3 cr.)
CSCI C463 Artificial Intelligence (3 cr.)
CSCI B481 Interactive Computer Graphics (3 cr.)
CSCI B438 Computer Networks (3 cr.)
CSCI C455 Analysis of Algorithms (4 cr.)

Continued on next page...

ENGL WX Web-Based Instruction (3 cr.)
ENGL WX Web-Based Writing / Journal Editing (3 cr.)
FINA PXX Advanced Digital Production (3 cr.)
FINA P374 Computer Arts and Design II (3 cr.)
INFO I300 Human Computer Interaction (3 cr.)
INFO I303 Organizational Informatics (3 cr.)
INFO I310 Multimedia Arts and Technology (3 cr.)
INFO I320 Distrib. Sys & Collaborative Computing (3 cr.)
INFO I400 Topics in Informatics (3 cr.)
MATH M365 Probability and Statistics (3 cr.)
MATH MXXX Simulation (3 cr.)
PHIL P338 Philosophy of Technology (3 cr.)
PHIL PXXX Computer Ethics (3 cr.)
PHYS P303 Digital Electronics (4 cr.)
PHYS P334 Fundamentals of Optics (3 cr.)
PSY P335 Cognitive Psychology (3 cr.)
PSY P438 Language and Cognition (3 cr.)
SOC S319 Sociology of Science (3 cr.)
SOC XX Human Computer Interaction (3 cr.)
SOC S451 Web Based Survey Techniques (3 cr.)

Naturally, the selection of informatics electives will be expanded as additional cognate areas develop.

Area 9 (Informatics Cognates)

Fifteen to eighteen credits taken from cognate areas. Consult the Director of Informatics Program for the most up-to-date list of cognates.

NOTE: At least half of the credit hours for the Informatics major must be taken at IUSB.

A POSSIBLE PROGRAM FOR INFORMATICS MAJORS

	FALL	SPRING
1st. YEAR	I101 Intro. To Informatics (4) W131 Eng. Comp. (3) M118 Finite Math (3) Natural Sciences (3) Arts & Humanities (3)	W231 Prof. Writing (3) I201 Math. Foundations (4) Natural Sciences (5) Social & Behavioral Sci. (3)
2nd. YEAR	I202 Social Informatics (3) S121 Public Speaking (3) Social & Behavioral Sci. (3) Foreign Language (3) I210 Info. Infrastructure I (4)	Foreign Language (3) I211 Info. Infrastructure II (4) I303 Organizational Informatics (3) P140 Intro. to Ethics (3) K300 Statistics (3)
3rd. YEAR	I300 Human Computer Interaction (3) I310 Multimedia Arts and Technology (3) Cognate Area Course (3) Cognate Area Course (3) Foreign Language (3)	Informatics Elective (3) Cognate Area Course (3) Cognate Area Course (3) Foreign Language (3) I308 Information Representation (3)
4th. YEAR	I450 Design and Dev. of an Info. System (CSCI C308) (4) Cognate Area Course (3) Natural Sciences (5) Social & Behavioral Sci. (3)	I451 Design and Development of an Information System (CSCI C442) (3) General Electives (9) Social & Behavioral Sci. (3)

MINOR IN INFORMATICS

The minor in Informatics requires students to take three lower level Informatics courses and two upper level Informatics or upper level elective courses from the table below.

LOWER LEVEL

INFO I101 Introduction to Informatics (4 cr.)
INFO I202 Social Informatics (3 cr.)
INFO I210 Information Infrastructure I (4 cr.)
INFO I211 Information Infrastructure II (4 cr.)

UPPER LEVEL INFORMATICS COURSES

INFO I300 Human Computer Interaction (3 cr.)
INFO I303 Organization Informatics (3 cr.)
INFO I310 Multimedia Arts and Technology (3 cr.)
INFO I312 Information Representation (3 cr.) (Was I200)
INFO I320 Distributed Systems and Collaborative Computing (3 cr.)
INFO I400 Topics in Informatics (3 cr.)

UPPER LEVEL ELECTIVES

BUS K301 Enterprise Resource Planning (3)
BUS K321 Management Information Systems (3 cr.)
PHYS P281 Solid State Electronics I (3 cr.)
PHYS P303 Digital Electronics (4 cr.)
SOC S319 Sociology of Science (3 cr.)
SOC XXX Human Computer Interaction (3 cr.)
SOC S451 Web Based Survey Techniques (3 cr.)
CSCI A340 Introduction to Web Programming (3 cr.)
CSCI C335 Computer Structures (3 cr.)
CSCI B424 Parallel and Distributed Programming (3 cr.)
CSCI C442 Database Systems (3 cr.)
CSCI C463 Artificial Intelligence (3 cr.)
CSCI B481 Interactive Computer Graphics (3 cr.)
CSCI B438 Computer Networks (3 cr.)
PHIL P338 Philosophy of Technology (3 cr.)
PHIL PXXX Computer Ethics (3 cr.)
MATH M365 Probability and Statistics (3 cr.)
MATH MXXX Simulation
PSY P335 Cognitive Psychology (3 cr.)
BIOL L311 GENETICS (3 cr.)
BIOL LXXX Bioinformatics (3 cr.)
CHEM C371 Chemical Informatics I (3 cr.)
ARTS PXXX Advanced Digital Production (3 cr.)

ARTS P274, P374 Computer Arts and Design I and II (3, 3 cr.)
ENGL WXXX Web-Based Instruction (3 cr.)
ENGL WXXX Web-Based Writing / Journal Editing (3 cr.)

The courses offered as Informatics electives will vary over time. Many courses at the 300 level or above in computer and information sciences and decision sciences can count as an elective. The student should consult the Informatics program director for details.

A minimum grade of 2.0 (C) is required in all courses taken for the minor.

Consult the Informatics web site for additional details: http://www.informatics.iusb.edu

COMPLEMENTARY MAJOR IN COMPUTER SCIENCE

Students with majors in the Division of Arts may earn a Complementary Major in computer science. Students must complete at least 30 credit hours in computer science, to be satisfied with C101, C151, C201, C243 and other courses above the level of C201 approved by the Department of Computer and Information Sciences.

MASTER OF SCIENCE IN APPLIED MATHEMATICS AND COMPUTER SCIENCE

This graduate degree is offered jointly by the Department of Computer and Information Sciences and the Department of Mathematical Sciences at IUSB. The goal of this program is to address the needs of people who already have work experience in technical or quantitative fields, people with undergraduate degrees in science or business, or people who simply wish to increase their level of skills and expertise in computing and applied mathematics.

Students begin with a flexible core curriculum in both computer science and applied mathematics, then proceed to specialize in their desired field. We anticipate that students with the proper background can complete the 36 credit program in two years. Students will be able to tailor a program to their needs with the help of an advisor. The emphasis throughout the curriculum will be on the real-world problems and applications likely to be encountered in business and industry.

ADMISSION REQUIREMENT

Candidates for admission to the program are required to hold a baccalaureate degree from an accredited institution with a minimum GPA of 3.0 and promising application materials. An applicant whose past academic record is not sufficiently strong (low GPA, undergraduate degree completed too long ago and work experience not in the field) may qualify for admission by scoring 600 or higher on at least one GRE (Graduate Record Examination). Although no specific undergraduate field of study is required, students with satisfactory competence in undergraduate study of basic computer and mathematics subjects will be encouraged to apply. Generally, these will be graduates with undergraduate degrees in mathematics, computer science, chemistry, physics, biological sciences, engineering, secondary mathematics education, business, economics, and other technical fields. Students who do not have appropriate background in computer science and/or in mathematics are also welcome, and they will be allowed to take the necessary pre-requisite

course work. In addition to the above, applicants whose native language is not English should submit proof of such proficiency (TOEFL) by the time they apply for admission. A minimum TOEFL score of 550 is required.

DEGREE REQUIREMENT

The program will be tailored to individual student needs, and will consist of 36 credit hours, including 30-33 hours of course work and 3-6 hours of a thesis or graduate project. A student will choose to specialize either in computer science or in applied mathematics. The core courses for each of those disciplines are as follows.

- *Computer Science Core:* Algorithm Design and Analysis, Networks and Distributed Computing, Advanced Database Concepts, Advanced Computer Graphics.
- *Applied Mathematics Core:* Statistical Design of Experiments, Analysis of Numerical Methods, Forecasting, Simulation Modeling.

A student is also required to take at least 3 courses in the complementary discipline. A student choosing to specialize in Applied Mathematics will take all four courses listed in the Applied Mathematics core in Table A, and at least three Computer Science courses: B503 (Algorithms Design and Analysis) and 2 or more Computer Science courses from tables B or C. Similarly, a student choosing to specialize in Computer Science will take all four courses listed in the Computer Science core in Table A, and at least three Applied Mathematics courses: M575 (Simulation Modeling) and 2 or more Applied Mathematics courses from tables B or C.

Students from both disciplines will be encouraged to take courses bridging the two disciplines (e.g. M562 - Statistical Design of Experiments and B581 - Advanced Computer Graphics). Students requiring additional background will be allowed to take up to 9 hours of undergraduate 400 level course work, in fulfillment of their credit requirements for the degree. Both full-time and part-time study will be possible.

THESIS

Students will be required to complete a thesis or project. The project should involve a substantial level and amount of work which reflect what a student learned in coursework. The project should have applications to industry or business, and it should have strong academic merit. In preparation for the project, a student should identify to the program's graduate studies director a project committee. The committee will consist of a faculty member in the student's discipline to serve as project advisor, a faculty member in the other discipline, and a third person who may be faculty from within or outside of the department, or who may be an appropriate individual in business or industry. The student should submit a project proposal to the committee for approval. The project itself should be reported in a thesis format, and defended before the committee. Copies of the final version of the thesis will be archived in the department and library. Note that there will be no comprehensive exams; in particular, a student finishes the program by finishing a project.

COURSES OFFERED FOR GRADUATE CREDIT

Students must first choose a concentration in either Computer Science or Applied Mathematics. The core courses for each concentration are shown in Table A.

Table A - Core Requirements	
For students specializing in Computer Science	For students specializing in Mathematics
B503 - Algorithms Design and Analysis B538 - Networks and Distributed Computing B561 - Advanced Database Concepts B581 - Advanced Computer Graphics	M562 - Statistical Design of Experiments M571 - Analysis of Numerical Methods M576 - Forecasting M575 - Simulation Modeling

In addition to the core, students will be allowed to take at most 3 courses from the following list (Table - B) to prepare for advanced level courses.

	Table B - Preparatory Courses
Computer Science	C421 - Computer Organization B424 - Parallel and Distributed Programming C431 - Assemblers and Compilers I C435 - Operating Systems I B438 - Computer Networks C441 - Information Organization and Retrieval C442 - Database Systems C455 - Analysis of Algorithms C463 - Artificial Intelligence B481 - Interactive Computer Graphics C490 - Seminar in Computer Science
Mathematics	M471 - Numerical Analysis I M472 - Numerical Analysis II M447 - Mathematical Modeling I M448 - Mathematical Modeling II M451 - The Mathematics of Finance

ADVANCED COURSES

Students will be required to select their advanced courses from Table C below according to their needs and interests.

	Table C - Advanced Courses
	Course Titles
Computer Science	B503 - Algorithms Design and Analysis P536 - Advanced Operating Systems B538 - Networks and Distributed Computing B524 - Parallel and Distributed Programming B541 - Hardware System Design I B551 - Elements of Artificial Intelligence B553 - Biomorphic Computing (3 cr.) B561 - Advanced Database Concepts B565 - Software Engineering I B581 - Advanced Computer Graphics B582 - Image Synthesis B651 - Natural Language Processing B661 - Database Theory and Systems Design B665 - Software Engineering Management Y790 - Graduate Independent Study - Thesis
Mathematics	M546 - Control Theory M562 - Statistical Design of Experiments M569 - Statistical Decision Theory M571-572 - Analysis of Numerical Methods I,II M577 - Operations Research M5xx - Transform Methods M575 - Simulation Modeling M576 - Forecasting M5xx - Sampling

SAMPLE CURRICULUM FOR MS IN APPLIED MATH AND CS

Although some students will need prerequisite courses, the following two tables represent a typical two year schedule for a student specializing in computer science or mathematics.

Table D - For a student specializing in Computer Science	
1st. Year	2nd. Year
Fall M471 - Numerical Methods (3) B565 - Software Engineering I (3) B503 - Algorithms Design & Analysis (3)	Fall B581 - Advanced Computer Graphics (3) B551 - Elem. of Artificial Intelligence (3) M575 - Simulation Modeling (3)
Spring B561 - Advanced Database Concepts (3) B538 - Networks & Distrib. Comp. (3) M562 - Statistical Design of Exper (3)	Spring B661 - Database Theory & Design (3) B582 - Image Synthesis (3) Y790 - Grad. Indep. Study/Thesis (3)

For more information about application procedures, course offering, and other requirements please consult the web site:
http://www.cs.iusb.edu/applied_mcs.html

MASTER OF SCIENCE IN MANAGEMENT OF INFORMATION TECHNOLOGIES

This graduate degree is given by the Division of Business and Economics. It requires between 21 and 63 credit hours, depending on the undergraduate background of the student entering the degree program. Highly qualified students may apply for exemption for various courses listed below. For students with no background in business or computer science, the curriculum is as follows:

Phase 1: Mathematics and Statistics Core (2 courses)

Statistical Applications
Mathematics Tools in Business

Phase 2: Basic Business Core (9 courses)

Survey of Financial Accounting & Reporting
Management Information Systems
Survey of Economics
Organizational Behavior
Legal/Ethical Environment of Business
Management of Marketing
Financial Management
Production Management
Managerial Decision-Making Models

Phase 3: Basic Applied Computing Core (4 courses, to include the first three of the following)

Object Oriented Programming
Database Management Systems
Telecommunications and Computer Networking
Web Site Development Techniques
Enterprise Resource Planning

Phase 4: Advanced Business Core (4 courses)

Management of IT Projects
Decision Support Systems
Electronic Commerce
Business Process Re-engineering Using IT

Phase 5: Capstone Project Core (2 courses)

Seminar in Management of Information Technologies I
Seminar in Management of Information Technologies II

Admission into the program requires a bachelor's degree from an accredited college or university, a satisfactory score on the GMAT exam, satisfactory undergraduate academic performance, and letters of recommendation. Experience in the workplace is strongly recommended.

Students interested in this degree program should contact the Division of Business and Economics or the IUSB Office of Graduate Programs.

COURSE DESCRIPTIONS

UNDERGRADUATE NON-MAJOR COURSES

A106 Introduction to Computing (3 cr.)
Fundamentals of computer hardware and software; use of packaged programs in areas such as word processing, spreadsheets, database management, communications, graphics; the role and impact of computers in society. Course is designed for people with little or no computer experience. One class per week is spent in the microcomputer teaching laboratory. *This course is not intended for computer science majors*.

A107 Advanced Microcomputing (4 cr.)
P: A106 or equivalent. This course is designed to increase students' ability to perform tasks using the personal computer. Advanced study and use of the Microsoft Office productivity suite (Word, Excel, Access, PowerPoint) will be one focus of the course with an emphasis on database systems. We will also show how the Office capabilities can be enhanced through the use of programming. The course will also take a look at the design, construction and publishing of web pages. Furthermore, various topics in computing, networking, and the use of personal computers will be covered. *This course is not intended for computer science majors*.

A150 Introduction to Operating Systems (1 cr.)
UNDER CONSTRUCTION
P: A106 or equivalent. Study of the basic concepts of operating systems, understanding the role of operating systems in providing a virtual machine interface. Understanding the relationship between the hardware and operating system. Survey of the user level operating system facilities and commands. *This course is not intended for computer science majors*.

A201 - Introduction to Programming I (VISUAL BASIC) (4 cr.)
R: M014, A106. Fundamental programming constructs, including

loops, arrays, classes, and files. General problem-solving techniques. Emphasis on modular programming, user-interface design, and developing good programming style. *This course is not intended for computer science majors*.

A338 Network Technologies and Administration (3 cr.)
UNDER CONSTRUCTION
P: A106, A150. Introduction to network principles and current network technology, both hardware and software. Network administration tools and techniques. Laboratory provides practical experience. *This course is not intended for computer science majors*.

A340 Introduction to Web Programming (3 cr.)
P: A201 or C101. An introduction to programming web documents, including HTML, JavaScript and Perl. Creation of a simple web site, including a home page with dynamic elements, using both client-side and server-side techniques. *This course is not intended for computer science majors.*

UNDERGRADUATE CS-MAJOR COURSES

C101 Computer Programming I (C++) (4 cr.)
P: M014 or equivalent. Fundamental concepts of algorithm development, modularity and program design, computer programming. The programming language used will be C++. [An exemption exam is available to students who already have some knowledge of C++.]

C151 Multiuser Operating Systems (2 cr.)
P: C101. Survey of the operating system facilities and commands. Installation and maintenance of operating systems such as Linux. Understanding process management, file systems, memory and virtual memory management issues. Understanding networking and its role in modern computing environment. Operating system security. Writing shell scripts and batch files.

C201 Computer Programming II (C++) (4 cr.)
P: C101. Fundamental concepts of computer science, including top-down design, data structures, structured control flow, modular programming, recursion and standard algorithms. Programming language concepts are illustrated with C++.

C243 Introduction to Data Structures (4 cr.)
P: C201, C151. Abstract data types; implementations using various data structures and algorithms; elementary algorithm analysis; space/time trade-offs; sorting and searching; finite graph algorithms; object oriented design and programming; software engineering principles.

C251 Foundations of Digital Computing (3 cr.)
P: C243; M208 or M215. Mathematical foundations of computing, including mathematical induction, propositional logic, proofs of correctness, turing machines, computability, and the halting problem.

C297 Sophomore Topics in Computer Science (2-3 crs.)
Contents and prerequisites vary from year to year. (This course may count towards a minor or Associate of Science, but not a bachelor's degree.)

C308 System Analysis and Design (4 cr.)
P: C243. The software development life cycle structured top-down and bottom-down design; data flow diagraming; entity relationship modeling; study of computer aided software engineering; I/O design and validation; file and database design; design of user interfaces; comparison of structured vs. object oriented design. A team project will be completed.

C311 Organization of Programming Languages (3 cr.)
(Scheduled to change from 4 to 3 credits Fall 2004)
P: C243 and C335. Design and implementation of programming languages: syntax; semantics; comparison of programming paradigms such as imperative, functional, logic, and object oriented. Implementation of concepts such as binding, scope, parameter passing, looping, branching, subprograms, tasks and concurrency, heap management, exception handling, templates, inheritance, overloading.

C335 Computer Structures (4 cr.)
P: C201. Computer architecture and machine language; internal data representation; assembly systems; program segmentation and linking; I/O devices; serial communication. Projects to illustrate basic machine structure and programming techniques.

Y398 Internship - Professional Practice (3 cr.)
P: C308, C335, and one additional course in computer science above the level of C243. Enrollment requires that the student be accepted as a temporary employee of an organization or business. The work must offer the student challenging computer experience in a closely supervised position. The student will report weekly to the faculty member in charge. Prior approval of the position is required. The

course can be taken twice for a total of 6 credits, but only 3 credits can be used to satisfy the requirements for computing electives.

C421 Computer Organization (3 cr.)
P: Physics P302 or P303, C243, C335. Principles of logic design; addressing; central processing units; microprogrammed versus hardwired control; input-output organization, interrupts; other topics chosen by the instructor.

B424 Parallel and Distributed Programming (3 cr.)
P: C243, M301. Overview of parallel computers, shared memory, message passing, MIMD and SIMD classifications. Understanding and use of message passing and synchronization facilities such as MPI. Study of parallel programming models such as master-slave, client-server, tast-farming, divide-and-conquer and pipelining. Performance analysis of parallel systems, execution time, time complexity, load balancing and scalability. (Credit not given for both B424 and B524)

C431 Assemblers and Compilers I (3 cr.)
P: C311. Analysis and implementation of a compiler for a high level programming language. Relationship between regular languages, finite automata, lexical analysis, and scanner generators such as lex. Relationship between context-free grammars, stack machines, parsers, and parser generators such as yacc and llgen. Symbol tables and semantic analysis for translating declarations, expressions, assignments, I/O, control structures, and subroutines. Large programming project.

C435 Operating Systems I (4 cr.)
P: C251, C308, and C335. R: C311. Design and implementation of operating systems: the process model, process synchronization, semaphores, deadlock management, multi-tasking, multi-threading, interprocess communication, process scheduling, memory management, paging, segmentation, virtual memory management, file system design and implementation, I/O device drivers, interrupt

handlers and spoolers. Students will complete the design and implementation of a simulated multi-tasking operating system.

B438 Computer Networks (3 cr.)
P: C243 and C335. Fundamental concepts and technologies used in design of computer networks. Architecture and design philosophy of Internet and basic performance issues. Low-level technologies like Ethernet and wireless. Packet switching and virtual circuits. Core protocols of the Internet, such as TCP and IP. Error control, congestion control, and routing.

C441 Information Organization & Retrieval (3 cr.)
P: C243. Fundamental structures and algorithms for the management of secondary storage devices: persistence; sharability; file and database organization; fields; records; transactions; hardware concepts of storage devices; sequential, random, indexed, hashed, and B-tree files; operations on files; search; sort; performance issues.

C442 Database Systems (3 cr.)
P: C308. The fundamental concepts, theory, and practices in the design and implementation of database management systems: data independence; data modeling; entity relationship modeling; functional dependencies; normalization; relational, hierarchical, network, and object oriented data models; relational algebra; relational calculus; data definition and manipulation languages; recovery; concurrency; security; integrity of data.

C455 Analysis of Algorithms (3 cr.)
(Scheduled to change to from 4 to 3 credits as of Spring 2005)
P: C251, M209 or M216. R: M301. Mathematical analysis of time and space requirements for algorithms, using combinatorics, recurrence relations, and elementary probability theory. Advanced graph algorithms. Tractable and intractable problems.

C463 Artificial Intelligence (3 cr.)
P: C251. R: C311. Techniques and principles of artificial intelligence and implementations of some of these techniques.

Various formalisms for representing knowledge, and relationships of this to such tasks as inference, game playing, and machine learning.

C481 Interactive Computer Graphics (3 cr.)
P: C243, Math M301. An introduction to interactive programming: design and implementation of graphical user interfaces (GUI). Fundamentals of modern interactive graphics: hardware, software, data structures, mathematical manipulation of graphical objects, algorithms for two- and three-dimensional graphics. No prior background in graphics is needed, although a good background in C++ programming and data structures is required. Some familiarity with computer architecture is assumed.

C490 Seminar in Computer Science (l-3 cr.)
P: Varies. Special topics in computer science.

P = Prerequisite
R = Recommended
C = Co-requisite

UNDERGRADUATE INFORMATICS COURSES

I101 Introduction to Informatics (4 cr.)
P: Computer literacy. Emphasis on topics in human-computer interaction and human factors, collaborative technologies and group problem solving, ethics, privacy, and ownership of information and information sources, information representation and the information life cycle, the transformation of data to information, futuristic thinking.

I201 Mathematical Foundations of Informatics (4 cr.)
P: MATH M118. R: INFO I101. An introduction to the suite of mathematical and logical tools used in information sciences, including finite mathematics, automata and computability theory, elementary probability, and statistics and basics of classical information theory. Credit given for either INFO I201 or CSCI C251. (CSCI C251 requires Calculus 1 as a prerequisite)

I202 Social Informatics (3 cr.)
P: INFO I101. Introduces the social and behavioral foundations of informatics. Theoretical approaches to how technology is used from psychological and sociotechnical perspectives. Examples of how current and emerging technologies such as games, e-mail, and electronic commerce are affecting daily lives, social relations, work, and leisure time.

I210 Information Infrastructure I (4 cr.)
P: MATH M014. Recommended prerequisite or concurrent: INFO I101. The software architecture of information systems. Basic concepts of systems and applications programming. Cross listed with CSCI C101. Credit given for only one of the following: INFO I210, CSCI N331 (IUPUI) or CSCI A201, CSCI C211 (IUB) or CSCI C101 (IUSB).

I211 Information Infrastructure II (4 cr.)
P: INFO I210. The systems architecture of distributed applications. Advanced programming, including an introduction to the programming of graphical systems. Cross listed with CSCI C201. Credit given for only one of the following: INFO I211, CSCI N345 (IUPUI), CSCI A202, CSCI C212 (IUB) or CSCI C201 (IUSB).

I300 Human Computer Interaction (3 cr.)
P: INFO I211. The analysis of human factors and the design of computer application interfaces. A survey of current best practice with an eye towards what future technologies will allow.

I303 Organizational Informatics (3 cr.)
P: INFO I101. Examines the various needs, uses, and consequences of information in organizational contexts. Topics include organizational types and characteristics, functional areas and business processes, information-based products and services, the use of and redefining role of information technology, the changing character of work life and organizational practices, socio-technical structures and the rise and transformation of information-based industries. Credit given for either INFO I303 and SPEA V369.

I308 Information Representation (3 cr.)
P: Knowledge of a programming language as can be obtained from INFO I210, or similar courses. Recommended prerequisite or concurrent: INFO I201. The basic structure of information representation in social and scientific applications. Representational structures and approaches from many disciplines are introduced: philosophical theories of classification and categorization; information access and representation on the World Wide Web; object-oriented design and relational databases; AI knowledge representation and discovery.

I310 Multimedia Arts and Technology (3 cr.)
P: INFO I308. The study of the evolution of media arts and underlying principles of communication. Application development

paradigms in current practice. Cross listed with CSCI N351 (IUPUI).

I320 Distributed Systems and Collaborative Computing (3 cr.)
P: INFO I211. An introductory treatment of the distributed systems and programming. Topics range from the distributed and object models of computation to advanced concepts, such as remote method invocations, object brokers, object services, open systems, and future trends for distributed information systems.

I400 Topics in Informatics (1-3 cr.)
P: At least junior standing or permission of instructor. Variable topic. Emphasis is on new developments and research in informatics. Can be repeated twice for credit when topics vary, subject to approval of the informatics director.

I420 Internship in Informatics Professional Practice (3-6 cr.)
P: Approval of informatics director and completion of 100 and 200 level requirements in informatics. Students gain professional work experience in an industry or research organization setting, using skills and knowledge acquired in informatics course work.

I450/I451 Design and Development of an Information System (3/3 cr.)
P: Senior standing and approval of the informatics director. System design and development present both technical and managerial problems with which students will be familiar from their undergraduate course work. This course puts these lessons into practice, as students work in teams to develop an information system. Examples of course projects include design and development of a database for a business or academic application, preparation and presentation of an interactive media performance or exhibit, or design and implementation of a simulated environment (virtual reality). I450 is Cross listed with CSCI C308. Credit given for only one of the following: INFO I450, CSCI C308 (IUSB). I451 is Cross listed with CSCI C442. Credit given for only one of the following: INFO I451, CSCI C442 (IUSB).

I460/461 Senior Thesis (3/3 cr.)
P: Senior standing and approval of the informatics director. The senior student prepares and presents a thesis: a substantial, typically multi-chapter paper based on a well-planned research or scholarly project, as determined by the student and a sponsoring faculty member.

I499 Readings and Research in Informatics (1-3 cr.)
P: Consent of instructor and completion of 100 and 200 level requirements in informatics. Independent readings and research related to a topic of special interest to the student. Written report required.

P = Prerequisite
R = Recommended
C = Co-requisite

GRADUATE MS-MIT COURSES

A505 Object Oriented Programming (4 cr.)
Fundamental concepts of software engineering, algorithm development, computer programming, objects, and data structuring. Emphasis on understanding how software is developed, writing small programs and learning to read code with understanding. Will include a weekly closed laboratory session for most of the course.

BUSB K506 Web Site Development Techniques (3 cr.)
P: CSCI A505. The course provides students with knowledge and skills in the development of web site to support electronic commerce. The emphasis in the course is on effective design and implementation issues related to web applications for business. . (This course is offered by the School of B&E)

A510 Database Management Systems (3 cr.)
P: A505. Fundamental concepts and practices in design and implementation of database management systems. Topics include data modeling, functional dependencies, normalization, relational, hierarchical, network and object oriented data models, relational algebra, relational calculus, data definition and manipulation languages, SQL, recovery, concurrency, security, distribution and integrity of data.

A515 Telecommunications and Computer Networks (4 cr.)
P: A505. Fundamental concepts and technologies used in design of computer networks and the Internet. The architecture of the Internet and performance issues. Low-level technologies ranging from Ethernet to wireless will be compared. Packet switching and virtual circuits. Core protocols of the Internet: TCP (Transport Control Protocol) and IP (Internet Protocol). Ongoing and future changes in the Internet.

MS-AM/CS COURSES

A504 - Introductory C++ Programming (2 cr.)
P: Programming Experience. Topics include aspects of C++ that are not object-oriented, basic data structures, standard libraries, and Unix tools for project management. (Does not count as computer science credit for CS majors)

A506 - Object-Oriented Programming in C++ (2 cr.)
C: A504. Topics include objects, classes, encapsulation, inheritance, polymorphism, templates and exceptions. (Does not count as computer science credit for CS majors)

A593 Computer Structures (3 cr.)
P: C201 or A504, A506. Computer architecture and machine language; internal data representation; symbolic coding and assembly systems; macros; program segmentation and linking; I/O devices; serial communication. Projects to illustrate basic machine structure and programming techniques. Credit not given for both A594 and C335. Undergraduate CS majors should take C335.

A594 Data Structures (3 cr.)
P: C201 or C504, C506. Abstract data types and their implementations using various data structures and algorithms; advanced features of C++; elementary algorithm analysis; space/time trade-offs; sorting and searching; introduction to object oriented design and programming; software engineering principles. Credit not given for both A594 and C243. Undergraduate CS majors should take C243.

B503 Algorithms Design and Analysis (3 cr.)
P: C251, M209 or M216. R: M301. Models, algorithms, recurrences, summations, growth rates. Probabilistic tools, upper and lower bounds; worst-case and average-case analysis, amortized analysis, dynamization. Comparison-based algorithms: search,

selection, sorting, hashing. Information extraction algorithms (graphs, databases). Graphs algorithms: spanning trees, shortest paths, connectivity, depth-first search, breadth-first search. (Credit not given for both C455 and B503)

B524 Parallel and Distributed Programming (3 cr.)
P: C243, M301. Overview of parallel computers, shared memory, message passing, MIMD and SIMD classifications. Understanding and use of message passing and synchronization facilities such as MPI. Study of parallel programming models such as master-slave, client-server, tast-farming, divide-and-conquer and pipelining. Performance analysis of parallel systems, execution time, time complexity, load balancing and scalability. (Credit not given for both B424 and B524)

P536 Advanced Operating Systems (3 cr.)
P: C435. Advanced topics in operating systems, such as: multi-tasking, synchronization mechanisms, distributed system architecture, client-server models, distributed mutual exclusion and concurrency control, agreement protocols, load balancing, failure recovery, fault tolerance, cryptography, multiprocessor operating systems.

B538 Networks and Distributed Computing (3 cr.)
Advanced concepts and technologies of computer networks. Protocols and protocol stacks. Client-server models. Distributed object technology. High-performance and high-bandwidth techniques. Distributed operating systems.

B541 Hardware System Design I (3 cr.)
Structured approach to hardware design, emphasizing hardwired and microprogrammed control. Boolean algebra, hardware building blocks, architecture and control, implementation issues. In the laboratory, students build a working computer using hardware prototyping technologies. Basic training in the use of design and simulation software. Lecture and laboratory. Credit not given for both

B541 and C421.

B551 Elements of Artificial Intelligence (3 cr.)
Introduction to major issues and approaches in artificial intelligence. Principles of reactive, goal-based, and utility-based agents. Problem-solving and search. Knowledge representation and design of representational vocabularies. Inference and theorem proving, reasoning under uncertainty, and planning. Overview of machine learning.

B553 Biomorphic Computing (3 cr.)
Biologically-inspired approaches to the design of intelligent systems. Distributed and perceptually-grounded representations. Temporal processing. Neural-network approaches to vision and natural language processing. Evolutionary computation. Additional topics may include an introduction to analogy computing, dynamical systems, and artificial life.

B561 Advanced Database Concepts (3 cr.)
P: C442. Database models and systems: specially relational and object-oriented; relational database design theory; structures for efficient data access; query languages and processing; database applications development; views. Transaction management: concurrency and recovery.

P565 Software Engineering I (3 cr.)
P: C308. Analysis, design and implementation of software systems. Requirements specification: data and process modeling. Software design methodologies. Software quality assurance: testing and verification. Software development processes.

B581 Advanced Computer Graphics (3 cr.)
P: B481. Introduction to graphics hardware and software. Two-dimensional graphics methods, transformations, and interactive methods. Three-dimensional graphics, transformations, viewing geometry, object modeling and interactive manipulation methods.

Basic lighting and shading. Video and animation methods. A selection of topics from contemporary computer graphics incorporating and extending the material in C481, such as advanced rendering, procedural modeling, and data visualization.

B582 Image Synthesis (3 cr.)
P: B581. Raster image display: color theory, gamma correction, and filtering. Advanced shading methods: local illumination models, global illumination models. Surface display, including ray tracing and Z-buffering. Solid modeling; spline surfaces, CSG, superquadrics, and deformations. Scientific visualization: isosurfaces and volume rendering.

B651 Natural Language Processing (3 cr.)
Theory and methods for natural language processing. Algorithms for sentence parsing and generation. Context-free and unification grammars. Question-and-answer systems. Analysis of narratives. Finite-state approaches to computational phonology and morphology. Machine translation. Machine learning of natural language. Speech recognition. Neural-network and statistical alternatives to symbolic approaches.

B657 Computer Vision (3 cr.)
UNDER CONSTRUCTION
P: C463 or B551. Concepts and methods of machine vision as branch of artificial intelligence. Basics of digital image processing. Local and global tools for deriving information from images data. Model-base object recognition and scene understanding.

B661 Database Theory and Systems Design (3 cr.)
P: B561. Database models: relational, deductive, complex-object, object-oriented. Query languages: relational algebra and calculus, datalog, fixpoint logics, object-oriented query languages. Transaction management theory: concurrency control, recovery, distribution. Post-relational and object-oriented database systems.

Y790 Graduate Independent Study (1-6 cr.)
Independent study under the direction of a faculty member, culminating in a written report. May be repeated for credit. R grade not allowed. The different departmental options for independent study are: Research and Reading, Software System Development, Master's Research Project, Master's Software Project, and a University Master's Thesis.

Courses Offered for Graduate Credit In Mathematics
Consult with the department of Mathematical Sciences for the most up-to-date version.

Preparatory Courses

M447-M448 Mathematical Models and Applications I-II (3 - 3)
P: M301 (Applied Linear Algebra);
Formation and study of mathematical models used in the biological, social, and management sciences. Mathematical topics include linear programming, games, graphs, Markov, and Poisson processes, mathematical programming, queues, and equations of growth. Suitable for secondary school teachers.

M471-M472 Numerical Analysis I-II (3 - 3)
P: (for M471) M301 (Linear Algebra), M311 (Calculus III), C201.
P: (for M472) M471 and M343 (Intro. to Differential Equations with Applications I);
Numerical solutions of nonlinear equations; interpolation, including finite difference and splines; approximation, using various Hilbert spaces; numerical differentiation and integration; direct methods for linear systems; iterative techniques in matrix algebra. Numerical solutions of nonlinear systems; solution of ordinary differential equations: initial-value problems, boundary-value problems; computation of eigenvalues and eigenvectors; introduction of numerical solutions for partial differential equations.

Advanced Courses

M546 Control Theory (3 cr.)
Examples of control problems; control and observability of discrete and continuous systems; optimal control, the maximum principle; state-space and frequency domain approaches; stochastic control.

M562 Statistical Design of Experiments (3 cr.)
Fundamentals, completely randomized design, randomized complete blocks. Latin squares, multi-classification, factorial, nested factorial, incomplete blocks, fractional replications, confounding, general mixed factorial, split-plot and optimum design. Use of existing statistical computing packages.

M569 Statistical Decision Theory (3 cr.)
Foundation of statistical analysis, Bayesian and decision theoretic formulation of problems; construction of utility functions and quantifications of prior information; methods of Bayesian decision and inference, with applications; empirical Bayes; combination of evidence; game theory and minimax rules, Bayesian design and sequential analysis. Comparison of statistical paradigms.

M571-M572 Analysis of Numerical Methods I,II (3 cr.)
Solution of systems of linear equations, elimination and iterative methods, error analyses, eigenvalue problems; numerical methods for integral equations and ordinary differential equations; finite difference, finite element, and Galerkin methods for partial differential equations; stability of methods.

M5xx Sampling (3 cr.)
Survey designs, simple random, stratified, and systematic samples, systems of sampling, methods of estimation, ratio and regression estimates, costs. Other topics as time permits.

M5xx Transform Methods (3 cr.)
Basic transform methods in problem solving; Laplace transforms,

Fourier transforms, other integral transforms, inversion of transforms; introduction to wavelets and their applications.

M575 Simulation Modeling (3 cr.)
Basic simulation modeling, discrete, continuous, and mixed simulation, Monte Carlo simulation.

M576 Forecasting (3 cr.)
Forecasting systems, regression models, stochastic forecasting, time series, smoothing approach to prediction, model selection, seasonal adjustment.

M577 Operations Research (3 cr.)
Introduction to the methods of operations research. Linear programming, dynamic programming, integer programming, network problems, queuing theory, scheduling.

SCHEDULING OF COURSES

To help students make long-range curriculum plans, the Department attempts to offer courses in predictable fashion. Courses are offered both in the daytime and in the evenings (5:30 p.m. or later). A course that is offered in the evening in one term will normally be offered during the day in the next term in which it is scheduled, and conversely. If a course has more than one section in a given term, both daytime and evening sections are almost always scheduled. The following tables may be useful in predicting future core course offerings.

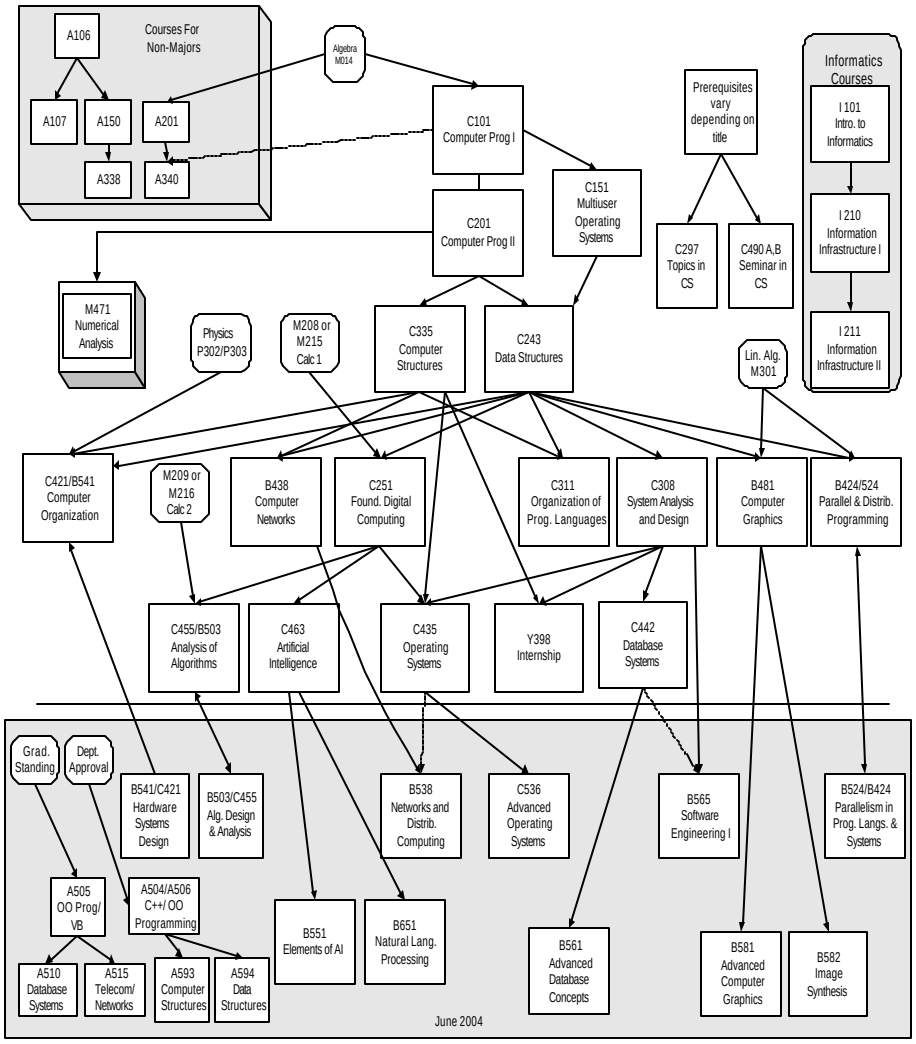
CORE COMPUTER SCIENCE COURSES

Course Number	Usual Semesters Offered
C101	Fa, Sp*
C151	Fa, Sp*
C201	Fa, Sp*
C243	Fa, Sp
C251	Fa
C308	Sp
C311	Fa
C335	Fa, Sp
C435	Sp
C455	Sp

* = multisectioned Fall and Spring,
Sp = Spring, Fa = Fall

For elective courses please consult the departmental web site at www.cs.iusb.edu

PREREQUISITE HIERARCHY CHART



APPENDIX - A
THE MATHEMATICS PLACEMENT EXAM

Students who have not taken an IUSB mathematics course must take the placement exam before registering for computer science courses, (exception is computer science A106). This exam is designed to help IUSB students determine the level at which they should begin their mathematics studies. Contact the Academic Resource Center for testing.

Students from other IU campuses will be required to take the IUSB math placement exam if they have not satisfied the IUSB prerequisites for a particular course even though they may have met the prerequisites for the course at another IU campus. For example, M014 is the prerequisite for M119 at I.U. Bloomington, but M014 does not fulfill the prerequisite requirements for this course at IUSB. Students having mathematics credits from another college may obtain a placement examination waiver from the Chairman of the Department of Mathematical Sciences, if it can be determined that the transferred credits satisfy the stated IUSB prerequisites for a given course.

The placement exam consists of five parts:

Part A: Arithmetic
Part B: Algebra I
Part C: Algebra II
Part D: Algebra II
Part E: Algebra II and Trigonometry

The test will place you at one of the following levels:

Level	Course(s) you are eligible to enroll in
Level I	M004 Introduction to Algebra.
Level II	M014 Basic Algebra.
Level III	C101, M107 College Algebra.
Level IV	M115, M125.
Level V	Ml26. Students at this level can move to level VI by completing M126 or M115.
Level VI	Students at this level have a solid mathematics background and can enroll in M208 or M215.

APPENDIX - B
REMEDIAL MATHEMATICS COURSES

M004 Introduction to Algebra (3cr.)
P: Level I on the mathematics placement examination. Designed for remediation of advanced arithmetic and beginning algebra skills. Arithmetic of fractions and signed numbers. Beginning equations in one variable. S/F grading. Credit may not be used toward a degree.

M014 Basic Algebra (4 cr.)
P: M004, or level II on the mathematics placement examination. Designed to provide algebraic skills needed for future mathematics courses. Algebraic fractions, exponents, linear equations, quadratic equations, inequalities, factoring, elementary graphs. S/F grading. Credit may not be used toward a degree.

NOTE:

Remedial courses are counted when computing a student's credit hour load in any semester, but they do not count toward graduation in any curriculum at Indiana University.

APPENDIX - C
PREREQUISITE COURSES IN MATHEMATICS

Computer science students who have not taken adequate mathematics courses in high school may need to enroll in the following courses prior to enrolling in Calculus I.

M107 College Algebra (3cr.)
P: M014, or level III on the mathematics placement examination.

Mll5 Pre-Calculus and Trigonometry (5 cr.)
P: Ml07 or equivalent or level IV on the mathematics placement examination. Designed to prepare students for higher numbered mathematics and computer science courses, including calculus (M208 or M215).Graphing equations in two variables; functions and their graphs; linear, quadratic, polynomial, and rational functions; exponential and logarithmic functions; trigonometric and inverse trigonometric functions. Equivalent to Ml25/Ml26. Credit not given for both Mll5 and Ml25/Ml26.

Ml25 Pre-Calculus Mathematics (3 cr.)
P: M107 or equivalent or level IV on the mathematics placement examination. Designed to prepare students for higher numbered mathematics and computer science courses including calculus (M119) Graphing equations in two variables; functions and their graphs; linear, quadratic, polynomial, and rational functions; exponential and logarithmic functions.

Ml26 Trigonometric Functions (2 cr.)
P: Ml25 or equivalent or level V on the mathematics placement examination. Designed to develop the properties of the trigonometric and inverse trigonometric functions and to prepare for a course in calculus (M215).

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