



**DEPARTMENT OF
COMPUTER AND
INFORMATION SCIENCE**

SCHOOL OF SCIENCE

**Indiana University-Purdue University
Indianapolis**

11/15/2016

IUPUI Graduate Affairs Committee:

The faculty in the Department of Computer & Information Science would like to request a minor change to our existing MS degree program in Computer Science. This request is being made to allow faculty advisors and students greater flexibility in course enrollment and completion of the student's plan of study. We want to ensure students stay on track towards timely degree completion. In some semesters, students have encountered delays in their progression and degree completion when a course approved within the major area is not offered. While infrequent, this lack of course availability is disruptive to students. The change requested will allow faculty mentors and the student's committee members to propose alternate courses which fit the student's academic program plan when a required course is not offered. This option will only be used sparingly in cases where it is not possible for students to enroll in the approved courses for the program. This proposed change in the program was reviewed and approved by the faculty in the department and faculty in the School of Science. We are asking that this change be approved by the GAC so that our students can continue to work towards degree completion as outlined in the original program plan.

Sincerely,

A handwritten signature in black ink that reads "Mihran Tuceryan".

Mihran Tuceryan

Professor

317-274-9736

tuceryan@iupui.edu

What matters. Where it matters.

Proposal
Department of Computer and Information Science
Purdue School of Science, Indianapolis
5-Year Bachelor of Science/Master of Science
Combined Degree Program

Programs

Bachelor of Science in Computer Science
Master of Science in Computer Information Science

Department

Department of Computer and Information Science
Purdue School of Science, Indianapolis

Proposed Date of Implementation

Fall 2013

Shiaofen Fang, Ph.D.
Chair, Department of Computer and Information Science
Purdue School of Science, Indianapolis

Date

Kathleen A. Marrs, Ph.D.
Associate Dean for Academic Affairs
Purdue School of Science, Indianapolis

Date

David G. Skalnik, Ph.D.
Associate Dean for Research and Graduate Education
Purdue School of Science, Indianapolis

Date

M. J. T. Smith, Ph.D.
Dean
Purdue Graduate School

Date

Victor L. Lechtenberg, Ph.D.
Provost
Purdue University

Date

I. Summary

This is a proposal for a combined degree program in which students will earn a Bachelor of Science (B.S.) in Computer Science and a Master of Science (M.S.) in Computer Information Science.

II. Degrees to be conferred

Bachelor of Science (B.S.) in Computer Science and a Master of Science (M.S.) in Computer Information Science.

III. Rationale

The Department of Computer and Information Science, Purdue School of Science, Indianapolis is proposing a combined Bachelor of Science (B.S.) in Computer Science and Master of Science (M.S.) in Computer Information Science that can be completed in five academic years. This proposed change is intended to assist in the integration and consolidation of the entire Department of Computer and Information Science curricula while appealing to a wider spectrum of students.

IV. Objective

This option will attract highly motivated and qualified students to complete their graduate degree in an accelerated timeframe, while retaining the academic standards of the M.S. program. The combined program will result in an increase in local M.S. students and motivate strong B.S. students to attempt more rigorous graduate-level courses. All of the M.S. options—thesis, project, and course only—will be open to students in the B.S./M.S. program.

The integration of the two curricula will provide a more seamless transition between programs for students and provide the opportunity for undergraduate students to include 50000-level coursework in their degree program. Students will be able to take three dual-level graduate courses, with a minimum grade of B, to satisfy general/free elective requirements in the B.S. Students will choose from the following approved courses:

1. Networking and Security -- CSCI 53600
2. Databases and Intelligent Systems -- CSCI 54100
3. Visualization and Graphics -- CSCI 55000
4. Software Engineering -- CSCI 50600
5. Theory -- CSCI 56500
6. Systems -- CSCI 53700

The graduate committee may substitute other courses as needed in place of those listed above in special situations where a course on the list has not been offered and a student's graduation may be affected. The courses will also apply as major requirements in the M.S. degree programs. In addition the curricula for the program will be more robust and will encourage the participation of students from diverse backgrounds.

The Department of Computer and Information Science believes that this program will serve as an important recruitment tool as the completion of both a B.S. and an M.S. degree in a 5-year time frame will be attractive to a broad range of students.

Graduates will be afforded more and better opportunities for employment since this type of combined degree program will identify them as unique to potential employers. In addition, persons who have earned an M.S. degree in the field of Computer Science can usually demand higher salaries than those with only a B.S. degree.

V. Current and Proposed Program Structure

A.1. Current Undergraduate Admission Requirements:

- A high school Indiana Core 40 curriculum or academic honors diploma.
- A high school minimum grade point average of 3.00 on a 4.00 scale.
- SAT (CR+MA) ≥ 1000 ; SATM ≥ 500 or ACT equivalent.

A.2. Current Graduate Admission Requirements:

The applicant to the graduate program must have a four-year bachelor's degree or equivalent. Students with three-year degrees may be required to complete additional course work in order to be eligible for admission.

The applicant's record should demonstrate strong individual accomplishments, include recommendations from independent references and exhibit outstanding achievement as indicated by the grade point average for each degree over his or her entire academic record. An applicant is expected to have a GPA of at least a 3.00 on a scale of 4.00.

The Graduate Record Exam (GRE) General Test is optional for admission, but required to be eligible for financial aid. Those submitting GRE General Test scores are encouraged to submit Computer Science Subject Test scores.

All applicants should have a background in the following core areas of computer science:

- software development experience in a high-level language
- data structures and algorithms
- systems (operating systems, compilers, and programming languages)
- theory (discrete math and theory of computation)
- hardware (computer architecture)

In addition, applicants should have a strong background in mathematics, including calculus, linear algebra, and numerical computations.

A.3. Proposed Combined Degree Admission Requirements:

A minimum college cumulative GPA of 3.20 on a 4.00 scale.

Completion of the application to the program.

B.1. Undergraduate Degree Requirements:

Students must first complete the requirements for the B.S. in Computer Science degree, which currently requires 124 credit hours. Nine of the total required credits may consist of 50000-level CSCI courses.

First-Year Experience Course. Beginning freshmen and transfer students with fewer than 18 credit hours are required to take CSCI 12000 Windows on Computer Science (1 cr.) or an equivalent first-year experience course.

AREA I English Composition and Communication Skills (9 cr.)

- ENG-W131 *Elementary Composition I*
- COMM-R110 *Fundamentals of Speech Communication*

The second semester of English composition must be satisfied with:

- TCM 32000 *Written Communication in Science and Industry*

AREA II Foreign Language No foreign language proficiency is required for a Bachelor of Science degree.

AREA IIIA Humanities, Social Sciences, and Comparative World Cultures (12 cr.)

- HIST-H114 *Western Civilization II* (3 cr.) or HIST-H109 *Perspectives on the World: 1800-Present* (3 cr.)
- List H One course from a list of humanities courses (3 cr.).
- List S One course from a list of social science courses (3 cr.).
- List C One course from a list of comparative world culture courses (3 cr.).

AREA IIIB Junior/Senior Integrator (3 cr.) The Junior/Senior Integrator requirement is suspended indefinitely. The three credit hours formerly required for this AREA may be replaced with a sixth CSCI 40000 level course.

AREA IIIC Physical and Biological Sciences The Department of Computer and Information Science requires all computer science majors to take PHYS 15200 *Mechanics* and three other physical science courses chosen from the areas of biology, chemistry, geology, and physics, or from certain courses in engineering. Each course that counts as one of the physical science required courses must have a lecture component and be at least 3 credit hours. The following engineering courses may be applied toward AREA IIIC requirements: ECE 20100, ECE 20200, and ECE 26600. Laboratory courses without a lecture component may be taken for credit, but do not count toward the four-course requirement.

AREA IIID Mathematical Sciences Computer Science majors are required a minimum of 17 credit hours of mathematical sciences. Five course requirements are MATH 16500, MATH 16600, MATH 17100, MATH 35100 or MATH 51100, STAT 35000 or STAT 41600 or STAT 51100.

AREA IV Major Requirements Minimum requirements include 26 credit hours of core computer science courses and at least 33 additional hours of computer science and supporting course electives. Core courses are: CSCI 23000, CSCI 24000, CSCI 34000, CSCI 36200, CSCI 40200, CSCI 40300, CSCI 48400, and CSCI 49500. Students who do not maintain a minimum GPA of 2.50 in MATH 17100, and in CSCI 23000, CSCI 24000, CSCI 34000, and CSCI 36200 will not be permitted to continue as departmental majors.

Computer and Information Science Electives

Students are encouraged to focus their required electives in such areas as databases and data mining, software engineering, game and graphics, networking, and security. Students choose a minimum of 11 courses from among the list of computer science and supporting course electives. No more than 3 courses can be chosen from the select list of N-series courses; a minimum of 6 courses must be CSCI 40000-level or above, and no more than 2 courses can be chosen from a recommended list of courses outside of computer science.

- CSCI-N-Series and 300 level Electives—Choose no more than three
- CSCI 30000 Systems Programming
- CSCI 35500 Introduction to Programming Languages
- CSCI-N300 Mobile Computing Fundamentals
- CSCI-N311 Advanced Database Programming, Oracle
- CSCI-N321 System and Network Administration
- CSCI-N335 Advanced Programming, Visual Basic
- CSCI-N342 Server Side Web Development
- CSCI-N343 Object-Oriented Programming for the Web
- CSCI-N345 Advanced Programming, Java
- CSCI-N351 Introduction to Multimedia Programming
- CSCI-N355 Introduction to Virtual Reality
- CSCI-N410 Mobile Computing Application Development
- CSCI-N420 Mobile Computing Cross Platform Development
- CSCI-N430 Mobile Computing and Interactive Applications
- CSCI-N431 E-Commerce with ASP.NET
- CSCI-N435 Data Management Best Practices with ADO.NET
- CSCI-N450 Mobile Computing with Web Services
- CSCI-N451 Web Game Development (Pending)
- CSCI-N452 3D Game Programming
- CSCI-N461 Software Engineering for Applied Computer Science
- CSCI-N499 Topics in Applied Computing (topic varies)

CSCI 400 and 500 level Electives—Choose at least six courses

- CSCI 43200 Security in Computing
- CSCI 43500 Multimedia Information Systems
- CSCI 43600 Principles of Computer Networking
- CSCI 43700 Introduction to 3D Game Graphics
- CSCI 43800 Advanced Game Development
- CSCI 44300 Database Systems
- CSCI 44800 Biometric Computing
- CSCI 45000 Principles of Software Engineering
- CSCI 45200 Object-Oriented Analysis and Design
- CSCI 46300 Analysis of Algorithms
- CSCI 47000 Automata and Formal Languages
- CSCI 47500 Scientific Computing I
- CSCI 47600 Scientific Computing II
- CSCI 47700 High Performance Computing
- CSCI 48100 Data Mining
- CSCI 48500 Expert System Design
- CSCI 48700 Artificial Intelligence
- CSCI 49000 Variable Title
- CSCI 53600 Data Communication and Computer Networks
- CSCI 54100 Database Systems

- CSCI 54800 Bioinformatics
- CSCI 55000 Computer Graphics
- CSCI 55200 Advanced Graphics and Visualization
- CSCI 59000 Cryptography and Network Security (P or C: CSCI 43600)

Computer Science Supporting Electives

Choose no more than 2 courses. Note that this list of courses is not all-inclusive. Other courses outside of computer science can be considered and can be counted with prior written approval of a computer science faculty advisor.

- NEWM-N204 Introduction to Interactive Media
- NEWM-N210 Introduction to Digital Sound
- NEWM-N230 Introduction to Game Design and Development
- NEWM-N304 Interactive Media Applications
- NEWM-N330 Game Design, Development, and Production
- NEWM-N335 Computer-Based Character Simulation/Animation II
- CIT 40200 Design and Implementation of Local Area Networks
- CIT 40600 Advanced Network Security
- CIT 42000 Digital Forensics
- CIT 44000 Computer Network Design
- HERR-A371 Introduction to Interactive Design
- HERR-A471 Advanced Interactive Design
- INFO-I300 Human Computer Interaction
- INFO-I310 Multimedia Arts: History, Criticism, and Technology
- INFO-I320 Distributed Systems and Collaborative Comp
- BUS-S302 Management Information Systems
- BUS-L203 Commercial Law I
- BUS-L303 Commercial Law II
- ECE 20400 Introduction Electrical and Electron Circuits
- ECE 36200 Microprocessor Systems and Interfacing
- ECE 47100 Embedded Systems
- STAT 51400 Design of Experiments

B.2. Graduate Degree Requirements:

To receive the Master of Science degree, the applicant must be admitted as a graduate student *without provisions* and complete 30 semester credit hours of study in CSCI courses numbered 500 or above, at least 6 credit hours of which must be from the following core courses:

- CSCI 50300 Operating Systems
- CSCI 50400 Concepts in Computer Organization
- CSCI 56500 Programming Languages
- CSCI 58000 Algorithm Design, Analysis, and Implementation

Each student is required to submit to the graduate committee for approval an initial plan of study during the first year in the program. This is prepared in consultation with the faculty advisor. Before the semester of expected graduation, the student's formal plan of study must be submitted to, and accepted by, Purdue University Graduate School. Graduate students are required to enroll in at least one fee-bearing credit hour and CAND99100 (0 credit) in their last semester.

C. Scope and Size of Proposed Program:

The primary clientele for the proposed program will be already enrolled undergraduate students who are performing well in the B.S. program. This program will give them an opportunity to receive relatively advanced training and education resulting in a graduate degree, in about one additional year of study, by exploiting some natural overlap in the coursework in the senior year and the first year of an M.S. program. This will prepare them well for higher education, research careers, as well as industrial jobs that require advanced, graduate degrees. There are also long-term career benefits of possessing a graduate degree. Based on our preliminary estimates, we anticipate about 10 B.S. students in each of the junior and senior years to choose this combined program, resulting in a student population of 20 in the proposed program.

D. Administrative Structure:

D.1. Current Undergraduate Administrative Structure:

Students completing the undergraduate degree in computer and information science will have acquired a fundamental understanding of computing, information processing, and information communication. The department's graduates serve in a variety of programming, software engineering, database administration, systems analysis, management, and research positions.

Sample Plan of Study, B.S. in Computer Science

First Semester

CSCI 23000	Computing I	4
MATH 16500	Integral Calculus and Analytic Geometry I	4
ENG-W131	Elementary Composition I	3
Humanities	List H Elective	3
CSCI 12000	Windows on Computer Science	1
	Total	15

Second Semester

CSCI 24000	Computing II	4
CSCI 34000	Discrete Computational Structures	3
MATH 16600	Integrated Calculus and Analytic Geometry II	4
HIST-H114 or HIST-H109	Western Civilization II or Perspectives on the World: 1800-Present	3
Science Elective		3
	Total	17

Third Semester

CSCI 36200	Data Structures	3
CSCI Elective (1)		3
MATH 17100	Multidimensional Mathematics	3
PHYS 15200	Mechanics	4
COMM R110	Fundamentals of Speech and Communication	3
	Total	16

Fourth Semester

CSCI Elective (2)		3
CSCI Elective (3)		3
CSCI Elective (4)		3
MATH 35100 or MATH 51100	Elementary Linear Algebra or Linear Algebra with Applications	3
Culture	List C – Comparative World Cultures	3
Unrestricted Elective		3
	Total	18

Fifth Semester

CSCI 40200	Architecture of Computers	3
CSCI Elective (5)		3
STAT 35000 or STAT 41600 or STAT 51100	Introduction to Statistics or Probability or Statistical Methods	3
Science Elective		3
Social Science	List S – Social Science	3
	Total	15

Sixth Semester

CSCI 40300	Introduction to Operating Systems	3
Supporting Elective		3
CSCI Elective (6)		3
Science Elective		3
General Elective		3
	Total	15

Seventh Semester

CSCI 48400	Theory of Computation	3
CSCI Elective (7)		3
CSCI Elective (8)		3
TCM 32000	Written Communication in Science and Industry	3
General Elective		3
	Total	15

Eighth Semester

CSCI 49500	Explorations in Applied Computing Capstone Course	3
CSCI Elective (9)		3
CSCI Elective (10)		3
Supporting Elective		3
General Elective		1
CAND 99100	Candidate for Graduation	0
	Total	13

TOTAL: 124 credit hours**D.2. Current Graduate Administrative Structure:**

The Department offers three options for Master of Science students: Thesis, Project, and Course Only. Each option requires 30 completed credit hours. Thesis students complete a research project that counts for 6 or 9 credit hours of the 30 required credits. Project students complete a project, usually of a more practical nature related to their work or academic interests, counting for 3 or 6 of the 30 required credits. Course Only option students take 30 credit hours of course work, and select an area or areas of concentration. No thesis or project work is required.

To receive the Master of Science degree, the applicant must be admitted as a graduate student *without provisions* and complete 30 semester credit hours of study in CSCI courses numbered 500 or above, at least 6 credit hours of which must be from the following core courses:

- CSCI 50300 Operating Systems
- CSCI 50400 Concepts in Computer Organization
- CSCI 56500 Programming Languages

- CSCI 58000 Algorithm Design, Analysis, and Implementation

Each student is required to submit to the graduate committee for approval an initial plan of study during the first year in the program. This is prepared in consultation with the faculty advisor. Before the semester of expected graduation, the student's formal plan of study must be submitted to, and accepted by, Purdue University Graduate School. Each student must register in CAND 99100 for 0 credits during the final semester before graduation.

Sample Plan of Study, M.S. in Computer Information Science

First Semester

CSCI 50400	Concepts in Computer Organization	3
CSCI 50000 Level		3
CSCI 50000 Level		3
	Total	9

Second Semester

CSCI 50300	Operating Systems	3
CSCI 50000 Level		3
CSCI 50000 Level		3
CSCI 50000 Level		3
	Total	12

Third Semester

CSCI 56500	Programming Languages	3
CSCI 58000	Algorithm Design, Analysis, and Implementation	3
CSCI 50000 Level		3
CAND 99100	Candidate for Graduation	0
	Total	9

TOTAL: 30 credit hours

D.3. Proposed Combined Degree Program

Sample Plan of Study, combined B.S. in Computer Science/M.S. in Computer Information Science

First Semester

CSCI 23000	Computing I	4
MATH 16500	Integral Calculus and Analytic Geometry I	4
ENG-W131	Elementary Composition I	3
CSCI 12000	Windows on Computer Science	1
	Total	12

Second Semester

CSCI 24000	Computing II	4
CSCI 34000	Discrete Computational Structures	3
MATH 16600	Integrated Calculus and Analytic Geometry II	4
H/S/C Course		3
	Total	14

Summer

CSCI-N Series Elective		3
Physical Science		3
	Total	6

Third Semester

CSCI 36200	Data Structures	3
CSCI 40200	Architecture of Computers	3
MATH 17100	Multidimensional Mathematics	3
COMM R110	Fundamentals of Speech and Communication	3
	Total	12

Fourth Semester

CSCI 40300	Introduction to Operating Systems	3
CSCI 48400	Theory of Computation	3
MATH 35100 or MATH 51100	Elementary Linear Algebra or Linear Algebra with Applications	3
PHYS 15200	Mechanics	4
	Total	13

Summer

CSCI-N Series Elective		3
Physical Science		3
	Total	6

Fifth Semester

CSCI 40000 Elective		3
CSCI 40000 Elective		3
STAT 35000 or STAT 41600 or STAT 51100	Introduction to Statistics or Probability or Statistical Methods	3
TCM 32000	Written Communication in Science and Industry	3
H/S/C Course		3
	Total	15

Sixth Semester

CSCI 40000 Elective		3
HIST-H114 or H109	Western Civilization	3
Supporting Elective		3
CSCI 40000 Elective		3
CSCI 40000 Elective		3
	Total	15

Summer

CSCI-N Series Elective		3
	Total	3

Seventh Semester

CSCI 50000 Elective		3
CSCI 50000 Elective		3
Supporting Elective		3
Physical Science		3
H/S/C Course		3
	Total	15

Eighth Semester

CSCI 49500	Explorations in Applied Computing Capstone Course	3
CSCI 50000 Elective		3
CSCI 40000 Elective		7
	Total	13

Ninth Semester

CSCI 50000 Level		3
CSCI 50000 Level		3
CSCI 50000/60000 Level		3
	Total	9

Tenth Semester

CSCI 50000 Level		3
CSCI 50000 Level		3
CSCI 50000/60000 Level		3
	Total	9

Summer

CSCI 50000/60000 Level		3
	Total	3

TOTAL: 145 credit hours**VI. Sustainability and Impact on the State and Region**

Computer science is one of the fastest growing sectors of the economy in Indiana and the country. Over the past two years, the number of open positions within 50 miles of Indianapolis has been in the range of 200-550. Clearly, there is a great need for qualified computing professionals in Central Indiana that is currently going unfilled. Indiana's Department of Workforce Development releases a list of the "Hot 50 Hoosier Jobs" biannually. In 2008 and in 2010, Computer Software Engineer was listed as the number one job (See <https://netsolutions.dwd.in.gov/hh50/jobList.aspx?hotJobs=true> for the 2010 list). At least some of these jobs require or give preference to candidates with a graduate degree in the Computing field. A combined B.S. and M.S. option would expand the pool of qualified applicants for these rewarding, high-paying, and challenging career opportunities. Since the proposed program does not require any additional resources in terms of new courses or personnel, but merely provides a relatively fast track

towards an M.S. degree for outstanding B.S. students, and since the demand for such highly qualified is expected to continue to be high, the long term sustainability outlook for the proposed program appears to be excellent.

VII. Staffing and Infrastructure

Because this program would consist of coursework taken from two already existing programs, no additional resources over and above present levels will be required to initiate the program.