



07144

# Curriculum Proposal

Please type or select the requested information. Print completed forms, add appropriate paper attachments, and route through MSU's curricular process for recommendations and decisions.

		(Check all that apply):		Proposal #	290
College:	Science, Engineering and Technology	<input checked="" type="checkbox"/>	Undergraduate	Effective Date of Change:	
Department:	Computer Science	<input checked="" type="checkbox"/>	Graduate	Academic Year	06-07
Program:	Computer Science	CIP # 11.010104		(For Office Use Only)	
Type of Change	COURSE PROPOSALS			Course Designator and Number	Number of Credits
Proposed:	New Course				
Title Current:					
Title Proposed:	Formal Languages/Abstract Machines			CS 410/510	3
24-Char. Abbrev:	Formal Lang/Abst Machine			(if applicable)	

Include a course or program description for the Bulletin (30-40 words maximum for courses, 100 for programs):

This course studies the theoretical underpinnings of modern computer science, focusing on three main models of computation: DFA, PDA, and Turing Machines. Students determine model capabilities and limitations are: what is and is not computable by each of them.  
Pre: CS 310 and MATH 375 F

Rationale or Justification for change:

This is part of the CS program redesign and includes material from COMS 410.

### \*\*\*For General Education or Cultural Diversity Courses Only\*\*\*

<b>General Education Course:</b>		<b>Cultural Diversity Course:</b> (Please check one.) <input type="checkbox"/> Core (At least 75% devoted to topics of race, gender, sexual orientation, age, class, and disabilities as they occur in United States Society.) <input type="checkbox"/> Related (At least 25% devoted to the above topics or to a global perspective on topics related to African American, Asian, Hispanic, and Native American inhabitants of the United States.)
GE Category #	GE Category Name (Maximum of 3 Categories)	
N/A		
N/A		
<p>? For Writing Intensive Courses, attach a description of the kind and quantity of writing.</p> <p>? For Upper Division Courses, include a description of the respects in which it is broad and general rather than narrow and specific, and so suitable as GE.</p> <p>Attach paper copies of the following:</p> <ol style="list-style-type: none"> <li>Syllabus or course outline.</li> <li>Course's student learning outcomes associated with each GE competency or CD designation.</li> <li>List of strategies to be used to assess students' achievement of each GE competency or CD designation.</li> </ol>		

### \*\*\*For New Courses\*\*\*

(Check all that apply):	Instructional Type:	Lecture	Course will be offered:
<input type="checkbox"/> Course is an elective.	Grading Format:	<input checked="" type="checkbox"/> Grade <input type="checkbox"/> P/N	<input checked="" type="checkbox"/> Fall Semester
<input checked="" type="checkbox"/> Course is required for program		Computer Science	<input type="checkbox"/> Spring Semester
<input checked="" type="checkbox"/> Pre- or Co-requisites:		Prerequisites: CS 310 and MATH 375	<input type="checkbox"/> Summer Session
<input type="checkbox"/> Other courses are being changed or eliminated. (Explain.)			
<input type="checkbox"/> Course content or title is similar to courses in other departments. (Attach copy of letter of agreement with other program(s) contacted. Indicate the nature of the discussions and/or resolution of differences or potential conflicts.)			
Attach paper copies of the following:			
<ol style="list-style-type: none"> <li>Syllabus or course outline.</li> <li>Course's student learning outcomes.</li> <li>A list of resources required to offer and support this course.</li> <li>A description of how teaching this course will affect department staffing.</li> <li>If 400/500 level course, an explanation of added expectations of graduate students.</li> </ol>			



Minnesota State University, Mankato  
Curriculum Proposal

\*\*\*Signature Page\*\*\*

**Department**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*Daniel J. Acopi* 10/17/06  
 Department Chair Date

Comments:

**College Curriculum Committee**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*Kam C. Chon* 11/2/06  
 Committee Chair Date

Comments:

**College Dean**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*[Signature]* 11/6/06  
 Dean Date

Comments:

**General Education Subcommittee**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

\_\_\_\_\_  
 General Education Subcommittee Chair Date

Comments:

**Undergraduate Curriculum and Academic Policy Committee**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*[Signature]* 1-31-07  
 UCAAP Faculty/Chair Date

Comments:

**Faculty Association Graduate Committee**

Recommended  
 Not Recommended

\_\_\_\_\_  
 Faculty Association Graduate Chair Date

Comments:

**Graduate Dean**

Recommended  
 Not Recommended

\_\_\_\_\_  
 Graduate Dean Date

Comments:

**Academic Affairs Council**

Recommended (Category/ies \_\_\_\_\_)  
 Not Recommended (Category/ies \_\_\_\_\_)

*[Signature]* 2/9/07  
 Assistant Vice President Date

Comments:

**Senior Vice President and Vice President for Academic Affairs**

Approved (Category/ies \_\_\_\_\_)  
 Not Approved (Category/ies \_\_\_\_\_)

*[Signature]* 2/13/07  
 Sr. Vice President / Vice Pres. Academic Affairs Date

Comments:

CS 410: Theory of Computation (3 credits)

Course Description:

This course studies the theoretical underpinnings of modern computer science. We focus on 3 main models of computation --- DFA, PDA, and Turing Machines --- determining what their capabilities and limitations are: what is and is not computable by each of them.

3 lecture hours per week.

Prerequisites: CS 310 and MATH 375

Proposed Text:

*An introduction to formal languages and automata*, Peter Linz, 2006.

Supplementary Reading:

- 1) *Introduction to the Theory of Computation*, Michael Sipser.
- 2) *Elements of the theory of computation*, Harry R Lewis and Christos H Papadimitriou, 2nd edition.

Schedule of Topics:

- 1) Languages: alphabets, strings, string operations, languages, language operations, string and language equalities. (~2.5 wks)
- 2) Regular languages: finite automata, regular expressions, non-determinism and Kleene's theorem, non-regular languages and the pumping lemma. (~2.5 wks)
- 3) Context-free languages: regular grammars, context-free grammars, derivation trees, ambiguity, normal forms, pushdown automata, deterministic pushdown automata and DCFLs, pumping results for context-free languages. (~2.5 wks)
- 4) Turing machines: definitions, deterministic and non-deterministic Turing machines, universal Turing machines, Church-Turing thesis. (~2.5 wks)
- 5) Recursive and recursively enumerable languages: unrestricted grammars, Chomsky hierarchy, linearly bounded automata, languages which are not recursively enumerable. (~2.5 wks)
- 6) Solvability and unsolvability: halting problem, reductions, Rice's theorem, Post's correspondence problem. (~2.5 wks)

Student Outcomes:

Students who complete this course will be able to:

- 1) Understand the computational limits of various models of computation including automata, grammars and Turing machines.
- 2) Present a valid proof about computation using sound, logical deductions.
- 3) Be able to prove the computability or uncomputability in various models of computation for certain problems.
- 4) Have a working-level familiarity with the mathematics of theoretical computer science.

Added Expectations of Graduate Students

- 1) Graduate students will be held to a higher standard in all coursework, including assignments and exams.
- 2) Graduate students will also be expected to perform in depth and thorough independent investigation of the subject matter.

Grades will be assigned based on exams and assignments.

Required Resources & Departmental Staffing:

Resources currently in place within the department, the college, and the university library will support this new course. No new resources are required.

There is no impact on staffing requirements.