School of Computing and Information Sciences

Course Title: Theory of Algorithms **Date:** 3/20/10

Course Number: MAD-3512

Number of Credits: 3

Subject Area: Foundations	**Subject Area Coordinator:** Geoffrey Smith **email:** smithg@cis.fiu.edu
Catalog Description: Strings, formal languages, finite state machines, Turing machines, primitive recursive and recursive functions, recursive unsolvability.	
Textbook: Peter Linz, *An Introduction to Formal Languages and Automata, 4th Edition.* (D.C. Heath & Co., 2006)	
References:	
Prerequisite Courses: MAD 2104 and COT 3420	
Corequisite Courses: None	

Type: Required for CS Major

Prerequisites Topics:

- Familiarity with definitions and theorems involving sets, relations, and functions.
- Familiarity with mathematical induction and recursion.
- Familiarity with formal proofs.

Course Outcomes:

1. Be familiar with formal languages.
2. Master finite state machines.
3. Master Turing machines.
4. Be familiar with primitive recursive and recursive functions.
5. Be exposed to recursive unsolvability.

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Relationship between Course Outcomes and Program Outcomes

BS in CS: Program Outcomes	Course Outcomes
a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms	1, 2, 3, 4, 5
b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.	1, 2, 3, 4, 5
c) Demonstrate proficiency in problem solving and application of software engineering techniques	
d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.	
e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist.	
f) Demonstrate the ability to work cooperatively in teams.	
g) Demonstrate effective communication skills.	

Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: http://www.cis.fiu.edu/programs/undergrad/cs/assessment/

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Outline

Topic	Number of Lecture Hours	Outcome
1. Regular Languages 1.1. Regular Expressions 1.2. Regular Grammars 1.3. Deterministic Finite Automata 1.4. Nondeterministic Finite Automata 1.5. Minimizing DFAs 1.6. Closure and decidability properties 1.7. The pumping lemma for regular languages	24	1, 2
2. Context-Free Languages 2.1. Context-free grammars 2.2. Parsing and ambiguity	4	1
3. Recursive and Recursively Enumerable Languages 3.1. Turing Machines 3.2. The Church-Turing Thesis 3.3. A Universal Turing Machine 3.4. Undecidable problems	8	3, 5
4. Other Models of Computation 4.1. Recursive Functions 4.2. Primitive Recursive Functions	4	4

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Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
1	4
2	4
3	2
4	1
5	2

Oral and Written Communication

No significant coverage

Written Reports		Oral Presentations	
Number Required	Approx. Number of pages	Number Required	Approx. Time for each
0	0	0	0

Social and Ethical Implications of Computing Topics

No significant coverage

Topic	Class time	student performance measures

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Approximate number of credit hours devoted to fundamental CS topics

Fundamental CS Area	Core Hours	Advanced Hours
Algorithms:		1.0
Software Design:		
Computer Organization and Architecture:		
Data Structures:		
Concepts of Programming Languages		

Theoretical Contents

Topic	Class time
Formal languages and automata	40 hours

Problem Analysis Experiences

Solution Design Experiences

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The Coverage of Knowledge Units within Computer Science Body of Knowledge[1]

Knowledge Unit	Topic	Lecture Hours
AL5. Basic computability	1, 2, 3, 4	20
AL7. Automata theory	1, 2, 3, 4	20

[1]See http://www.computer.org/education/cc2001/final/chapter05.htm for a description of Computer Science Knowledge units