

School of Computing and Information Sciences

Course Title: Theory of Algorithms

Date: April 1, 2019

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.	
Typical Textbook: Peter Linz, <i>An Introduction to Formal Languages and Automata, Third Edition</i> . (Jones and Bartlett, 2001)	
References:	
Prerequisite Courses: MAD 2104 or COP 3530	
Corequisite Courses: None	

Type: Required

Prerequisites Topics:

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

Course Outcomes:

- O1. Be familiar with formal languages.
- O2. Master finite state machines.
- O3. Master Turing machines.
- O4. Be familiar with primitive recursive and recursive functions.
- O5. Be exposed to recursive unsolvability.

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Outline

Topic	Number of Lecture Hours	Outcome
1. <u>Regular Languages</u> 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	<u>24</u>	<u>O1, O2</u>
2. <u>Context-Free Languages</u> 2.1. Context-free grammars 2.2. Parsing and ambiguity	<u>4</u>	<u>O1</u>
3. <u>Recursive and Recursively Enumerable Languages</u> 3.1. Turing Machines 3.2. The Church-Turing Thesis 3.3. A Universal Turing Machine 3.4. Undecidable problems	<u>8</u>	<u>O3, O5</u>
4. <u>Other Models of Computation</u> 4.1. Recursive Functions 4.2. Primitive Recursive Functions	<u>4</u>	<u>O4</u>

Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
O1	4
O2	4
O3	2
O4	1
O5	2

Oral and Written Communication:

No significant coverage

Social and Ethical Implications of Computing Topics

No significant coverage

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Approximate number of credit hours devoted to fundamental CS topics

Topic	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

No significant coverage

Solution Design Experiences

No significant coverage

The Coverage of Knowledge Units within Computer Science Body of Knowledge¹

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

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