School of Computer Science

Course Title: Logic for Computer Science

Date: March 18, 2019

Course Number: COT 3541

Number of Credits: 3

Subject Area: Foundations	**Subject Area Coordinator:** Geoffrey Smith **email:** smithg@cis.fiu.edu
Catalog Description: An introduction to the logical concepts and computational aspects of propositional and predicate logic, as well as to concepts and techniques underlying logic programming, in particular, the computer language Prolog.	
Typical Textbooks: Stanley Burris, *Logic for Mathematics and Computer Science*. (Prentice Hall, 1998) Ivan Bratko, *PROLOG: Programming for Artificial Intelligence, third edition*. (Addison Wesley, 2001)	
References: Uwe Schoening, *Logic for Computer Scientists*. (Birkhaeuser Verlag, 1989) Anil Nerode and Richard Shore, *Logic for Applications*. (Springer Verlag, 1993)	
Prerequisite Courses: COP 3337 and (COT 3100 or MAD 2104)	
Corequisite Courses: None	

Type: Required

Prerequisites Topics:

- Familiarity with programming in Java or C++.
- Familiarity with definitions and theorems involving sets, relations, and functions.
- Familiarity with propositional logic.
- Familiarity with mathematical induction and recursion.

Course Outcomes:

O1. Become familiar with the concepts, methods, and results of first-order logics.
O2. Master formal proofs, both syntactic and semantic.
O3. Master specifying problems as first-order logic formulas.
O4. Become familiar with the application of logic to logic programming, in particular, be able to write and debug small Prolog programs.

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Outline

Topic	Number of Lecture Hours	Outcome
1. Propositional Logic	12 - 14	O1, O2
1.1. Syntax	2	O1
1.2. Structural Induction	2–3	O2
1.3. Semantics	2	O1, O2
1.4. Conjunctive Normal Form	2	O1
1.5. Resolution	2 - 3	O1, O2
1.6. Soundness and Completeness	2	O1
2. First-Order Logic	14 - 17	O1, O2, O3
2.1. Syntax	2	O1
2.2. Semantics	2 - 3	O1, O2
2.3. Conjunctive Normal Form	3	O1, O3
2.4. Resolution	3	O1, O2
2.5. Examples of resolution proofs	2 - 3	O2, O3
2.6. Soundness and Completeness	2 – 3	O1, O2
3. Logic Programming and Prolog	9 - 12	O3, O4
3.1. What is logic programming?	1	O3, O4
3.2. Prolog: facts and rules	2	O3, O4
3.3. Resolution in Prolog	2 - 3	O3, O4
3.4. Lists in Prolog	2 - 3	O3, O4
3.5. Applications	2 - 3	O3, O4

Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
O1	9
O2	9
O3	7
O4	6

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Oral and Written Communication:

No significant coverage

Social and Ethical Implications of Computing Topics

No significant coverage

Approximate number of credit hours devoted to fundamental CS topics

Topic	Core Hours	Advanced Hours
Algorithms:	0.4	
Software Design:		
Computer Organization and Architecture:		
Data Structures:	0.3	
Concepts of Programming Languages:	0.3	

Theoretical Contents

Topic	Class time
Mathematical logic	30 hours

Problem Analysis Experiences

No significant coverage

Solution Design Experiences

Design of some small Prolog programs

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

Knowledge Unit	Topic	Lecture Hours
DS2. Basic logic	1,2	10
DS3. Proof techniques	1,2	6
PF4. Recursion	3	2
IS3. Knowledge representation and reasoning	3	6

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