

## School of Computer Science

**Course Title:** Logic for  
Computer Science

**Date:** March 22, 2019

**Course Number:** COT 3541

**Number of Credits:** 3

<b>Subject Area:</b> Foundations	<b>Subject Area Coordinator:</b> Geoffrey Smith  <b>email:</b> smithg@cis.fiu.edu
<b>Catalog Description:</b> 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.	
<b>Typical Textbooks:</b> Stanley Burris, <i>Logic for Mathematics and Computer Science</i> . (Prentice Hall, 1998) Ivan Bratko, <i>PROLOG: Programming for Artificial Intelligence, third edition</i> . (Addison Wesley, 2001)	
<b>References:</b> Uwe Schoening, <i>Logic for Computer Scientists</i> . (Birkhaeuser Verlag, 1989) Anil Nerode and Richard Shore, <i>Logic for Applications</i> . (Springer Verlag, 1993)	
<b>Prerequisite Courses:</b> COP 3337 and (COT 3100 or MAD 2104)	
<b>Corequisite Courses:</b> None	

Type: Elective

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**

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

**Course Outcomes Emphasized in Laboratory Projects / Assignments**

<b>Outcome</b>	<b>Number of Weeks</b>
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**

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

**Theoretical Contents**

<b>Topic</b>	<b>Class time</b>
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<sup>1</sup>**

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

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