Saint Leo University

COM 217
Theoretical Foundation of Computer Science

Course Description:
This course presents the theoretical underpinnings of computer science, including propositional and predicate logic, mathematical reasoning and proof techniques, algorithm analysis and computability of algorithms, regular expressions and the theory of formal languages, and applications of trees and graphs.

Prerequisite:
MAT 231 and COM 207

Textbook*:*
Required: Epp, S. S. (2020). Discrete mathematics with applications (5th ed.). Boston, MA: Cengage Learning. ISBN-13: 9780357097724 (Loose-Leaf)

OR

Recommended: Epp, S. S. (2020). Discrete mathematics with applications (5th ed.). Boston, MA: Cengage Learning. ISBN-13: 9780357035252 (eBook).

Learning Outcomes:
The student will able to:

1. apply basic principles of sets, relations, and functions and their properties, to analyze problems.
2. apply principles of propositional and predicate logic to computational problems.
3. apply mathematical reasoning in order to decipher, understand, and create mathematical proofs, and be able to distinguish between and utilize different methods of proofs.
4. apply graphs and trees to represent systems and relationships, and utilize them for some applications.
5. evaluate algorithms by analyzing their time and storage requirements in order to select the most effective one to use in specific situations.
6. apply regular expressions and finite state automata to the theory of formal languages.
7. **VALUES OUTCOMES**: Discuss, integrate, and illustrate the relevance of **Excellence**, including the criticality of ethical behavior, in the development and implementation of software products.

Core Value:
Excellence: Saint Leo University is an educational enterprise. All of us, individually and collectively, work hard to ensure that our students develop the character, learn the skills, and assimilate the knowledge essential to become morally responsible leaders. The success of our University depends upon a conscientious commitment to our mission, vision, and goals.

Evaluation:

Assignments	**Percentage**
Exams (3)	48
Homework (8)	42
Discussion (8)	10
Total	**100%**

Examinations: Three exams will be given and will cover the material presented since the previous exam. These will have both an objective and a hands-on component.

Homework Questions/Problems: Students will perform exercises from the textbook, some of which are pencil-paper type activities and some of which are light programming assignments.

Discussion/Participation: Students are encouraged to interact with each other and exchange opinions of technical issues as well as the ethical issues of these technologies. This interaction can provide great opportunities to explore how these issues relate to our Core Values.

Assessment of the Learning Outcomes

Learning Outcome	Assessment Method(s)
1	**Exams, Homework**
2	**Exams, Homework**
3	**Exams, Homework**
4	**Exams, Homework**
5	**Exams, Homework**
6	**Exams, Homework**
7	**Discussions**

Grading Scale:

Grade Score (%)

A	94-100
A-	90-93
B+	87-89
B	84-86
B-	80-83
C+	77-79
C	74-76
C-	70-73
D+	67-69
D	60-66 F
F	0-59

Module 1 **Mathematical Preliminaries**

Objectives When you complete this module, you should be able to:

- Formulate mathematical statements using variables.
- Use sets to describe collections of objects, and demonstrate an understanding basic concepts in set theory.
- Apply the concept of relations and functions to sets of real numbers.

Readings Complete the following readings for this module:

- Chapter 1 (Sections 1.1 to 1.3)

Assignments

Items to be Completed:	**Due No Later Than:**
Post an introduction to the class	Thursday 11:59 PM EST/EDT
Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 1	Sunday 11:59 PM EST/EDT

Module 2 **Propositional Logic**

Objectives

When you complete this module, you should be able to:

- Use propositions to formally express logical statements.
- Construct compound logical statements using the operators of AND, OR, and NOT.
- Evaluate conditional logical statements.

Readings

Complete the following readings for this module:

- Chapter 2 (Sections 2.1 to 2.3)

Assignments

Items to be Completed:	**Due No Later Than:**
Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 2	Sunday 11:59 PM EST/EDT

Module 3 **Predicate Logic**

Objectives

When you complete this module, you should be able to:

- Use predicate logic to formally express quantified statements.
- Use universal and existential quantifiers to formulate conditional logical statements.
- Formulate logical statements with multiple quantifiers using AND, OR, and Negation operations.

Readings

Complete the following readings for this module:

- Chapter 3 (Sections 3.1 to 3.4)

Items to be Completed:	**Due No Later Than:**

Assignments

Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 3	Sunday 11:59 PM EST/EDT
Complete Exam 1	Sunday 11:59 PM EST/EDT

Module 4 **Proof Techniques I (Direct and Indirect Methods)**

Objectives

When you complete this module, you should be able to:

- Apply direct proof techniques to prove basic properties of integers and real numbers.
- Apply direct proof techniques to prove basic properties of rational numbers.
- Apply direct proof techniques to prove divisibility of numbers.
- Using contradictions and contrapositions as indirect proof techniques.

Readings

Complete the following readings for this module:

- Chapter 4 (Sections 4.1 to 4.4 and 4.6)

Assignments

Items to be Completed:	**Due No Later Than:**
Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 4	Sunday 11:59 PM EST/EDT

Module 5 **Proof Techniques II (Method of Induction)**

Objectives

When you complete this module, you should be able to:

- Apply the notations for summations and products to represent number sequences.
- Use factorial and “n choose r” notation.
- Use mathematical induction as a proof technique.

Readings

Complete the following readings for this module:

- Chapter 5 (Sections 5.1 to 5.3)

Assignments

Items to be Completed:	Due No Later Than:
Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 5	Sunday 11:59 PM EST/EDT
Complete Exam 2	Sunday 11:59 PM EST/EDT

Module 6 **Graphs and Trees**

Objectives When you complete this module, you should be able to:

- Provide basic properties of graphs and trees.
- Provide direct proofs for graph properties.
- Provide inductive proofs for graph properties.
- Provide properties and applications of spanning trees.

Readings Complete the following readings for this module:

- Chapter 10 (Sections 10.1 to 10.2 and 10.5 to 10.7)

Assignments

Items to be Completed:	Due No Later Than:
Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 6	Sunday 11:59 PM EST/EDT

Module 7 **Analysis of Algorithms**

Objectives When you complete this module, you should be able to:

- Apply the notion of functions and show their growth using graphical notation.
- Apply O, Ω, and Θ notations to analyze growth of functions.
- Use the Big-O approximations on functions to analyze algorithm efficiency.

Readings Complete the following readings for this module:

- Chapter 11 (Sections 11.1 to 11.4)

Assignments

Items to be Completed:	Due No Later Than:
Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 7	Sunday 11:59 PM EST/EDT

Module 8 **Regular Expressions and Finite-State Automata**

Objectives

When you complete this module, you should be able to:

- Demonstrate the basic definition of a formal language and regular expressions.
- Use regular expression to define a formal language.
- Apply finite-state automata to accept a regular expression using an automaton.
- Design a finite-state automaton.

Readings

Complete the following readings for this module (read all subsections):

- Chapter 12 (Sections 12.1 to 12.2)

Assignments

Items to be Completed:	Due No Later Than:
Read the assigned material	
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Homework Assignment 8	Sunday 11:59 PM EST/EDT
Complete Exam 3	Sunday 11:59 PM EST/EDT