Modify Credit Course: CS 226 - Discrete Structures

Units Lecture 3.50	**Units Lab** 0.50	**Units Total** 0.00 - 4.00
Lecture Weekly Contact Hours 3.50	**Lab Weekly Contact Hours** 1.50	**Total Weekly Contact Hours** 5.00
Lecture Weekly Out of Class Hours 7.00	**Lab Weekly Outside of Class Hours** 0.00	**Total Weekly Outside of Class Hours** 7.00
Total Contact Hours 80.00 - 90.00	**Total Outside of Class Hours** 112.00 - - 126.00	**Total Course Hours** 192.00 - 216.00

Typically Offered: Fall, Spring - F,SP

COURSE DESCRIPTION

Designed for students majoring in computer science, this course introduces discrete mathematics, including logic, methods of proof, number theory, sets, counting, relations, recursion, recurrence relations, Boolean algebra, graphs, trees, and networks. Topics are illustrated with applications to computer science, including design and analysis of algorithms, undecidability, program correctness, and digital logic design. C-ID COMP-152.

ENROLLMENT RESTRICTIONS

Prerequisite
CS 111 or CS 138 or CS 150 and MATH 126 or MATH 126S or eligibility determined by the math placement process.

OUTLINE OF COURSE LECTURE CONTENT

The course lecture will address the following topics:
I. Logic
A. Compound statements
B. Boolean algebra, including applications to digital logic design
C. De Morgan's Laws
D. Implication
E. Inverse
F. Converse
G. Contrapositive
H. Predicates
I. Quantifiers.

II. Methods of proof
A. Direct proof
B. Proof by cases
C. Proof by contradiction
D. Mathematical induction (including review of sequences and subscript notation).

III. Number theory
A. Modular arithmetic
B. Prime numbers
C. Euclidean algorithm
D. RSA cryptosystem
E. Floor and ceiling
F. Summation notation
G. Simple summation formulas.

IV. Sets
A. Union, intersection, and complement
B. Partitions
C. Subsets and power set
D. Cartesian product.

V. Counting
A. Addition rule
B. Product rule
C. Permutations
D. Combinations
E. Pigeon-hole principle.

VI. Recursion and recurrence relations
A. Recursion
B. Solution of linear, first and second order, recurrence relations
C. Divide and conquer relations
D. Program correctness.

VII. Relations
A. Binary relations
B. Reflexive, symmetric, and transitive properties
C. Equivalence relations
D. Partial orders
E. Linear orders.

VIII. Graphs
A. Introduction to graphs
B. Graph models
C. Paths and circuits
D. Matrix representation
E. Graph isomorphism
F. Euler and Hamiltonian paths.

IX. Trees
A. Characterization of trees
B. Binary trees

C. Rooted trees.

X. Networks and tree algorithms
A. Spanning trees
B. Minimum spanning trees using Kruskal's algorithm
C. Minimum spanning trees using Prim's algorithm.

OUTLINE OF COURSE LAB CONTENT

The course lab will address the following topics:
Individual and group assignments in the lab are designed to be hands-on activities that support, compliment, and extend the material and theory presented in the lectures.

PERFORMANCE OBJECTIVES

Upon successful completion of this course, students will be able to do the following:
1). Use basic logic to evaluate the correctness of mathematical arguments.
2). Apply appropriate problem-solving techniques and methods of proof to construct correct and complete proofs.
3). Solve selected problems from number theory.
4). Use fundamental techniques in discrete mathematics to solve computer science application problems.
5). Solve counting problems using appropriate combinatorial principles.
6). Solve recurrence relations using appropriate techniques and verify the solution(s).
7). Determine whether a given binary relation is a linear order, partial order, or equivalence relation.
8). Solve selected problems about graphs.
9). Solve selected problems about trees.
10). Find a minimum spanning tree of a network.

READING ASSIGNMENTS

Reading assignments will be consistent with, but not limited by, the following types and examples:
1). Read and solve discrete mathematics problems from the course text.
2). Read articles from books, journals, magazines, newspapers, and/or the Internet about discrete mathematics.

WRITING ASSIGNMENTS

Writing assignments will be consistent with, but not limited by, the following types and examples:
1). Write solutions to discrete mathematics homework.

OUTSIDE-OF-CLASS ASSIGNMENTS

Outside-of-class assignments will be consistent with, but not limited by, the following types and examples:
1). Complete reading assignments, including articles from journals, magazines, newspapers, and/or the Internet.
2). Write solutions to assigned discrete mathematics problems.
3). Create programs to solve assigned discrete mathematics problems.

STUDENT LEARNING OUTCOMES

1. At the end of the course the student will be able to apply discrete structures to computer science applications.

METHODS OF INSTRUCTION

Instructional methodologies will be consistent with, but not limited by, the following types or examples:

1). Lecture by instructor, including demonstrations of solutions to discrete mathematics problems.

2). Cooperative learning through small group discussion, practice, and programming in solving discrete mathematics problems.

3). Homework assignments, including reading a discrete mathematics textbook and solving, writing out, and programming solutions to exercises and problems from the textbook.

METHODS OF EVALUATION

Evaluation methodologies will be consistent with, but not limited by, the following types or examples:

1). Quizzes and examinations that measure the student's ability to solve discrete mathematics problems and exercises using appropriate theories, principles, and techniques.

2). Homework problems, including grading correctness and completeness of solutions of computational or non-computational discrete mathematics problems and exercises.

REQUIRED TEXTBOOKS

Examples of typical textbooks for this course include the following:

1. **Author** Epp, Susanna S

   Title Discrete Mathematics with Applications

   Edition 5th ed.

   Publisher Brooks Cole

   Year 2019

   ISBN 978-1337694193

   This is the most current, in-print edition. Yes

2. **Author** Rosen, Kenneth H

   Title Discrete Mathematics and Its Applications

   Edition 8th ed.

   Publisher McGraw-Hill

   Year 2018

   ISBN 978-1259676512

   This is the most current, in-print edition. Yes

COURSE REPEATABILITY

Total Completions Allowed: 1

Rationale for multiple enrollments:

Courses Related in Content (CRC) in Physical Education, Visual Arts, and Performing Arts:

DISTANCE ED (FORM A)

Type of Approval: 100% Online or Hybrid

You may indicate here which component(s) of the course should never be conducted online (e.g. proctored exams, labs, in-person orientation, etc.):

ARTICULATION

Transfer Status: Acceptable for Credit: CSU, UC -

CSU/IGETC GE Area(s): 103 - CSU, UC