GAVILAN COLLEGE
5055 Santa Teresa Blvd
Gilroy, CA 95023

Course Outline

COURSE: MATH 16 DIVISION: 10 ALSO LISTED AS:

TERM EFFECTIVE: Summer 2024 CURRICULUM APPROVAL DATE 07/09/2024

SHORT TITLE: Discrete Math

LONG TITLE: Discrete Mathematics

Units	Number of Weeks	Type	Contact Hours/Week	Total Contact Hours
4	18	Lecture:	4	72
		Lab:	0	0
		Other:	0	0
		Total:	4	72

Out of Class Hrs:	144.00
Total Learning Hrs:	216.00

COURSE DESCRIPTION:

This course presents discrete mathematical systems, including methods of proof that shape the foundations of computer science. Major topics include propositional logic, set and number theory, Boolean Algebra, deductive and inductive proof, functions and relations, combinatorics, discrete probability, graph theory and network models, and efficiency of algorithms. PREREQUISITE: Mathematics 8B or Math 11 with a grade of 'C' or better or equivalent skills. ADVISORY: CSIS 45 with a grade of 'C' or better or equivalent skills. C-ID: (MATH 160).

PREREQUISITES:

Completion of MATH 8B, as UG, with a grade of C or better.
OR
Completion of MATH 11, as UG, with a grade of C or better.

COREQUISITES:

CREDIT STATUS: D - Credit - Degree Applicable

GRADING MODES

L - Standard Letter Grade

REPEATABILITY: N - Course may not be repeated

SCHEDULE TYPES:

02 - Lecture and/or discussion

05 - Hybrid

71 - Dist. Ed Internet Simultaneous

72 - Dist. Ed Internet Delayed

STUDENT LEARNING OUTCOMES:

By the end of this course, a student should:

1. Evaluate the truth and falsity of mathematical statements employing deductive and inductive proof techniques.

2. Analyze the relationships among counting techniques (combinatorics), discrete probability, sets, Boolean algebra, and propositional logic.

3. Evaluate graphs, trees, and networks in terms of efficiency, redundancy, and similarity.

COURSE OBJECTIVES:

By the end of this course, a student should:

1. Construct statements and nonstatements, compound statements, apply DeMorgan's Laws.

2. Set up truth tables, logical equivalences and tautologies.

3. Use variations of IF and contrapositive statements.

4. Construct proofs and counter examples.

5. Apply the principles of mathematical induction, direct and indirect deductive methods of proof to explore integers, rational, and real numbers, and their

relationship.

6. Apply the properties of sequences.

7. Apply the Well-Ordering Principle for proofs.

8. Apply mathematical induction for proving theories.

9. Perform set operations and set proofs.

10. Utilize empty sets, partitions, and power sets for proofs.

11. Illustrate functional similarities of set theory, discrete probability, propositional logic, Boolean algebra, and digital circuits.

12. Identify and solve discrete probability and combinatorial problems.

13. Use the rules for counting in solving problems. Use the product rule to determine counts. Use the addition rule for disjoint sets and combination rule for subsets.

14. Use the rules of finite-state automata to solve problems.

15. Use the one-to-one and onto properties to solve problems.

16. Use composition with functions.

17. Use recurrence relations to solve problems. Use iteration to solve recurrence problems.

18. Provide recursive, iterative and explicit solutions to discrete mathematical problems.

19. Use relation theorems on sets and subsets to solve problems.

20. Use reflexivity, symmetry, and transitivity to solve problems.

21. Identify and solve recurrence relations including equivalence relations and partial orderings.

22. Use graphs, trees, paths and circuits to solve problems.

23. Create and search Eulerian and Hamiltonian graphs.

24. Create and manipulate trees and spanning trees to find their minimized forms.

25. Apply graph theory and principles of combinatorial analysis to network models.

26. Compare the efficiency of common sorting and searching algorithms in terms of big-O, big-Omega, and big-Theta notation.

27. Use real-valued, exponential, and logarithmic functions to graph values.

COURSE CONTENT:

Curriculum Approval Date 07/09/2024

1. HOURS: 8

Logic and Proof:

Logical form and equivalence, conditional statements, logical implication, valid and invalid arguments, predicates and quantified statements, arguments with quantified statements.

2. HOURS: 8

Number theory and methods of proof:

Direct proof and counterexamples, argument by contradiction and contraposition, rational numbers, divisibility, floor/ceiling, algorithm applications.

3. HOURS: 8

Sequences and mathematical induction:

Types and uses of sequences, mathematical induction on sequences, divisibility and proof in inequalities, strong mathematical induction and the Well-Ordering Principle, correctness of algorithms.

4. HOURS: 8

Set theory and Boolean Algebra:

Basic definitions and properties of set theory, countable and uncountable sets; the empty set, partitions, and power sets; Boolean Algebra; Russell's Paradox.

5. HOURS: 6

Counting and Probability:

Counting, possibility trees and the product rule, principle of inclusion and exclusion, counting elements of disjoint sets, counting subsets of a set, combinations/permutations, Pigeonhole Principle, Pascal's Triangle, Binomial Theorem, probability axioms, expected value, conditional probability, Bayes' Theorem, Independence, Chebyshev's Inequality.

6. HOURS: 8

Functions:

Functions defined on general sets, finite differences, finite-state automata, one-to-one and onto, inverse functions, composition of functions.

7. HOURS: 4

Recursion:

Recursively defined sequences, Stirling numbers, solving recurrence relations by iterations.

8. HOURS: 4

Relations:

Relations on sets; reflexivity, symmetry, and transitivity; equivalence and partial order relations.

9. HOURS: 8

Graphs and Trees:

Graphs, Eulerian and Hamiltonian paths and circuits, chromatic and planar graphs, matrix representation of graphs, isomorphism, trees and spanning trees.

10. HOURS: 8

Efficiency of Algorithms:

Real-valued, exponential, and logarithmic functions; Big-O, big-Omega, and big-Theta notation of real-valued functions.

HOURS: 2

Final exam.

METHODS OF INSTRUCTION:

Instruction will follow a standard lecture/discussion format. Extensive homework will be assigned in order to assure mastery of the concepts covered in class. Students will also be required to utilize technology to enhance their understanding of the material. Students will be given opportunities to work together on problems given in class and group projects.

OUT OF CLASS ASSIGNMENTS:

Required Outside Hours 144

Assignment Description

1. Regularly assigned homework that requires students to analyze and study pertinent text material, solved examples and lecture notes.

2. Regularly assigned homework that requires students to apply the principles and skills covered in class by solving related problems.

3. Projects which require students to explain, apply, and explore concepts taught in class.

METHODS OF EVALUATION:

Writing assignments

Evaluation Percent 10

Evaluation Description

Out-of-class projects.

Problem-solving assignments

Evaluation Percent 10

Evaluation Description

Out-of-class projects.

Objective examinations

Evaluation Percent 80

Evaluation Description

In-class written exams.

REPRESENTATIVE TEXTBOOKS:

Discrete Mathematics with Applications, Susanna Epp, Brooks/Cole, 2019 or a comparable textbook/material.

ISBN: ISBN-13: 978-1337694193 ISBN-10: 1337694193

Rationale: This is the most current edition of the textbook. It is considered a classic on the subject of discrete mathematics.

12 Grade Verified by: Jennifer Nari

Discrete Mathematics and Its Applications, Kenneth Rosen, McGraw-Hill, 2018.

ISBN: ISBN 10: 1260091996 ISBN 13: 9781260091991

Rationale: This is the most current edition of the textbook. It is considered a classic on the subject of discrete mathematics.

12 Grade Verified by: Jennifer Nari

ARTICULATION and CERTIFICATE INFORMATION

Associate Degree:
GAV B4, effective 202030
CSU GE:
CSU B4, effective 202030
IGETC:
IGETC 2A, effective 202030
CSU TRANSFER:
Transferable CSU, effective 202030
Not Transferable
UC TRANSFER:
Not Transferable
Not Transferable

SUPPLEMENTAL DATA:

Basic Skills: N
Classification: Y
Noncredit Category: Y
Cooperative Education:
Program Status: 1 Program Applicable
Special Class Status: N
CAN:
CAN Sequence:
CSU Crosswalk Course Department: MATH
CSU Crosswalk Course Number: 160
Prior to College Level: Y
Non Credit Enhanced Funding: N
Funding Agency Code: Y
In-Service: N
Occupational Course: E
Maximum Hours:
Minimum Hours:
Course Control Number: CCC000592762
Sports/Physical Education Course: N
Taxonomy of Program: 170100