MATH 4 Course Outline as of Summer 2019

CATALOG INFORMATION

Dept and Nbr: MATH 4 Title: DISCRETE MATHEMATICS
Full Title: Discrete Mathematics
Last Reviewed: 9/14/2020

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	4.00	17.5	Lecture Scheduled	70.00
Minimum	4.00	Lab Scheduled	0	6	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	4.00		Contact Total	70.00
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 140.00 Total Student Learning Hours: 210.00

Title 5 Category:	AA Degree Applicable
Grading:	Grade Only
Repeatability:	00 - Two Repeats if Grade was D, F, NC, or NP
Also Listed As:	
Formerly:	

Catalog Description:
A lower division discrete mathematics course including formal logic, Boolean logic and logic circuits, mathematical induction, introduction to number theory, set theory, principles of combinatorics, functions, relations, recursion, algorithm efficiency and graph theory.

Prerequisites/Corequisites:
Completion of MATH 27 or higher (MATH); OR Course Completion of MATH 25 and MATH 58; OR appropriate placement based on AB 705 mandates

Recommended Preparation:
Course Completion of MATH 1A

Limits on Enrollment:

Schedule of Classes Information:
Description: A lower division discrete mathematics course including formal logic, Boolean logic and logic circuits, mathematical induction, introduction to number theory, set theory, principles of combinatorics, functions, relations, recursion, algorithm efficiency and graph theory. (Grade Only)
Prerequisites/Corequisites: Completion of MATH 27 or higher (MATH); OR Course

Completion of MATH 25 and MATH 58; OR appropriate placement based on AB 705 mandates
Recommended: Course Completion of MATH 1A
Limits on Enrollment:
Transfer Credit: CSU;UC.
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**		Effective:	Inactive:
	B	Communication and Analytical Thinking	Fall 2001	
	MC	Math Competency	Fall 1981	
CSU GE:	**Transfer Area**		Effective:	Inactive:
	B4	Math/Quantitative Reasoning	Fall 2001	
IGETC:	**Transfer Area**		Effective:	Inactive:
	2A	Mathematical Concepts & Quantitative Reasoning	Fall 2001	

CSU Transfer:	Transferable	Effective:	Fall 2001	Inactive:
UC Transfer:	Transferable	Effective:	Fall 2001	Inactive:

CID:

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Recognize valid forms of arguments using predicate logic.
2. Construct mathematical proofs of propositions from elementary number theory.
3. Apply combinatorics and set theory to counting problems.
4. Analyze formal languages using finite-state automata.

Objectives:
During this course, students will:
1. Properly structure mathematical algorithms and proofs.
2. Prove theorems by induction.
3. Apply algorithms from elementary number theory.
4. Use set theory and Boolean algebra to construct proofs and solve problems.
5. Apply combinatorics to counting problems, including use of Pigeonhole, Principle, permutations, combinations, and probability.
6. Analyze functions, inverse functions, and finite-state automata.
7. Solve recurrence relations and use recursion to analyze algorithms.
8. Analyze the efficiency of algorithms.
9. Recognize relations and their properties.
10. Use graph theory and matrix representations to develop appropriate models.

Topics and Scope:

I. Logic
   A. Logical form, tautology, and symbolic representation in prepositional logic
   B. Equivalence and minimization of Boolean circuits
   C. Valid and invalid arguments
   D. Quantified statements and predicate logic
   E. Proof strategies
   F. Logic programming
II. Mathematical Induction
   A. Sequences
   B. Weak and strong induction
   C. Well-ordering principle
   D. Correctness of algorithms
III. Combinatorics
   A. Counting
   B. Probability
   C. Possibility trees
   D. Multiplication rule
   E. Addition rule
   F. Inclusion/exclusion
   G. Permutations
   H. Combinations and Binomial Theorem
   I. Counting of multisets
IV. Set Theory
   A. Definitions
   B. Binary operations
   C. Properties
   D. Partitions
   E. Power sets
   F. Boolean algebra
V. Functions
   A. Definition
   B. One-to-one, onto, and inverse functions
   C. Composition of functions
VI. Recursion
   A. Sequences defined recursively
   B. Solving recurrence relations by iteration
   C. Solutions of second-order linear homogeneous recurrence relations with constant coefficients
VII. Algorithm Efficiency
   A. Comparison of real valued functions and their graphs
   B. Big O notation
   C. Calculations of efficiency
VIII. Relations
   A. Relations on sets
   B. Reflexivity
   C. Symmetry
   D. Transitivity
   E. Equivalence relations and modular arithmetic
   F. Relational Databases
IX. Graph Theory
   A. Paths, Euler and Hamiltonian circuits

B. Matrix representations of graphs
C. Trees and its applications: decision trees, Huffman codes
D. Graph algorithms: minimal spanning tree, Warshall's algorithm

X. Formal Languages and Automata
A. Languages and regular expressions
B. Finite-state automata

Assignment:

1. Reading assignments (0-50 pages per week).
2. Homework assignments (15-30) consisting of 5-35 problems from required text(s) or supplementary materials chosen by the instructor.
3. Exams (2-6) including final exam, and quizzes (0-8).
4. Projects (0-2): research papers on a specific topic (5-10 pages) or presentations given as posters or short talks. Papers and presentations must be related to topics taught in the course.

Methods of Evaluation/Basis of Grade:

Writing: Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.	Writing 0 - 0%

Problem Solving: Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework problems	Problem solving 5 - 20%

Skill Demonstrations: All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

None	Skill Demonstrations 0 - 0%

Exams: All forms of formal testing, other than skill performance exams.

Exams and quizzes	Exams 70 - 95%

Other: Includes any assessment tools that do not logically fit into the above categories.

Projects	Other Category 0 - 10%

Representative Textbooks and Materials:
Discrete Mathematics. 8th ed. Johnsonbaugh, Richard. Pearson. 2017

Discrete Mathematics With Applications. 4th ed. Epp, Susanna. Cengage Learning. 2011 (classic)
Discrete Mathematics and Its Applications. 7th ed. Rosen, Kenneth. McGraw-Hill. 2011 (classic)
Discrete Mathematics. Irani, Sandy. zyBooks. online