

Dept Number	CS 215	Course Title	Discrete Mathematics							
Semester Hours	4	Course Coordinator	Kemal Akkaya							
Catalog Description	Introduction to topics relevant to the study of computer science including: number systems, sets, sequences, summations, logic and truth tables, proofs, functions, relations, matrix operations, combinations, permutations, counting techniques, discrete probability, algorithmic complexity, recurrence relations, Boolean algebra, simple combinational circuits, simplification techniques.									
Textbooks										
Rosen, Kenneth H. <u>Discrete Mathematics and Its Applications</u> . McGraw Hill Publisher, 7th edition, ISBN: 9780073383095.										
References										
Rosen, Kenneth H. <u>Discrete Mathematics and Its Applications</u> . McGraw Hill Publisher, 7th edition, ISBN: 9780077353506.										
Course Learning Outcomes										
<ul style="list-style-type: none"> • To obtain a good foundation for further study in computer science. • To learn greater proficiency in basic mathematical concepts that is important in computer science. • Understanding where and how these fundamental topics impact the study of computer science. 										
Assessment of the Contribution to Program Outcomes										
Outcome →	1	2	3	4	5	6	7	8	9	10
Assessed →	X	X	X			X		X		
Prerequisites by Topic										
Mathematics 111 or equivalent with a grade of C or better.										

Major Topics Covered in the Course

1. Logic
Propositional logic, truth tables; conjunction, disjunction, negation; conditional, inverse, converse, contra positive; logical equivalence
Quantification: existential and universal, nesting
Counterexample methods of proof: direct, indirect, contradiction
Example: logic programming { 6 classes }
2. Sets
Definitions: equality, subset, cardinality, power set; n-tuple, Cartesian product, empty set, disjoint sets, universe
Operations: union, intersection, difference, complement; principle of inclusion-exclusion; set identities
Example: computer representation of sets { 2 classes }
3. Functions and relations
Definitions: function, one-to-one functions, onto functions, domain range, inverse function, composition; representing the graph of a function
Common functions: floor, ceiling, factorial, absolute value, polynomial functions; Horner's method
Properties of relations: reflexive, symmetric, transitive, composite of two relations
Equivalence relations
Equivalence classes and partitions
n-ary relations
Examples: growth curves, databases and relations { 4 classes }
4. Integers
Definition of division; definition of a prime number and a composite; fundamental theorem of arithmetic; prime factorizations; the division algorithm; concept of the div and mod operators
Greatest common divisor; least common multiple; modular arithmetic; representations of integers in decimal, binary, and hexadecimal; conversion from one base to another; Horner's method
Euclidean algorithm
Examples: Pseudo random numbers, cryptography
5. Matrices
Definitions: identity matrix, sum, product, transpose symmetric matrix
Example: representation of relations using matrices { 2 classes }
6. Sequences and summations; arithmetic progression; geometric progression; summation notation; common summation { 2 classes }
7. Proof by mathematical induction; mechanics of a proof; validity of a proof by mathematical induction { 2 classes }
8. Counting techniques; product rule; sum rule; principle of inclusion-exclusion; use of tree diagrams; permutations; combinations; binomial theorem; Pascal's triangle; permutations with repetitions
Example: generating permutations and combinations { 3 classes }
9. Recurrence relations: definitions; common examples; compound interest, Fibonacci numbers, and tower of Hanoi solving recurrence relations; linear homogeneous relations with constant coefficients; linear non homogeneous relations with constant coefficients
Example: divide and conquer recurrence relations { 3 classes }
10. Boolean algebra; Boolean algebra and logic gates; simplification of Boolean functions; Karnaugh maps; simple combinational circuits { 12 classes }