

Course Outline

1. Document Information

Degree Program	Computer Science
Course Number	CS 215
Course Title	Discrete Mathematics
Semester Hours	4
Course Coordinator	Rana Salameh
Revision Term	Spring 2020
Latest Revision	Spring 2020

2. 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.

3. Textbooks

- Irani, Sandy. 2020. Discrete Mathematics. ZYBooks, e-book.

4. References

5. Course Learning Outcomes

- 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.

6. Assessment of the Contribution to Student Outcomes

Outcome	1	2	3	4	5	6
Assessed		X				X

7. Prerequisites by Topic

Mathematics 111 or equivalent with a grade of C or better.

8. Major Topics Covered in the Course

- 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}
- 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}
- 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}
- 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}