Course Number	**CS 215**	**Course Title**	**Discrete Mathematics**
Semester Hours	**4**	**Course Coordinator** SP20	**Rana Salameh**
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 SP20

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

References

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.

Assessment of the Contribution to Student Outcomes SP20

Outcome →	1	2	3	4	5	6
Assessed →		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}