Discrete Mathematics

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Abstract

Discrete Mathematics Udemy Course

1 Set Theory

- Set Operations

- Power Sets

- Subsets

- Venn Diagrams

Introduction to Sets

A set is a collection of objects which are called the members or elements of that set. If we have a set we say that some objects belong (or do not belong) to this set, are (or are not) in the set. We say also that sets consist of their elements.

Specifying Sets

There are three main ways to specify a set:

(1) by listing all its members (list notation);

(2) by stating a property of its elements (predicate notation);

(3) by defining a set of rules which generates (defines) its members (recursive rules).

- $\emptyset$ The empty set

- $\sqrt{(S)}$ The power set

2   Counting

- Combinations

- Permutations

- The choose operator

Factorial Function

The product of the positive integers from 1 to n inclusive is denoted by $n!$, read n factorial. Namely:

$$n! = 1 \times 2 \times 3 \times \ldots \times (n2) \times (n1) \times n$$

Accordingly, $1! = 1$ and $n! = n(nl)!$.
It is also convenient to define $0! = 1$.

$$\binom{n}{k} = \frac{n!}{k! \times (n-k)!}$$

Permutation

Any arrangement of a set of n objects in a given order is called a permutation of the object (taken all at a time).

3   Logic

- Important Logical Operators

- Conditional Connectives

- Logic Tables

- Using Logic Tables for Proofs

- Logical Gate Networks

Important Logical Operators

$p \vee q$ p and q

$p \wedge q$ p or q

$\neg p$ Not P

Logic Gates

AND gates

OR gates

XOR gates

NOT gates

4 Numbers and Number Systems

- Binary Numbers

- Hexadecimal Numbers

- Octal Numbers and Base 5 Numbers

Hexadecimal Numbers

Hexadecimal numbers are commonly used to represent memory addresses in computer systems.

Hexadecimal Numbers uses sixteen distinct symbols, most often the symbols 09 to represent values zero to nine, and A,B,C,D,E,F (or alternatively af) to represent values ten to fifteen. For example, the hexadecimal number 2AF3 is equal, in decimal, to $(2 \times 16^3) + (10 \times 16^2) + (15 \times 16^1) + (3 \times 16^0)$, or 10995.

5 Functions (1)

- Logarithms

- Exponentials

- The Absolute Value Functions

- Trigonometric Functions

- The floor and Ceiling functions

6 Functions (2)

- Arrow Diagrams

- One-to-One functions

- Onto Functions

7 Graph Theory

- Introduction to Graph Theory

- KEy Terms and Definitions in Graph Theury

- Isomorphism

- Digraphs

8 Proof by Induction

9 Relations and Functions

- Ordered Pairs

- Cartesian Products

Partial Ordering Relations

A relation R on a set S is called a partial ordering or a partial order of S if R is reflexive, antisymmetric, and transitive. A set S together with a partial ordering R is called a partially ordered set or poset.