Unit I

Digital computers and digital systems: binary numbers, Binary addition and Subtraction, Unsigned Binary numbers, 1's compliments, 2's compliments, Number base conversion, Octal and Hexadecimal number system, Compliments, Binary codes, Binary storage and Registers. Algebra: Definition of Boolean Algebra, Laws and Theorems and properties of Boolean algebra, Simplifications of Boolean functions for 2, 3 and 4 variable maps, Sum-of-products, product of sums, Karnaugh Map, menthol Canonical forms, Don't Care conditions.

Binary Numbers:

Representation: Binary numbers use only two digits, 0 and 1, to represent all values.

Place Value: Each digit's position represents a power of 2 (similar to how decimal positions represent powers of 10).

Conversion: Converting from decimal to binary involves division by 2 and noting remainders.

Binary Addition and Subtraction:

Addition: Adding binary numbers follows the same rules as decimal addition but with simpler carry rules (0 + 0 = 0, 1 + 0 = 1, 1 + 1 = 10).

Subtraction: Subtraction in binary involves borrowing, similar to decimal subtraction.

Unsigned Binary Numbers:

Representation: Positive integers are represented in binary without a sign bit.

1's Complement:

Representation: To represent negative numbers, invert all the bits of the corresponding positive number.

Addition: Add 1 to the least significant bit to convert between positive and negative numbers.

2's Complement:

Representation: To represent negative numbers, invert all bits and add 1 to the least significant bit.

Advantages: Provides a unique representation for zero and simplifies arithmetic operations.

Number Base Conversion:

Binary to Decimal: Multiply each digit by its place value and sum the results.

Decimal to Binary: Successively divide the decimal number by 2, noting remainders.

Octal and Hexadecimal Number Systems:

Octal (Base 8): Uses digits 0-7 to represent binary numbers in groups of 3 bits.

Hexadecimal (Base 16): Uses digits 0-9 and A-F to represent binary numbers in groups of 4 bits.

Complements:

Used for Representation: Techniques to represent negative numbers in binary.

Operations: Used in arithmetic operations to handle negative numbers.

Binary Codes:

Gray Code: A binary code where consecutive numbers differ by only one bit.

BCD (Binary Coded Decimal): Represents each decimal digit with a fixed number of binary bits.

Binary Storage and Registers:

Memory Units: Storage of binary data in memory units (RAM, ROM, etc.).

Registers: Temporary storage units used in CPUs for data manipulation.

Algebra

Boolean Algebra:

Variables: Operates on variables that can have only two values, typically denoted as 0 (false) and 1 (true).

Operations: Involves logical operations such as AND, OR, NOT, XOR, etc.

Laws and Theorems of Boolean Algebra:

Idempotent Law: A OR A = A; A AND A = A.

Commutative Law: A OR B = B OR A; A AND B = B AND A.

Distributive Law: A AND (B OR C) = (A AND B) OR (A AND C).

Properties of Boolean Algebra:

Associative Property: (A OR B) OR C = A OR (B OR C).

De Morgan's Laws: NOT(A AND B) = NOT A OR NOT B; NOT(A OR B) = NOT A AND NOTB.

Simplification of Boolean Functions:

Karnaugh Maps: Visual method for simplifying Boolean expressions by grouping adjacent

1s.Sum-of-Products and Product-of-Sums:

Sum-of-Products: Expression in which variables are ANDed together and then

ORed. Product-of-Sums: Expression in which variables are ORed together and

then ANDed.Karnaugh Map:

Graphical Method: Represents truth tables in a grid to identify patterns for

simplification.Minterm and Maxterm Canonical Forms:

Minterm: Represents each row in a truth table where the output

is 1. Maxterm: Represents each row in a truth table where the

output is 0.Don't Care Conditions:

Unused Outputs: Conditions where the output value is irrelevant for certain input combinations.