Digital Logic and Circuit

Number System

B.Sc. 2^{nd} Semester

Introduction

- Information representation
  - Elementary storage units inside computer are electronic switches. Each switch holds one of two states: on (1) or off (0). We use a bit (binary digit), 0 or 1, to represent the state.
    - Storage units can be grouped together to cater for larger range of numbers

$$1 \rightarrow 01$$

$$2 \rightarrow 10$$

$$3 \rightarrow 11$$

$$4 \rightarrow 100$$

- N bits can represent 2^N different values.

example:

1 bit = 2^1= 2 different values

values are 0 and 1.

2 bit = 2^2 = 4 different values

values 00, 01, 10, 11

00 → 0

01 → 1

10 → 2

11 → 3

Test

- If the number of bits are 4 then the values are??
- 100 values require how many bits??
- 1024 values require how many bits??

- For M values $\lceil \log_2 M \rceil$

100 values → 7 bits

1024 values → 10 bits

64 values → 6 bits

40 values → 6 bits

Position Notation

- Decimal number System
  - Uses ten symbols (base 10 system)
  - Symbols = {0,1,2,3,4,5,6,7,8,9}
  - Position is important
  - Example : $(5897)_{10} = (5 \times 10^3) + (8 \times 10^2) + (9 \times 10^1) + (7 \times 10^0)$
  - In general :$(a_n a_{n-1} a_{n-2} \dots a_0)_{10} = (a_n \times 10^n) + (a_{n-1} \times 10^{n-1}) + (a_{n-2} \times 10^{n-2}) + \cdots + (a_0 \times 10^0)$