Digital Electronics

Syllabus:

Number Representations - Binary, integer and float point numb

Combinational circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circu code converters, multiplexers, decoders.

Sequential Circuits: Latches and flip flops, counters, shif registers, finite state machines, propogation delay, setup an hold time, critical path delay.

Data Converters: sample and hold circuits, ADCs and DAC

semiconductor Memories: ROM, SRAM, DRAM

Computer Organisation: Machine Instructions and addressing modes, ALU, data-path and control unit, instruction pipelining

Number System:

It defines a set of values used to represent quantity

Name	Base / Radix (r)	
Binary (0,1)	2	Here 0 and 1 are called as bits
Octal (0-7)	8	0, 1, 2, 3, 4, 5, 6, 7
Decimal (0-9)	10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Hexadecimal (0-15)	16	10 - A 11 - B 12 - C 13 - D 14 - E 15 - F

Weighted and Non weighted Codes:

Eg: $\underset{10^3}{7}\ \underset{10^2}{3}\ \underset{10^1}{9}\ \underset{10^0}{2} = 7000 + 300 + 90 + 2$

$7\times10^3 + 3\times10^2 + 9\times10^1 + 2\times10^0$

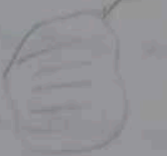
$\Rightarrow$ These are weighted codes

Number System

- Weighted Codes
  1. Binary
  2. Decimal
  3. Octal
  4. Hexadecimal
- Non weighted Codes
  1. Gray code
  2. Excess 3 code

*When a number is converted from one number system to another the number of digits increase or decrease depending on the system

Quantity



$r_1 \rightarrow$ binary

$r_2 \rightarrow$ decimal

r_1 r_2

N_1 N_2

Total No of digits

$\boxed{r_1 < r_2 \text{ but } N_1 > N_2}$ Some time this number of digits will occurs to be same.

$(7392)_{10} \rightarrow (1110011100000)_2$

Binary Number System:

*Binary digits (0, 1) are called as bits

Eg: $\underset{2^4}{1}\ \underset{2^3}{0}\ \underset{2^2}{1}\ \underset{2^1}{0}\ \underset{2^0}{1} \rightarrow (21)_{10}$

$(1\times2^4 + 0 + 1\times2^2 + 0 + 1\times2^0$

$(1\times16) + 0 + (1\times4) + 0 + (1\times1)$

$16 + 0 + 4 + 0 + 1$

21

0.25

0.5

10101.11

$1\times2^4 + 1\times2^2 + 1\times2^0 \quad 1\times2^{-1} + 1\times2^{-2}$

21.075

MSB and LSB:

MSB - Most Significant Bit

LSB - Least Significant Bit

Eg: $\overset{b_4}{1}\ \overset{b_3}{0}\ \overset{b_2}{1}\ \overset{b_1}{0}\ \overset{b_0}{1} = 21$

MSB   LSB

When b_4 is changed to 0   When b_0 is changed to 0

00101 - 5   10100 - 20

The difference between these 2 changes is, one has less changes and the other has greater changes.

Hence, b_4 has more significance, so MSB and b_0 has less significance, so LSB.

* Bits are smallest units of data.

1 Nibble - 4 bits (used for BCD, Hexadecimal)

1 Byte - 8 bits (

1 Word - 16 bits = 2 bytes

1 double word - 32 bits = 4 bytes.

Decimal to Binary Conversion:

- To convert decimal to any other base 'r', divide the integer part by r and multiply fractional part by r.

Eg: $(13)_{10} \rightarrow (1101)_2$

Quotient	Dividend	remainder
2	13	1
2	6	0 LSB
2	3	1
2	1	1 MSB
	0	

when remainder is zero
write the output this way

$(25.625)_{10} \rightarrow (11001.101)_2$

$.625 \times 2 = 1.25 \rightarrow 1$

$0.25 \times 2 = 0.5 \rightarrow 0$

$0.5 \times 2 = 1.0 \rightarrow 1$

$0 \times 2 = 0$

2	25	1
2	12	0
2	6	0
2	3	1
2	1	1
	0	

Eg $(67)_{10} \rightarrow (100011)_2$

2	67	1
2	33	1
2	16	0
2	8	0
2	4	0
2	2	0
2	1	1
	0	

Eg $(129.75)_{10} \rightarrow (10000001.110)_2$

$0.75 \times 2 = 1.5$ 1

$0.5 \times 2 = 1.0$ 1

$0 \times 2 = 0$ 0

2	129	1
2	64	0
2	32	0
2	16	0
2	8	0
2	4	0
2	2	0
2	1	1
	0	

Decimal to Octal Conversion:

1. $(112)_{10} \rightarrow (160)_8$

8	112	0
8	14	6
8	1	1
	0	

2. $(25.625)_{10} \rightarrow (31.50)_8$

8	25	1
8	3	3
	0	

$0.625 \times 8 = 5.00$ 5

$0.0 \times 8 = 0$

Decimal to Hexadecimal Conversion:

1. $(254)_{10} \rightarrow (FE)_{16}$

16	254	14 - E
16	15	15 - F
	0	

2. $(25.625)_{10} \rightarrow (19.A0)_{16}$

16	25	9
16	1	1
	0	

$0.625 \times 16 = 10.00 - A$

$0.00 \times 16 = 0$

Sum with different base $r = 4$

3) $(27.4)_{10} \rightarrow (123.1212)_4$

4	27	3
4	6	2
4	1	1
	0	

$0.4 \times 4 \rightarrow 1.6$ 1

$0.6 \times 4 \rightarrow 2.4$ 2

$0.4 \times 4 \rightarrow 1.6$ 1

$0.6 \times 4 \rightarrow 2.4$ 2

point