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Lecture ONE : Number Systems

Number systems :

In general any number N can be represented in the base (radix) R as show below :

$N_R = d_nR^n + d_{n-1}R^{n-1} + \ldots\ldots\ldots d_1R^1 + d_0R^0$

1-Decimal system (R= 10) :

This system uses (10) symbols (0 – 9)

Ex: $N_{10} = 2^33^26^18^0 = 2x10^3 + 3 \times 10^2 + 6x10^1 + 8x10^0 = 2000 + 300 + 60 + 8 = 2368$

2-Binary system (R = 2) :

It uses only two basic symbol (0,1) . It is the most suitable number system for digital circuits.

Ex: $N_2 = 1^41^30^20^11^0 = 1(2)^4 + 1(2)^3 + 0(2)^2 + 0(2)^1 + 1(2)^0 = 16 + 8+0+0+1 = (25)_D$

Ex: $1^30^20^11^0 = 1(2)^3 + 0(2)^2 + 0(2)^1 + 1(2)^0 = 8+0+0+1 = (9)_D$

3-Octal system (R= 8) :

It uses 8 symbols (0- 7)

Ex : $1^17^0 = 1(8)^1 + 7(8)^0 = 8+7 = (15)_D$

Ex: $7^30^24^15^0 = 7(8)^3 + o(8)^2 + 4(8)^1 + 5(8)^0 = 3584 + 0 + 32 + 5 = (3621)_D$

4- Hexadecimal system (R =16)

It uses 16 symbol :

(0,1,2,……,9,A,B,C,D,E,F)

Ex: $1^1A^0 = 1(16)^1 + A(16)^0 = 16+10 = (26)_D$

Ex: $3^29^15^0 = 3(16)^2 + 9(16)^1 + 5(16)^0 = 768 + 144 + 5 = (917)_D$

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Logic Design First Stage

The following table gives the correspondence between the four number system :

Decimal	Binary	Octal	Hexadecimal
0	0	0	0
1	01	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	.	C
.	.	.	D
.	.	.	E
.	.	.	F
.	.	.	10
.	.	.	11
.	.	.	12

Continue the above table.