DIGITAL SYSTEM DESIGN

UNIT 1 : LOGIC SIMPLIFICATION AND COMBINATIONAL LOGIC DESIGN

Today's Target

Conversion of

- Binary number to Decimal
- Decimal to octal
- Binary to Octal
- DPP

Binary To Decimal Conversion

- The decimal number is equal to the sum of binary digits (d_n) times their power of 2 (2^n):

$$\text{decimal} = d_0\times2^0 + d_1\times2^1 + d_2\times2^2 + \ldots$$

MSB LSB

1 0 1 1

$1\times2^3 + 0\times2^2 + 1\times2^1 + 1\times2^0$

$8 + 0 + 2 + 1$

$= (11)_{10}$

1 0 1 0 1 1

$1\times2^5 + 0\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 1\times2^0$

$32 + 0 + 8 + 0 + 2 + 1$

$= (43)_{10}$

Example: Find the decimal value of 111001_2

$$(0.111001)_2$$

$$= 0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-3} + 0 \times 2^{-4} + 0 \times 2^{-5} + 1 \times 2^{-6}$$

$$= 0 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + 0 + 0 + \frac{1}{64}$$

$$= 0.5 + 0.25 + 0.125 + 0 + 0 + 0.015625$$

$$= (\quad)_{10}$$

Binary with decimal point

$(1101.101)_2 = (\ \ )_{10}$

$1\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0 + 1\times2^{-1} + 0\times2^{-2} + 1\times2^{-3}$

$8 + 4 + 0 + 1 + 0.5 + 0 + 0.125$

$13 + 0.625$

$= (13.625)_{10}$

Decimal To Octal

- **Convert decimal number 210 into octal number.**

$(210)_{10} \longrightarrow (1262)_8$

8	210	2
8	86	6
8	10	2
8	1	1
	0	

↑

Conversion of Decimal Fraction Number in Octal Number

$(0.12)_{10} = (\quad)_8 = (0.0751)_8$

$0.12 \times 8 = 0.96 \rightarrow 0$

$0.96 \times 8 = 7.68 \rightarrow 7$

$0.68 \times 8 = 5.24 \rightarrow 5$

$0.24 \times 8 = 1.92 \rightarrow 1$

$$(10.56)_{10} = (12.436)_8$$

8	10	2
8	1	1
	0	

$0.56 \times 8 = 4.48 \quad 4$

$0.48 \times 8 = 3.84 \quad 3$

$0.84 \times 8 = 6.72 \quad 6$

Binary To Octal Conversion

There are two methods:

1) Binary to Decimal to Octal
2) Grouping

Convert binary number 10010110 into octal number.

Method-I

$$1\ 0\ 0\ 1\ 0\ 1\ 1\ 0$$

$$1\times2^{7}+0+0+1\times2^{4}+0\times2^{3}+1\times2^{2}+1\times2^{1}+0\times2^{0}$$

$$128+16+4+2+0$$

$$(150)_{10}$$

8	150	6
8	18	2
8	2	2
	0	

$= (226)_8$

$$(10010110)_2 \rightarrow (226)_8$$

Convert binary number 10010110 into octal number.

Method-II

$$\underline{\underline{.}}\,|0|1|1|0|0|1|0|1\cdot|1|0|0|1|0|0|0|1|0\underline{\underline{\ }}$$

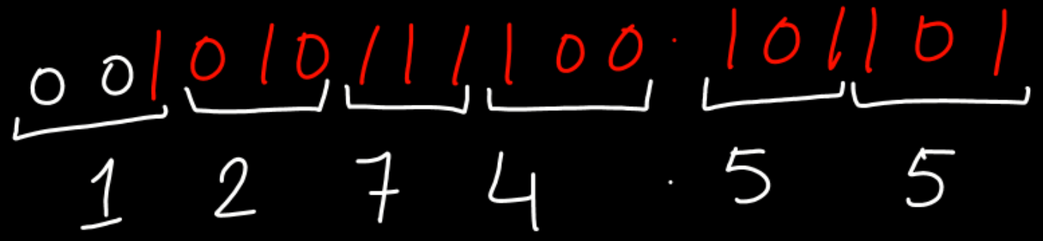
$$5\ \ 4\ \ 5\cdot 4\ 4\ 2$$

$$(10110010\cdot 10010001\underline{0})_2$$

$$=(545\cdot 442)_8$$

0 →	0 0 0
1 →	0 0 1
2 →	0 1 0 ✓
3 →	0 1 1
4 →	1 0 0 ✓
5 →	1 0 1 ✓
6 →	1 1 0
7 →	1 1 1

Convert binary number 1010111100.101101 into octal number.



$$= (1274 \cdot 55)_8$$

DPP :Lec-2

Convert :

a) $(1011010.10110)_2 = (\ )_{10}$

b) $(1011010)_2 = (\ )_{10}$

c) $(0.10110)_2 = (\ )_{10}$

d) $(421)_{10} = (\ )_8$

e) $(125.68)_{10} = (\ )_8$

f) $(1011010)_2 = (\ )_8$

g) $(10111010.10110)_2 = (\ )_8$

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