Logical Design

Lecture 3

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Decimal Number System to Other Bases Conversion

To convert a decimal number into an equivalent binary number we have to divide the original number system by 2 until the quotient is 0 , when no more division is possible. The remainder so obtained is counted for the required number in the order of LSB (Least significant bit) to MSB (most significant bit).

Example: Convert 26_{10} into a binary number.

Solution: Given 26_{10} is a decimal number.

Divide 26 by 2

26/2 = 13 Remainder →0 (MSB)

13/2 = 6 Remainder →1

6/2 = 3 Remainder →0

3/2 = 1 Remainder →1

½ = 0 Remainder →1 (LSB)

Hence, the equivalent binary number is $(11010)_2$

Decimal to Octal Conversion

the decimal number is required to be divided by 8 until the quotient is 0. Then, in the same way, we count the remainder from LSB to MSB to get the equivalent octal number.

Example: Convert 65_{10} into an octal number.

Solution: Given 65_{10} is a decimal number.

Divide by 8

65/8 = 8 Remainder →1 (LSB)

8/8 = 1 Remainder →0

⅛ = 0 Remainder →1 (MSB)

Hence, the equivalent octal number is $(101)_8$

Decimal to Hexadecimal Conversion

The given decimal number here is divided by 16 to get the equivalent hex. The division of the number continues until we get the quotient 0.

Example: Convert 127_{10} to a hexadecimal number.

Solution: Given 127_{10} is a decimal number.

Divide by 16

127/16 = 7 Remainder →15

7/16 = 0 Remainder → 7

In the hexadecimal number system, alphabet F is considered as 15.

Hence, 127_{10} is equivalent to $7F_{16}$

Binary to Octal Conversion

Example 1: Convert 1010101_2 to octal

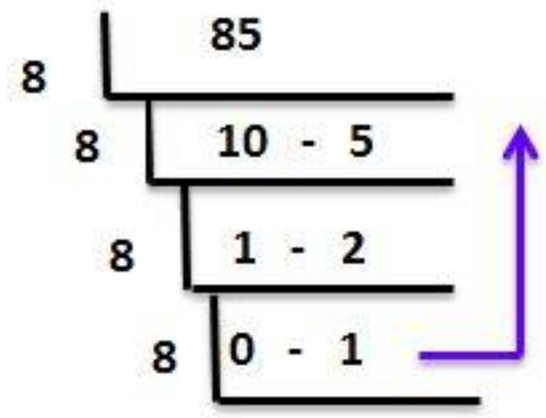
First, we convert given binary to decimal

$= (1 * 2^6) + (0 * 2^5) + (1 * 2^4) + (0 * 2^3) + (1 * 2^2) + (0 * 2^1) + (1 * 2^0)$

$= 64 + 0 + 16 + 0 + 4 + 0 + 1$

$= 64 + 21$

$010101_2 = 85$ (Decimal form)



Therefore, the equivalent octal number is 125_8.

Octal to Binary Number Conversion

Convert 41_8 to a binary number.

Step1 : convert the given octal number into its equivalent decimal number

$41_8 = (4 * 8^1) + (1 * 8^0)$

= 4 * 8 + 1 * 1

= 32+1

= 33(Decimal number)

Decimal Number divided by 2	Quotient	Remainder
33 divided by 2	16	1
16 divided by 2	8	0
8 divided by 2	4	0
4 divided by 2	2	0
2 divided by 2	1	0
1 divided by 2	0	1

Therefore, the equivalent binary number is 100001_2.

Binary to Hexadecimal Conversion

Example − Convert binary number 1101010 into hexadecimal number.

First convert this into decimal number:

$= (1101010)_2 = 1x2^6+1x2^5+0x2^4+1x2^3+0x2^2+1x2^1+0x2^0 = 64+32+0+8+0+2+0$

$= (106)_{10}$

Then, convert it into hexadecimal number

Divide $(106)_{10}$ successively by 16 until the quotient is 0:

106/16 = 6, remainder is 10

6/16 = 0, remainder is 6

$= (6A)_{16}$ which is answer.