Number System

- Base or Radix: A number system of *base* or *radix, r* is system that uses distinct symbols for r digits.

- Decimal: A decimal number is having base as 10. The 10 symbols are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

- Binary: A binary number is having base as 2. The 2 symbols are 0 & 1.

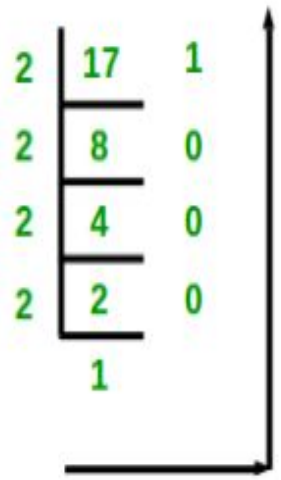
- Octal: A octal number is having base as 8. The 8 symbols are 0, 1, 2, 3, 4, 5, 6 & 7.

- Hexadecimal: A hexadecimal number is having base as 16. The symbols used are 0, 1, 2, 3, 4, 5, 6, 8, 9 , A, B, C, D, E, F.

Decimal(10) to Binary(2) & Vice-versa

Decimal to Binary

Decimal number : 17



Binary number: 10001

Binary to Decimal

Convert 101100101_2 to the corresponding base-ten number.

$$1\times2^8 + 0\times2^7 + 1\times2^6 + 1\times2^5 + 0\times2^4 + 0\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0$$

$$= 1\times256 + 0\times128 + 1\times64 + 1\times32 + 0\times16 + 0\times8 + 1\times4 + 0\times2 + 1\times1$$

$$= 256 + 64 + 32 + 4 + 1$$

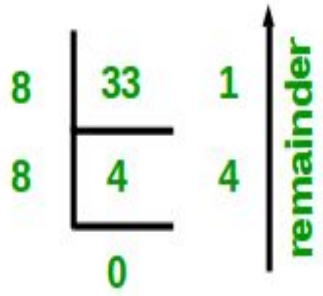
$$= 357$$

Then 101100101_2 converts to 357_{10}.

Decimal(10) to Octal(8) & Vice-versa

Decimal to Octal

Decimal Number: 33



Octal Number: 41

Octal to Decimal

- Example: 253.64_8

$= (2\times8^2) + (5\times8^1) + (3\times8^0) + (6\times8^{-1}) + (4\times8^{-2})$

$= 128 + 40 + 3 + 0.75 + 0.0625$

$= 171.8125$

Decimal(10) to Hexadecimal(16) & Vice-versa

Decimal to Hexadecimal

		Remainders
16	455	
16	28	7
16	1	12(C)
	0	1

Read in reverse order

Therfore, $(455)_{10} = (1C7)_{16}$

Hexadecimal to Decimal

Digit	5	4	D	2
Place value	16^1	16^0	16^{-1}	16^{-2}

$54.D2_{16}$

$= 5 \cdot 16^1 + 4 \cdot 16^0 + D \cdot 16^{-1} + 2 \cdot 16^{-2}$

$= 5 \cdot 16^1 + 4 \cdot 16^0 + 13 \cdot 16^{-1} + 2 \cdot 16^{-2}$

$= 80 + 4 + 0.8125 + 0.0078125$

$= 84.8203125$

Questions

Q1. Convert the following:

a) $(101110)_2 \rightarrow (\ ?\ )_{10}$

b) $(110110100)_2 \rightarrow (\ ?\ )_{10}$

c) $(7562)_{10} \rightarrow (?)_8$

d) $(1938)_{10} \rightarrow (?)_{16}$

e) $(175)_{10} \rightarrow (?)_2$

Q2. Convert the following:

a) $(10110.0101)_2 \rightarrow (\ ?\ )_{10}$

b) $(16.5)_{16} \rightarrow (\ ?\ )_{10}$

c) $(26.24)_{16} \rightarrow (\ ?\ )_{10}$

Q3. Convert the following:

a) $(12121)_3 \rightarrow (\ ?\ )_{10}$

b) $(4310)_5 \rightarrow (?)_{10}$

c) $(50)_7 \rightarrow (?)_{10}$

d) $(198)_{12} \rightarrow (?)_{10}$

Answers

Q1. Convert the following:

a) $(101110)_2$ □ $(46)_{10}$

b) $(110110100)_2$ □ $(436)_{10}$

c) $(7562)_{10}$ □ $(16612)_8$

d) $(1938)_{10}$ □ $(792)_{16}$

e) $(175)_{10}$ □ $(10101111)_2$

Q2. Convert the following:

a) $(10110.0101)_2$ □ $(22.3125)_{10}$

b) $(16.5)_{16}$ □ $(22.3125)_{10}$

c) $(26.24)_{16}$ □ $(38.140625)_{10}$

Q3. Convert the following:

a) $(12121)_3$ □ $(151)_{10}$

n $(4310)_5$ □ $(580)_{10}$

n $(50)_7$ □ $(35)_{10}$

n $(198)_{12}$ □ $(260)_{10}$