

## ASSIGNMENT-1

( Number System Question Bank)

### QUESTION/ANSWERS:-

1. Subtract the following decimal number by 9's and 10's complement method.

$$376.3 - 765.6$$

Ans

9's complement of subtraction :

Step-1 :  $999.99 - 765.6 = 234.39$

Step-2 :  $376.3 + 234.39 = 610.69$

Since, there is no carry so the final answer is negative.  
To get the final answer 9's complement of 610.69

Step-3 :  $999.99 - 610.69 = -389.3$

10's complement of subtraction :

Step-1 :  $999.99 - 765.6 = 234.39$

$$234.39 + 1 = 235.39$$

Step-2 :  $376.3 + 235.39 = 611.69$

Since, there is no carry so the final answer is negative.  
To get the final answer we takes 10's complement  
of ~~765.6~~ 611.69

$$\text{Step - 3 : } 999.99 - 611.69 = 388.3$$

$$388.3 + 1 = -389.3$$

2. Convert the following binary number to decimal.

110110.011

Ans

- To convert the binary number 110110.011 to decimal, you need to handle the integer part and the fractional part separately.

i). Integer part conversion :

• For the binary integer part 110110:

- $1 \times 2^6 = 64$
- $1 \times 2^5 = 32$
- $0 \times 2^4 = 0$
- $1 \times 2^3 = 8$
- $1 \times 2^2 = 4$
- $1 \times 2^1 = 2$
- $0 \times 2^0 = 0$

Adding these values together :  $64 + 32 + 0 + 8 + 4 + 2 + 0$   
 $= 110$

So, the integer part in decimal is 110.

ii). Fractional part conversion :

• For the binary fractional part 0.011 :

- $0 \times 2^{-1} = 0$
- $1 \times 2^{-2} = 0.25$
- $1 \times 2^{-3} = 0.125$

Adding these values together :  $0 + 0.25 + 0.125 = 0.375$

Combining both parts :



Adding the integer and fractional parts :  $110 + 0.375$   
=  $110.375$

Thus, the binary number  $1101110.011$  converts to decimal number  $110.375$

3. Convert the following decimal to binary

205.65

Ans

i). Converting the integer part (205)

$$205 \div 2 = 102 \text{ with remainder } 1$$

$$102 \div 2 = 51 \text{ with remainder } 0$$

$$51 \div 2 = 25 \text{ with remainder } 1$$

$$25 \div 2 = 12 \text{ with remainder } 1$$

$$12 \div 2 = 6 \text{ with remainder } 0$$

$$6 \div 2 = 3 \text{ with remainder } 0$$

$$3 \div 2 = 1 \text{ with remainder } 1$$

$$1 \div 2 = 0 \text{ with remainder } 1$$

Reading the remainders from bottom to top, the binary representation of 205 is 11001101.

ii). Converting the fractional part (0.65)

$$0.65 \times 2 = 1.30 \rightarrow \text{Integer part : 1, fractional : 0.30}$$

$$0.30 \times 2 = 0.60 \rightarrow \text{Integer part : 0, fractional : 0.60}$$

$$0.60 \times 2 = 1.20 \rightarrow \text{Integer part : 1, fractional : 0.20}$$

$$0.20 \times 2 = 0.40 \rightarrow \text{Integer part : 0, fractional : 0.40}$$

$$0.40 \times 2 = 0.80 \rightarrow \text{Integer part : 0, fractional : 0.80}$$

$$0.80 \times 2 = 1.60 \rightarrow \text{Integer part : 1, fractional : 0.60}$$

$$0.60 \times 2 = 1.20 \rightarrow \text{Integer part : 1, fractional : 0.20}$$

$$0.20 \times 2 = 0.40 \rightarrow \text{Integer part : 0, fractional : 0.40}$$

So, the binary representation of 0.65 is 0.10011010

Combining both parts :

The binary representation is 11001101.10011010



4. Add the following binary number.

$$10111.010 + 110111.01$$

Ans

i). Align the binary numbers :

$$\begin{array}{r} 010111.010 \\ + 110111.010 \\ \hline \end{array}$$

ii). Add the binary numbers :

$$0 + 0 = 0$$

$$1 + 0 = 1$$

$$1 + 1 = 10$$

$$1 + 1 + 1 = 11$$

Fractional part :

$$\begin{array}{r} 0.010 \\ + 0.010 \\ \hline 0.100 \end{array} = 0.100$$

Integer part :

$$\begin{array}{r} 010111 \\ + 110111 \\ \hline \end{array}$$

The final result for integer is 1000100.

iii). Combining fractional and integer part :

$$1000100.100$$

5. Subtract following binary number

$$10110 - 1011$$

Ans

i). Align the Binary numbers

$$\begin{array}{r} 10110 \\ - 01011 \end{array}$$

ii). Subtract column by column

0 - 1 requires borrowing.

$$1 - 1 = 0$$

0 - 1 requires borrowing

$$1 - 0 = 1$$

$$1 - 0 = 1$$

$$\begin{array}{r} 10110 \\ - 01011 \\ \hline 01001 \end{array}$$

Hence, the result of subtracting 1011 from 10110 is 01001.

6. Convert following octal number to hexadecimal and Binary.  
256

Ans

i). Convert octal to Binary

• Each octal digit corresponds to a 3-bit binary number.

2 in octal is 010 in binary.

5 in octal is 101 in binary

6 in octal is 110 in binary.

Combine these binary numbers :

$$256_8 \rightarrow (010\ 101\ 110)_2$$

ii). Convert octal to hexadecimal

Binary of 256 :  $010101110_2$

0010 in binary is 2 in hexadecimal

1010 in binary is A in hexadecimal

1110 in binary is E in hexadecimal

$$256_8 \rightarrow 2AE_{16}$$



7. Convert following hexadecimal number to octal and binary.

42FD.

Ans

i). Convert hexadecimal to Binary

- 4 in hexadecimal is 0100 in binary.
- 2 in hexadecimal is 0010 in binary.
- F in hexadecimal is 1111 in binary.
- D in hexadecimal is 1101 in binary.

Combine these binary numbers :

$42FD_{16} \rightarrow 0100\ 0010\ 1111\ 1101_2$

ii). Convert hexadecimal to Octal

Binary : 010000101111101

So, the groups are : 001 010 000 101 111 110

Convert each group to Octal :

001 in binary is 1 in octal

010 in binary is 2 in octal

000 in binary is 0 in octal

101 in binary is 5 in octal

111 in binary is 7 in octal

110 in binary is 6 in octal

Combine these octal numbers :

$42FD_{16} \rightarrow 120576_8$

8. Convert following octal to decimal.

2057.64

Ans

i). Convert the integer (2057) to decimal

$$2 \times 8^3 = 2 \times 512 = 1024$$

$$0 \times 8^2 = 0 \times 64 = 0$$

$$5 \times 8^1 = 5 \times 8 = 40$$

$$7 \times 8^0 = 7 \times 1 = 7$$

Sum these values :

$$1024 + 0 + 40 + 7 = 1071$$

The integer part (2057) in decimal is 1071

ii). Convert the fractional (0.64) to decimal

$$6 \times 8^{-1} = 0.75$$

$$4 \times 8^{-2} = 0.0625$$

The fractional part (0.64) in decimal is 0.8125

Combining (i) and (ii),

The number 2057.64 in decimal is 1071.8125



9. Convert following decimal to octal

8476.47

Ans

i) Convert the integer (8476) to Octal

$$8476 \div 8 = 1059 \text{ with remainder } 4$$

$$1059 \div 8 = 132 \text{ with remainder } 3$$

$$132 \div 8 = 16 \text{ with remainder } 4$$

$$16 \div 8 = 2 \text{ with remainder } 0$$

$$2 \div 8 = 0 \text{ with remainder } 2$$

The integer (8476) in octal is  $20434_8$ .

ii). Convert the fractional (0.47) to octal

$$0.47 \times 8 = 3.76 \rightarrow \text{Integer : } 3, \text{ fractional : } 0.76$$

$$0.76 \times 8 = 6.08 \rightarrow \text{Integer : } 6, \text{ fractional : } 0.08$$

$$0.08 \times 8 = 0.64 \rightarrow \text{Integer : } 0, \text{ fractional : } 0.64$$

$$0.64 \times 8 = 5.12 \rightarrow \text{Integer : } 5, \text{ fractional : } 0.12$$

$$0.12 \times 8 = 0.96 \rightarrow \text{Integer : } 0, \text{ fractional : } 0.96$$

$$0.96 \times 8 = 7.68 \rightarrow \text{Integer : } 7, \text{ fractional : } 0.68$$

The fractional (0.47) in octal is  $0.36057_8$

• Combining (i) and (ii),

8476.47 in octal is  $2034.36057_8$



10. Convert decimal to hexadecimal.

1248.56

Ans

i). Convert integer (1248) to hexadecimal

$$1248 \div 16 = 78 \text{ with remainder } 0$$

$$78 \div 16 = 4 \text{ with remainder of } 14 (E)$$

$$4 \div 16 = 0 \text{ with a remainder of } 4$$

So, the integer (1248) is 4E0.

ii). Convert fractional (0.56) to hexadecimal

$$0.56 \times 16 = 8.96$$

$$0.96 \times 16 = 15.36$$

$$0.36 \times 16 = 5.76$$

$$0.76 \times 16 = 12.16$$

$$0.16 \times 16 = 2.56$$

$$0.56 \times 16 = 8.96$$

So, the fractional (0.56) is 8F5C2.

By combining (i) and (ii),

1248.56 in decimal is 4E0.8F5C2

11. Convert hexadecimal to decimal

8E47.AB

Ans

i). Integer (8E47) in decimal

8 in hexadecimal is 8 in decimal

E in hexadecimal is 14 in decimal

4 in hexadecimal is 4 in decimal

7 in hexadecimal is 7 in decimal

8E47 in decimal is 36323

ii). Fractional (AB) in decimal

A in hexadecimal is 10 in decimal

B in hexadecimal is 11 in decimal

The fractional (AB) in decimal is 0.66796875

Combining (i) and (ii),

36323.66796875

12. Convert following binary number to octal and hexadecimal numbers.

1101110.011

Ans

i). Binary to octal :-

i). Integer (1101110)

ii). Fractional (0.011)

$$001_2 = 1_8$$

$$101_2 = 5_8$$

$$111_2 = 7_8$$

$$011_2 = 3_8$$

Integer (1101110) is  $157_8$ . Fractional (0.011) is  $0.3_8$

Binary (1101110.011) in octal is  $157.3$

ii). Binary to hexadecimal :-

i). Integer (1101110)

ii). Fractional (0.011)

$$0110_2 = 6_{16}$$

$$1110_2 = E_{16}$$

$$0110_2 = 6_{16}$$

Integer (1101110) is  $6E_{16}$  Fractional (0.011) is  $0.6_{16}$ .

Binary (1101110.011) in hexadecimal is  $6E.6_{16}$ .



13. Add  $-45.75$  to  $87.5$  using 2's complement arithmetic.

Ans

i). Convert the number to binary :

a)  $87.5$

$$87.5_{10} = 1010111.1_2$$

b).  $-45.75$

$$-45.75_{10} = 101101.11_2$$

ii). Align both numbers to have the same number of bits :

$$87.5_{10} = 1010111.1_2 \text{ (needs 2 more bits for alignment)}$$

$$-45.75_{10} = 11010010.01_2 \text{ (needs 1 more bit for alignment)}$$

$$\begin{array}{r} 001010111.10 \quad (87.5) \\ + 11010010.01 \quad (-45.75) \end{array}$$

iii). Perform the addition :

$$\begin{array}{r} 001010111.10 \\ + 11010010.01 \\ \hline 100000010.11 \end{array}$$

iv). Convert back to decimal.

$$100000010.11_2$$

The correct binary result is  $00000010.11_2$ .

Convert back to decimal :

$$I = 00000010_2 = 2_{10}$$

$$F = 0.11_2 = 0.75_{10}$$

Therefore ,

$$= 2 + 0.75$$

$$= 2.75$$

- Hence , the result of adding  $-45.75$  to  $87.5$  using 2's complement arithmetic is  $2.75$ .

17. Add  $-45.75$  to  $87.5$  using 1's complement arithmetic.

Ans

i). Convert the numbers to binary :

a).  $87.5$

$$\text{Integer } 87_{10} = 1010111_2$$

$$\text{Fractional } 0.5_{10} = 0.1_2$$

$$87.5 \text{ is } 1010111.1_2.$$

b).  $47.5$

$$\text{Integer } 47_{10} = 101101_2$$

$$\text{Fractional } 0.5_{10} = 0.11_2$$

$$47.5 \text{ is } 101101.11_2.$$

$$87.5 \text{ in binary : } 01010111.10_2$$

$$47.5 \text{ in binary : } 00101101.11_2$$

ii). Find the 1's complement of  $45.75$  :

$$\cdot \text{ 1's complement of } 00101101.11_2 : 11010010.00_2$$

iii). Add the 1's complement of  $-45.75$  to  $87.5$

$$\begin{array}{r} 01010111.10 \\ + 11010010.00 \\ \hline 100101001.10 \end{array}$$



iv). Convert the result back to decimal :

Binary result :  $00101010.00_2$

• Integer :  $00101010_2 = 42_{10}$

• Fractional :  $0.00_2 = 0_{10}$

Thus, the final result in decimal is 42.00.

Using 1's complement arithmetic, the result of adding -45.75 to 87.5 is 42.00.

20. Multiply following binary numbers

$$1101 * 101$$

Ans

i). Write down the numbers:

$$1101$$

$$\times 101$$

ii). Multiple each of the second number (101) by the first number (1101).

$$\begin{array}{r} 1101 \\ \times 1 \\ \hline 1101 \end{array}$$

$$\begin{array}{r} 1101 \\ \times 0 \\ \hline 0000 \end{array}$$

$$\begin{array}{r} 1101 \\ \times 1 \\ \hline 1101 \end{array}$$

iii). Add the results:

$$\begin{array}{r} 1101 \\ 0000 \\ 110100 \\ \hline 100101 \end{array}$$

So, the product of  $1101 * 101$  is 100101