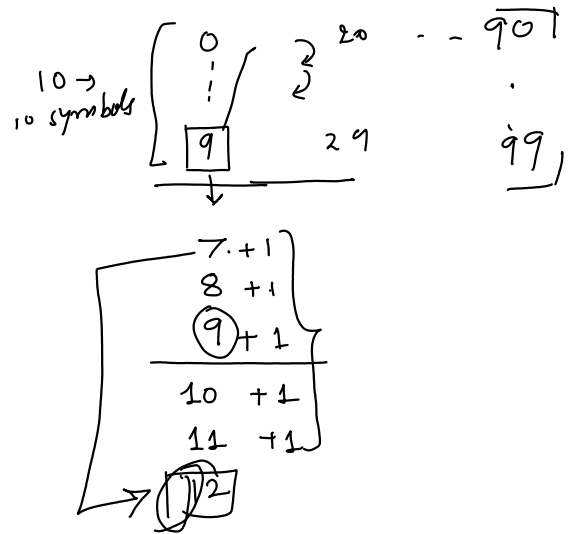


* Arithmetic Operation :-

(1) Addition (2) Subtraction (3) Multiplication (4) Division

[1] Addition :-

$$\begin{array}{r} \overset{1}{4}07 \\ + 85 \\ \hline 492 \end{array} \quad \left. \vphantom{\begin{array}{r} \overset{1}{4}07 \\ + 85 \\ \hline 492 \end{array}} \right\} \text{decimal}$$



* Octal :-

$$\begin{array}{r} (405)_8 + (75)_8 \\ \begin{array}{r} \overset{1}{4}05 \\ + 75 \\ \hline (502)_8 \end{array} \end{array}$$

$$\begin{array}{l} \left[\begin{array}{c} 0 \ 10 \\ \vdots \ 11 \\ \vdots \ 12 \\ \vdots \ 13 \\ \vdots \ 14 \\ \vdots \ 15 \end{array} \right] \quad 5+5 = (10)_{10} \neq (10)_8 \\ \text{Deci: } \left[\begin{array}{c} 7+1 \\ 8+1 \\ 9+1 \\ 10+1 \\ 11+1 \\ 12+1 \\ 13+1 \\ 14+1 \end{array} \right] \rightarrow (14)_8 \\ 7+5 = (12)_{10} = (14)_8 \end{array}$$

$(14)_8 \Rightarrow (12)_{10}$

$$1 \times 8^1 + 4 \times 8^0 = 8 + 4 = 12$$

(1) $(357.346)_8 + (65.137)_8$

(2) $(143.776)_8 + (751.667)_8$

$$\begin{array}{r} \overset{1}{3}57.346 \\ + 65.137 \\ \hline (444.505)_8 \end{array}$$

Ans 1 =

Ans 2 = $(1115.665)_8$

* Hexadecimal :-

$$(4A5.23)_{16} + (559.F8)_{16}$$

$$\begin{array}{r} \overset{1}{4}A5.23 \\ + 559.F8 \\ \hline \end{array}$$

$$\begin{array}{l} \left[\begin{array}{c} 0 \\ \vdots \\ F+1 = (F)_{10} \\ 10+1 = (16)_{10} \\ 11 = (17)_{10} \end{array} \right] \quad 16 \text{ symbol} \\ 8+3 = (11)_{10} = (B)_{16} \\ (15+2) = (17)_{10} = (11)_{16} \end{array}$$

$$(9FF.1B)_{16}$$

$$(2) (F092.875)_{16} + (B3CD.91A)_{16} = (1A460.18F)_{16}$$

$$\begin{array}{r} \overset{1}{\cancel{1}} \overset{1}{\cancel{1}} \leftarrow \\ F092.875 \\ + B3CD.91A \\ \hline 1A460.18F \end{array}$$

$$A+5 = (15)_{16} = (F)_{16}$$

$$9+8 = (17)_{16} = (11)_{16}$$

$$D+3 = (17)_{16} = (10)_{16}$$

$$(12+16) = (22)_{16} = (16)_{16}$$

$$(15+11) = (26)_{16} = (1A)_{16}$$

* Binary:-

$$\begin{array}{l} 2; 0 \& 1 \\ (6)_{10} + (5)_{10} = (11)_{10} \\ (110)_2 + (101)_2 = (1011)_2 \end{array}$$

$$\begin{array}{r} 110 \\ + 101 \\ \hline 1011 \end{array} \quad \uparrow$$

$$\begin{array}{r} 0 \\ \downarrow \\ 10 \\ \downarrow \\ 11 \\ \downarrow \\ 101 \end{array}$$

$$1+1 = (2)_{10} = (10)_2$$

$$1+1+1 = (3)_{10} = (11)_2$$

$$(1) (101111.1011)_2 + (1110001.111001)_2 =$$

$$(2) (101101101.111)_2 + (001111.000111)_2 =$$

* Other Number Systems:-

$$\begin{array}{r} 0 \quad (10) \rightarrow 6 \\ 6 \text{ symb} \downarrow \quad (12) \rightarrow 7 \\ \quad \quad \quad (13) \rightarrow 8 \\ \quad \quad \quad (14) \rightarrow 9 \\ \quad \quad \quad \underline{5} \quad \quad 15 \end{array}$$

$$(525)_6 + (354.23)_6$$

$$\begin{array}{r} 15 \\ + 525.00 \\ + 354.23 \\ \hline (1323.23)_6 \end{array}$$

$$(2) (613.56)_7 + (564.65)_7$$

$$\begin{array}{r} 15 \\ 613.56 \\ + 564.65 \\ \hline (1414.54)_7 \end{array} \quad \begin{array}{l} (10)_7 \Rightarrow (7)_{10} \\ (14)_7 = (11)_{10} \end{array}$$

$$\begin{array}{l} \Downarrow \\ (9)_{10} = (10)_6 = 6 + 3 \\ \text{Deci.} \quad \text{Base-6} \quad (13)_6 = 9 \\ \begin{array}{l} 0 \quad 0 \\ 1 \quad 1 \\ 2 \quad 2 \\ 3 \quad 3 \\ 4 \quad 4 \\ 5 \quad 5 \\ 6 \quad 10 \\ 7 \quad 11 \\ 8 \rightarrow 12 \\ 9 \rightarrow 13 \end{array} \end{array}$$

$$\begin{array}{r} 564.65 \\ (1511.54)_7 \end{array}$$

$$(\overset{\uparrow n_2}{\quad})_{n_1} + (\overset{\uparrow n_1}{\quad})_{n_2} = (\quad)_{n_1}$$

$$(\quad)_{n_2}$$

$$(14)_7 = (11)_{10}$$

$$8 \rightarrow 12$$

$$9 \rightarrow 13$$

$$10 \rightarrow 14$$

$$11 \rightarrow 15$$

$$12 \rightarrow (20)_6 \Rightarrow 2 \times 6^1 + 0 \times 6^0 = (12)_{10}$$

[2] Subtraction:-

$$\begin{array}{r} 3 \quad 9 \overset{\uparrow (n-1)}{\quad} \overset{\uparrow (10) \rightarrow n}{\quad} \\ \cancel{4} \quad 0 \quad 2 \\ - \quad 5 \quad 9 \\ \hline (343)_{10} \end{array}$$

$$\begin{array}{r} 3 \quad 7 \overset{\uparrow (n-1)}{\quad} \overset{\uparrow (11)}{\quad} \\ \cancel{4} \quad 0 \quad 5 \quad 6 \\ - \quad 3 \quad 6 \quad 3 \\ \hline 3 \end{array}$$

$$\begin{array}{r} 3 \quad 9 \quad 0 \Rightarrow \sqrt{100} \\ + \quad 9 \quad 0 \\ + \quad 2 \quad 0 \\ \hline (402) \end{array} \quad \begin{array}{l} \{ 90 \checkmark \\ \{ 10 \checkmark \\ \{ 00 \checkmark \end{array}$$

(a) Octal System:-

$$n = 8:$$

$$n-1 = 7$$

$$\begin{array}{r} (402)_8 \\ - (57)_8 \\ \hline (323)_8 \end{array}$$

$$\begin{array}{r} 4 \quad 3 \quad 2 \quad 8 \\ 5 \quad 4 \quad 3 \quad 8 \\ - 3 \quad 6 \quad 5 \quad 8 \\ \hline 1 \quad 5 \quad 5 \quad 8 \end{array}$$

$$(b) (543.365)_8 - (365.503)_8 = (155.662)_8$$

$$(c) (10001.762)_8 - (4753.616)_8 = (3026.144)_8$$

$$\begin{array}{r} 0 \quad 7 \quad 7 \quad 7 \quad 8 \quad 5 \quad 8 \\ 1 \quad 0 \quad 0 \quad 0 \quad 1 \quad 7 \quad 6 \quad 2 \\ - \quad 4 \quad 7 \quad 5 \quad 3 \quad 6 \quad 1 \quad 6 \\ \hline (3026.144)_8 \end{array}$$

* Hexadecimal Number System:-

$$n = 16$$

$$(n-1) = (15)_{10} = (F)_{16}$$

$$(405.A1)_{16} - (39.45)_{16}$$

$$\begin{array}{r}
 3 \text{ F } \overset{(10)}{\underset{(16)}{10}} 9 \text{ (16)}_{10} \\
 \text{A05.A1} \\
 - 39.45 \\
 \hline
 (3CC.5C)_{16}
 \end{array}$$

$$(12)_{10} = (C)_{16}$$

$$(1) \quad (A054.3B)_{16} - (999.881)_{16}$$

$$\begin{array}{r}
 9 \text{ F } \overset{16}{\underset{16}{4}} \overset{16}{\underset{16}{3}} \text{ (16)}_{10} \text{ (16)}_{10} \\
 \text{A084.3B0} \\
 - 999.881 \\
 \hline
 (9CBA.B2F)_{16}
 \end{array}$$

$$(16)_{10} - (1)_{10} = (15)_{10} = (F)_{16}$$

* Binary :-

$$r = 2; (r-1) = 1$$

$$\begin{array}{r}
 (10110.010)_2 - (0111.111)_2 \\
 \begin{array}{r}
 \overset{2}{0} \overset{2}{1} \overset{2}{0} \overset{2}{0} \overset{2}{1} \overset{2}{0} \overset{2}{0} \\
 \text{10110.010} \\
 - 0111.111 \\
 \hline
 (01110.011)_2 \Rightarrow (14.375)_{10}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 22.250 \\
 - 7.875 \\
 \hline
 14.375
 \end{array}$$

$$(1) \quad (100111.0101)_2 - (1111.01101)_2 = (011111.11101)_2$$

$$(2) \quad (11100.1011)_2 - (10011.0011)_2 = (01001.1000)_2$$

$$\begin{array}{r}
 \overset{6}{3} \overset{6}{0} \overset{7}{0} \overset{7}{1} \\
 \text{A001} \\
 \hline
 \end{array}$$

$$n = \text{base} =$$

$$(\quad)_7 + (\quad)_7 =$$

$$\begin{array}{r}
 \leftarrow \\
 (\quad)_7 + (\quad)_6 = (\quad)_{(7)} \\
 \leftarrow
 \end{array}$$

$$(39)_{10} \Rightarrow (\quad)_{16} \Rightarrow (27)$$

$$(10)_{11} \Rightarrow (16)_{10}$$

$$(39)_{10} \Rightarrow ()_{16} \Rightarrow \underline{(27)_{16}}$$

$$(10)_{16} \Rightarrow (16)_{10}$$

$$1 \times 16^1 + 0 \times 16^0 = (16)_{10}$$

$$= (32)_{10}$$

$$(39)_{10} \Rightarrow (36)_{11} \Rightarrow$$

$$(10)_{11} \rightarrow (11)_{10}$$

$$(20) \rightarrow (22)_{10}$$

$$(30) \rightarrow (33)_{10}$$

$$33 - 6 = 39$$

$$(30)_{11} + (6)_{11} = (39)_{10}$$

$$(36)_{11} = (39)_{10}$$

$$(20)_{16} \Rightarrow (32)_{10}$$

$$32 + 7$$

$$(27)_{16} = 2 \times 16^1 + 7 \times 16^0$$

$$= 32 + 7 = (39)_{10}$$

* Multiplication:-

↳ Decimal & Binary:

$$\begin{array}{r} 403 \\ \times 25 \\ \hline 8060 \\ 2015 \\ \hline (10075)_{10} \end{array}$$

$$\begin{array}{r} 403 \times 20 \rightarrow 8060 \\ 403 \times 5 \rightarrow 2015 \\ \hline \end{array}$$

$$\begin{array}{r} 4.25 \\ \times 1.2 \\ \hline \end{array}$$

$$\begin{array}{r} (11.5) \\ \times (2.5) \\ \hline (28.75)_{10} \end{array}$$

$$\begin{array}{r} 1011.1 \\ \times 10.1 \\ \hline 1011100 \\ + 10111 \\ \hline \end{array}$$

$$16 + 8 + 4 + 0.5 + 0.25 = (28.75)_{10}$$

$$\leftarrow (111100.11)_2$$

$$\begin{array}{r} 1010 \\ \times 101 \\ \hline 101000 \\ + 1010 \\ \hline (110010)_2 \Rightarrow (50)_{10} \end{array}$$

$$(1) \quad (1011.111)_2 \times (111.1)_2$$

$$> (3)_{10} \Rightarrow$$

$$\begin{array}{r} + 1 \\ + 1 \\ + 1 \\ \hline (11)_2 \Rightarrow (3)_{10} \end{array}$$

$$\begin{array}{r} + 1 \\ + 1 \\ + 1 \\ + 1 \\ \hline (1000)_2 \Rightarrow (4)_{10} \end{array}$$

$$\begin{array}{r} 1011.111 \\ \times 111.1 \\ \hline 1011111000 \\ + 101111100 \\ + 10111110 \\ + 1011111 \\ \hline \end{array}$$

$$\Rightarrow 28.875$$

$$\begin{array}{r} \times 15.5 \\ 4 \times 10.625 \\ 370.0625 \\ \hline \end{array}$$

$$\boxed{1001}$$

$$\begin{array}{r}
 \text{23444} \quad \text{44444} \quad \text{210} \\
 \rightarrow 10111110000 \\
 + x1011111000 \\
 + xx101111100 \\
 + xxx10111110 \\
 + xxxxx1011111 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 1011100100001 \Rightarrow \\
 \hline
 256 + 64 + 32 + 16 + 2 \Rightarrow 370.0625
 \end{array}$$

$$\begin{array}{r}
 4 \times 1.0625 \\
 370.0625 \\
 \hline
 +1 \\
 +1 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 (100)_2 \Rightarrow (4)_{10} \\
 (110)_2 \Rightarrow (6)_{10} \\
 (1000)_2 \\
 (1001)_2 \\
 (111)_2 \\
 (101)_2 \Rightarrow \\
 (100)_2
 \end{array}$$

Addition case

$$\begin{array}{r}
 101 \rightarrow 5 \\
 + 11 \rightarrow 3 \\
 + 11 \rightarrow 3 \\
 + 11 \rightarrow 3 \\
 \hline
 1110 \rightarrow 14
 \end{array}$$

* Division:-

Decimal \leftarrow Binary:-

$$\begin{array}{r}
 17 \\
 3 \overline{) 17} \\
 \underline{15} \\
 2 \rightarrow \text{Remainder}
 \end{array}$$

$$\begin{array}{r}
 105 \\
 11 \overline{) 105} \\
 \underline{99} \\
 6 \rightarrow \text{Remainder}
 \end{array}$$

$$\begin{array}{r}
 5.66 \leftarrow \\
 3 \overline{) 17.00} \\
 \underline{15} \downarrow \\
 20 \\
 \underline{18} \downarrow \\
 20
 \end{array}$$

* Binary systems:-

$$\begin{array}{r}
 (111)_2 \Rightarrow \\
 00111 \Rightarrow (7)_{10}
 \end{array}$$

* Binary systems: -

$$(10111)_2 \div (11)_2 \Rightarrow$$

$$\frac{23}{3} \Rightarrow \begin{matrix} 7 \rightarrow \\ 2 \rightarrow \end{matrix}$$

$$\begin{array}{r} (111)_2 \Rightarrow (7)_{10} \\ 00111 \Rightarrow \\ \underline{01011} \\ 11 \\ \underline{0101} \\ 11 \\ \underline{0101} \\ 11 \\ \underline{00} \\ 00 \Rightarrow (2)_{10} \end{array}$$

$$(1) \quad (101111)_2 \div (101)_2$$

$$\frac{10573}{5219} \Leftarrow \frac{10 \cdot 513}{5 \cdot 219} \times \frac{1000}{1000}$$

(2)

$$(101.110)_2 \div (11.011)_2$$

$$\begin{array}{r} 001001 \Rightarrow (1001)_2 \rightarrow 9 \\ 101 \overline{) 101111} \\ \underline{101} \\ 000111 \\ \underline{101} \\ 10 (10)_2 \rightarrow R \end{array}$$

$$\frac{101.110}{11.011} \times \frac{(1000)_2}{(1000)_2} \Rightarrow \frac{101110}{11011}$$

$$\begin{array}{r} 01 \\ 11011 \overline{) 101110} \\ \underline{11011} \\ 10011 \end{array}$$

$$9 \Rightarrow (10)_2$$

$$R = (10011)_2$$

$$(3) \quad (111010.011)_2 \div (101.11)_2$$