Binary

Fundament ch-[4]

1. Binary to Decimal (Base 10) (0 to 9)

(1) $(1011)_2 = (?)_{10}$

$$\overset{3}{1}\overset{2}{0}\overset{1}{1}\overset{0}{1} = (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1)(1 \times 2^0)$$

$$= 8 + 0 + 2 + 1$$

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

$$\boxed{1011_2 = (11)_{10}}$$

(2) $(1100)_2 = (?)$

$$\overset{3}{1}\overset{2}{1}\overset{1}{0}\overset{0}{0} = (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (0 \times 2^0)$$

$$= 8 + 4 + 2$$

$$\cancel{12}$$

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

$$\boxed{(1100_2) = (12)_{12}}$$

(3) $(10101010)_2 = (?)_{10}$

$$\overset{7}{1}\overset{6}{0}\overset{5}{1}\overset{4}{0}\overset{3}{1}\overset{2}{0}\overset{1}{1}\overset{0}{0} = (1 \times 2^7) + (0 \times 2^6) + (1 \times 2^5) + (0 \times 2^4)$$
$$(1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (0 \times 2^0)$$

$$= 128 + 0 + 32 + 0 + 8 + 0 + 2 + 0$$

$$= (170)_{10}$$

$$\boxed{(10101010)_2 = (170)_{10}}$$

(4) $(0111010) = (?)_{10}$

$$\overset{5}{0}\overset{4}{1}\overset{3}{1}\overset{2}{1}\overset{1}{0}\overset{0}{1}\overset{0}{0}$$

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

$$= 32 + 16 + 8 + 0 + 2 + 0$$

$$= (58)_2$$

$$\boxed{0111010 = (58)_2}$$

(5) $(11111)_2 = (?)_{10}$

$$\overset{4}{1}\overset{3}{1}\overset{2}{1}\overset{1}{1}\overset{0}{1} = (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) +$$
$$(1 \times 2^0)$$

$$= 16 + 8 + 4 + 2 + 1$$

$$= (31)_{10}$$

$$\boxed{11111 = (31)_{10}}$$

(6) $(10000000)_2 = (?)_{10}$

$$\overset{7}{1}\overset{6}{0}\overset{5}{0}\overset{4}{0}\overset{3}{0}\overset{2}{0}\overset{1}{0}\overset{0}{0} = (1 \times 2^7) + (0 \times 2^6) + (0 \times 2^5) + (0 \times 2^4) +$$
$$(0 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (0 \times 2^0)$$

$$= 128 + 0 + 0 + 0 + 0 + 0 + 0 + 0$$

$$= (128)_{10}$$

$$\boxed{10000000 = (128)_{10}}$$

(7) $(1011111)_2 = (?)_{10}$

$$\overset{6\ 5\ 4\ 3\ 2\ 1\ 0}{1011111} = (1\times2^6) + (0\times2^5) + (1\times2^4) + (1\times2^3) +$$
$$(1\times2^2) + (1\times2^1) + (1\times2^0)$$

$$= 64 + 0 + 16 + 8 + 4 + 2 + 1$$

$$= (95)_{10}$$

$$\boxed{1011111 = (95)_{10}}$$

(8) $(1011010110)_2 = (?)_{10}$

$$\overset{9\ 8\ 7\ 6\ 5\ 4\ 3\ 2\ 1\ 0}{1011010110} = (1\times2^9) + (0\times2^8) + (1\times2^7) + (1\times2^6) + (0\times2^5)$$
$$(1\times2^4) + (0\times2^3) + (1\times2^2) + (1\times2^1) + (0\times2^0)$$

$$= 512 + 0 + 128 + 64 + 0 + 16 + 0 +$$
$$+ 4 + 2 + 0$$

$$= (726)_{10}$$

$$\boxed{1011010110 = (726)_{10}}$$

(9) $(1100110011) = (?)_{10}$

$$\overset{9\ 8\ 7\ 6\ 5\ 4\ 3\ 2\ 1\ 0}{1100110011} = (1\times2^9) + (1\times2^8) + (0\times2^7) + (0\times2^6) + (1\times2^5)$$
$$+ (1\times2^4) + (0\times2^3) + (0\times2^2) + (1\times2^1) + (1\times2^0)$$

$$= 512 + 256 + 0 + 0 + 32$$
$$16 + 0 + 0 + 2 + 1$$

$$= (819)_{10}$$

$$\boxed{(1100110011) = (819)_{10}}$$

(10) $(0.1101)_2 = (?)_{10}$

$$\overset{0\ \cdot\ -1\ -2\ -3\ -4}{0.1101}$$

$$0.\overset{-1}{1}\overset{-2}{1}\overset{-3}{0}\overset{-4}{1} = (1\times2^{-1}) + (1\times2^{-2}) + (0\times2^{-3}) + (1\times2^{-4})$$

$$= \frac{1}{2} + \frac{1}{4} + 0 + \frac{1}{16}$$

$$= 0.5 + 0.25 + 0.0625$$

$$\boxed{(0.1101)_2 = 0.8125}$$

(11) $(1100.0010)_2 = (?)_{10}$

$$\overset{3\ 2\ 1\ 0}{1100} = (1\times2^3) + (1\times2^2) + (0\times2^1) + (0\times2^0)$$
$$= 8 + 4 + 0 + 0$$
$$= 12$$

$$\overset{-1\ -2\ -3\ -4}{0010} = (0\times2^{-1}) + (0\times2^{-2}) + (1\times2^{-3}) + (0\times2^{-4})$$
$$= 0 + 0 + \frac{1}{8} + 0$$
$$= 0.125$$

$$\boxed{(1100.0010) = 12.125}$$

(12) $(11111.10101)_2 = (?)_{10}$

$$\overset{4}{1}\,\overset{3}{1}\,\overset{2}{1}\,\overset{1}{1}\,\overset{0}{1} = (1\times2^4)+(1\times2^3)+(1\times2^2)+(1\times2^1)+(1\times2^0)$$
$$= 16+8+4+2+1$$
$$= (31)$$

$$\overset{-1}{1}\,\overset{-2}{0}\,\overset{-3}{1}\,\overset{-4}{0}\,\overset{-5}{1} = (1\times2^{-1})+(0\times2^{-2})+(1\times2^{-3})+(0\times2^{-4})$$
$$+(1\times2^{-5})$$
$$= \frac{1}{2}+0+\frac{1}{8}+0+\frac{1}{32}$$
$$= 0.65625$$
$$= 0.5+0.125+0.03125$$
$$= (0.65625)$$

$$\boxed{(11111.10101)_2 = (31.65625)_{10}}$$

(13) $(101110.101011)_2 = (?)_{10}$

$$\overset{5}{1}\,\overset{4}{0}\,\overset{3}{1}\,\overset{2}{1}\,\overset{1}{1}\,\overset{0}{0} = (1\times2^5)+(0\times2^4)+(1\times2^3)+$$
$$(1\times2^2)+(1\times2^1)+(0\times2^0)$$

$$= 32+0+8+4+2$$
$$= (46)$$

$$0.\overset{-1}{1}\overset{-2}{0}\overset{-3}{1}\overset{-4}{0}\overset{-5}{1}\overset{-6}{1} = (1\times2^{-1})+(0\times2^{-2})+(1\times2^{-3})+(0\times2^{-4})$$
$$(1\times2^{-5})+(1\times2^{-6})$$

$$= \frac{1}{2}+0+\frac{1}{8}+0+\frac{1}{32}+\frac{1}{64}$$
$$= 0.5+0.125+0.03125+0.015625$$
$$= (0.671875)$$

$$\boxed{(101110.101011)_2 = (46.671875)_{10}}$$

(14) $(10101.1010)_2 = (?)_{10}$

$$\overset{4}{1}\,\overset{3}{0}\,\overset{2}{1}\,\overset{1}{0}\,\overset{0}{1} = (1\times2^4)+(0\times2^3)+(1\times2^2)+(0\times2^1)$$
$$+(1\times2^0)$$

$$= 16+0+4+0+1$$
$$= (21)$$

$$0.\overset{-1}{1}\overset{-2}{0}\overset{-3}{1}\overset{-4}{0} = (1\times2^{-1})+(0\times2^{-2})+(1\times2^{-3})+(0\times2^{-4})$$

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

$$= 0.5+0.125$$
$$= \boxed{0.625}$$

$$\boxed{(10101.1010)_2 = (21.625)_{10}}$$

2.8

table સમજાવ બનાવ.

2. Binary to octal (Base 8) (0 to 7)

→ mac group off 3 digit form the right side off the table and from the left form fraction part.

Binary	octal
0 0 0	0
0 0 1	1
0 1 0	2
0 1 1	3
1 0 0	4
1 0 1	5
1 1 0	6
1 1 1	7

(1) $(101011100)_2 = (?)_8$

$= 001 \ 010 \ 111 \ 100$

$= (1274)$

$\therefore (101011100)_2 = (1274)$

(2) $(101101001)_2 = (?)_8$

$= 101 \ 101 \ 001$

$= (2731)_8$

$\therefore (101101001)_2 = (2731)_8$

(3) $(1010101010001)_2 = (?)_8$

$= 001 \ 010 \ 101 \ 010 \ 001$

$= (12521)_8$

$\therefore (1010101010001)_2 = (12521)_8$

(4) $(111101010111)_2 = (?)_8$

$= 011 \ 110 \ 101 \ 011$

$= 3 \quad 6 \quad 5 \quad 3$

$= (3653)_8$

$\therefore (111101010111)_2 = 3657$

(5) $(111000111000111)_2 = (?)_8$

$= 111 \ 000 \ 111 \ 000 \ 111$

$= 7070$

$= (7070)_8$

$\therefore (111000111000111)_2 = (7070)_8$

⋆ 10011   ⟵ 001100

6) (100 101100 1110)$_2$ = (?)$_8$

= ~~~~~~~~~~~~~~~~~
= <u>001</u> <u>001</u> <u>011</u> <u>001</u> <u>110</u>

= (11316)$_8$

∴ (100101100110)$_2$ = (11316)$_8$

⋆ Point.

(7) (0110011.1011)$_2$ = (?)$_8$

= <u>001</u><u>100</u><u>111</u>

= (63)$_8$

= <u>10</u> <u>1100</u>

= (54)$_8$

∴ (011011.1011)$_2$ = 63.54

(8) (10110.10110)$_2$ = (?)$_8$

= $\underset{2}{\underline{010}}$ $\underset{6}{\underline{110}}$

= (26)$_8$

= $\underset{5}{\underline{101}}$ $\underset{4}{\underline{100}}$

= (54)$_8$

∴ (10110.10110)$_2$ = (26.54)$_8$

(9) (1011111.110001) = (?)$_8$

= $\underset{1}{\underline{001}}$ $\underset{3}{\underline{011}}$ $\underset{7}{\underline{111}}$. $\underset{6}{\underline{110}}$ $\underset{0}{\underline{000}}$ $\underset{4}{\underline{100}}$

∴ (1011111.110001) = (137.604)$_8$

(10) (100000111100.00110111)$_2$ = (?)$_8$

= ~~$\underset{2}{\underline{001000001100}}$. $\underset{0}{\underline{001101110}}$~~
  ~~3 4   1 5 6~~

= $\underset{4}{\underline{100}}\underset{0}{\underline{000}}\underset{7}{\underline{111}}\underset{4}{\underline{100}}$. $\underset{1}{\underline{001}}$ $\underset{5}{\underline{101}}$ $\underset{6}{\underline{110}}$

∴ (100000111100.00110111) = (4074.156)$_8$

3. Binary to Hexa-Diecimal (Base 16) (0 to 9 and A to F)

→ make a grop of 4 digits form right Hand side and form Left Hand Side for fractinal part.

Binary				Hexa
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

example:-

(1) $(1010111100)_2 = (?)_{16}$

$$00\ 1010\ 1111\ 00 = (2BC)_{16}$$
$$2 \quad B \quad C$$

(2) $(101110110001)_2 = (?)_{16}$

$= 0101\ 1101\ 1001 = 5D9$
$$5\ \ D\ \ 9$$

$$\therefore (101110110001)_2 = (5D9)_{16}$$

(3) $(1010101010101110)_2 = (?)_{16}$

$= 1010\ 1010\ 1010\ 1110$
$$A \quad A \quad A \quad E$$

$$\therefore (1010101010101110)_2 = (AAAE)_{16}$$

(4) $(11011000111110)_2 = (?)_{16}$

$$\cancel{1101\ 100011\ 1110}$$

$= 0011\ 0110\ 00111110$
$$3 \quad 6 \quad 3 \quad E$$

$$\therefore (11011000111110)_2 = (363E)_2$$

(5) $(110110001100100111)_2 = (?)_{16}$

$= 0011\ 0110\ 0011\ 0010\ 0111$
$$3 \quad 6 \quad 3 \quad 2 \quad 7$$

$$\therefore (110110001100100111)_2 = (36327)_{16}$$

(6) $(10101.01001)_2 = (?)_{16}$

$$= \underline{0001} \quad \underline{0101} \quad . \quad \underline{0100} \quad \underline{1000}$$
$$\quad\quad 1 \quad\quad 5 \quad\quad\quad 4 \quad\quad 8$$

$$\boxed{= (10101.01001)_2 = (15.48)_{16}}$$

(7) $(11110001.1010101)_2 = (?)_{16}$

$$= \underline{1111} \quad \underline{0001} \quad . \quad \underline{1010} \quad \underline{1010}$$
$$\quad\quad F \quad\quad 1 \quad\quad\quad A \quad\quad A$$

$$\therefore \boxed{(11110001.1010101) = (F1.AA)_{16}}$$

(8) $(100000111.10101111) = (?)_{16}$

$$= \underline{0010} \quad \underline{0000} \quad \underline{1111} \quad . \quad \underline{1010} \quad \underline{1111}$$
$$\quad\quad 2 \quad\quad 0 \quad\quad F \quad\quad\quad A \quad\quad F$$

$$\therefore \boxed{(100000111.10101111) = (20F.AF)_{16}}$$

(9) $(10111101010001.1000001)_2 = (?)_{16}$

$$= \underline{0101} \quad \underline{1111} \quad \underline{0101} \quad \underline{0001} \quad . \quad \underline{1000} \quad \underline{0001}$$
$$\quad\quad 5 \quad\quad F \quad\quad 5 \quad\quad 1 \quad\quad\quad 8 \quad\quad 1$$

$$\therefore \boxed{(10111101010001.1000001)_2 = (5F51.81)_{16}}$$

(10) $(101010101010.10101010)_2 = (?)_{16}$

$$= \underline{0010} \quad \underline{1010} \quad \underline{1010} \quad . \quad \underline{1010} \quad \underline{1010}$$
$$\quad\quad 2 \quad\quad .A \quad\quad A \quad\quad\quad A \quad\quad A$$

$$\therefore \boxed{(101010101010.10101010) = (2AA.AA)_{16}}$$

Decimal Number system.

2. Decimal

Base = 10

= 0 to 9

Common use.

(1) Decimal to Binary (Base = 0, 1)

method - I

(1) $(28)_{10} = (?)_2$

2	28	
2	14	0
2	7	0
2	3	1
2	1	1
	0	1

= (11000)

$(28)_{10} = (11100)_2$

(2) $(160)_{10} = (?)_2$

2	160	
2	80	0
2	40	0
2	20	0
2	10	0
2	5	0

2	2	1
2	1	0
	0	1

$\therefore (160)_8 = (10100000)_2$

(3) $(198)_{10} = (?)_2$

2	198	
2	99	0
2	49	1
2	24	1
2	12	0
2	6	0
2	3	0
2	1	1
	0	1

$\therefore (198)_{10} = (11000110)_2$

(4) $(245)_{10} = (?)_2$

2	245	
2	122	1
2	61	0
2	30	1
2	15	0
2	7	1
2	3	1
2	1	1
	0	1

$\therefore (245)_2 = (111010)_2$

(5) $(542)_{10} = (?)_2$

2	542	
2	271	0
2	135	1
2	67	1
2	33	1
2	16	1
2	8	0

2	4	0
2	2	0
2	1	0
	0	1

$\therefore (542)_{10} = (1000011110)$

1024 512 256 128 64 32 16 8 4 2 1

(6) $(1024)_{10} = (?)_2$

2	1024	
2	512	0
2	256	0
2	128	0
2	64	0
2	32	0
2	16	0
2	8	0

2 | 4 | 0
2 | 2 | 0
2 | 1 | 1
    0

$\therefore (1024)_{10} = (10000000000)_2$

(7) $(672) = (?)$

2	672	
2	336	0
2	168	0
2	84	0
2	42	0
2	21	0
2	10	1
2	5	0

2 | 2 | 0
2 | 1 | 1
    0

$\therefore (672)_{10} = (1010100000)_2$

(8) $(2099)_{10} = (?)$

2	2099	
2	1049	1
2	524	1
2	262	0
2	131	0
2	65	1
2	32	1
2	16	0
2	8	0
2	4	0

2 | 2 | 0
2 | 1 | 1
    0

$\therefore (2099)_{10} = (100000110011)_2$

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method - 2

(1) $(28)_{10} = (?)_2$

2	4	8	16	16	8	4	2	1
				1	1	1	0	0

$(28)_{10} = (11100)_2$

(2) $(160)_2 = (?)_2$

$= \dfrac{128}{\dfrac{32}{160}}$

128	64	32	16	8	4	2	1
1	0	1	0	0	0	0	0

$(160)_{10} = (10100000)_2$

(3) $(198)_2 = (1)_2$

128	64	32	16	8	4	2	1
1	1	0	1		1	1	0

$(198)_{10} = (110110)_2$

(4) $(245)_{10} = (?)_2$

256	128	64	32	16	8	4	2	1
1	1	1	1		1	0	1	1

$(245)_{10} = (1111011)_2$

(5) $(542)_{10} = (?)$

512	256	128	64	32	16	8	4	8	2	1
1	0	0	0	0	1	1	1	1	1	0

$$\boxed{(542)_{10} = (1000011110)_2}$$

(6) $(162.125)_{10} = (?)_2$

2	128	64	32	16	8	4	2	1
	1	0	1	0	0	0	1	0

$\therefore 162 = 10100010$

$\therefore 0.125 \times 2$
$= 0.250$

$\therefore 0.125 \times 2 = 0.250$ 0
$\therefore 0.250 \times 2 = 0.500$ 0
$\therefore 0.500 \times 2 = 1.000$ 1
$\therefore 0.000 \times 2 = 0000$

$(0.125) = (0.001)$

$(162.125) = (10100010.001)_2$