

①

Binary values

$$0 - 10$$

$$0 - 0$$

$$1 - 01$$

$$2 - 10$$

$$3 - 11$$

$$4 - \cancel{000}$$

$$5 - 101$$

$$6 - 110$$

$$7 - 111$$

$$8 - 1000$$

$$9 - 1001$$

$$2) 4 \text{ (1)}$$

$$\cancel{4}$$

$$\cancel{2}$$

$$\cancel{2}$$

$$0$$

$$2(5)$$

$$2 \underline{2} - 1$$

$$1 - 0$$

$$2(6)$$

$$2 \underline{7} - 1$$

$$1 - 0$$

$$2(3 - 0)$$

$$2 \underline{3} - 1$$

$$1 - 1$$

$$2(8)$$

$$2 \underline{9} - 1$$

$$2 \underline{4} - 1$$

$$2 \underline{2} - 0$$

$$2 \underline{2} - 0$$

$$1 - 0$$

Rough work

②

Decimal to binary

a) $\begin{array}{r} 12 \\ \hline 2 | 6 - 0 \\ \hline 2 | 3 - 0 \\ \hline 1 - 1 \end{array}$ $(1100)_2$

b) $\begin{array}{r} 20 \\ \hline 2 | 10 - 0 \\ \hline 2 | 5 - 0 \\ \hline 2 | 2 - 1 \\ \hline 1 - 0 \end{array}$ $(10100)_2$

c) $\begin{array}{r} 45 \\ \hline 2 | 22 - 1 \\ \hline 2 | 11 - 0 \\ \hline 2 | 5 - 1 \\ \hline 2 | 2 - 1 \\ \hline 1 - 0 \end{array}$ $(101101)_2$

$$\begin{array}{r}
 d) \quad \begin{array}{c} 7,7 \\ \hline 3 & 8 & -1 \\ \hline 1 & 9 & -0 \end{array} \\
 2 \quad \begin{array}{c} 9 & -1 \\ \hline 4 & -1 \end{array} \\
 2 \quad \begin{array}{c} 2 & -0 \\ \hline 1 & -0 \end{array}
 \end{array}$$

$(1\ 001101)_2$

$$\begin{array}{r}
 e) \quad \begin{array}{c} 103 \\ \hline 51 & -1 \\ \hline 25 & -1 \\ \hline 12 & -1 \\ \hline 6 & -0 \\ \hline 3 & -0 \\ \hline 1 & -1 \end{array}
 \end{array}$$

$(1100111)_2$

③

(9910)

10

Dec to Oct.

$$8 \overline{)9 \quad 9 \quad 1 \quad 0}$$

1 3 7

$$8 \overline{)1 \quad 2 \quad 3 \quad 8 \quad - \quad 6}$$

4 3

$$8 \overline{)1 \quad 5 \quad 4 \quad - \quad 6}$$

7

$$8 \overline{)1 \quad 9 \quad - \quad 2}$$

$$2 \quad - \quad 3$$

Ans

$$\left[\begin{matrix} 2 & 3 & 2 & 6 & 6 \end{matrix} \right]_8$$

Binary to decimal

Q)

(a)

1101

$$2^3 \ 2^2 \ 2^1 \ 2^0 = (13)_{10}$$

$$8 + 4 + 0 + 1$$

(b)

1110

$$2^3 \ 2^2 \ 2^1 \ 2^0 = (14)_{10}$$

$$8 + 4 + 2 + 0$$

(c) 1111 0101

$$2^7 \ 2^6 \ 2^5 \ 2^4 \ 2^3 \ 2^2 \ 2^1 \ 2^0$$

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

$$128 + 64 + 32 + 16 + 0 + 4 + 0 + 1$$

(d) 01010101

$$2^7 \ 2^6 \ 2^5 \ 2^4 \ 2^3 \ 2^2 \ 2^1 \ 2^0$$

$$= (85)_{10}$$

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

$$\begin{array}{r} 85 \\ -64 \\ \hline 21 \\ -16 \\ \hline 5 \\ -4 \\ \hline 1 \end{array}$$

(e)

1000111

$$2^7 \ 2^6 \ 2^5 \ 2^4 \ 2^3 \ 2^2 \ 2^1 \ 2^0$$

$$\cancel{= (143)_{10}}$$

$$128 + 0 + 0 + 0 + 8 + 4 + 2 + 1$$

$$= (143)_{10}$$

5

(a) $(1101)_2 \Rightarrow (?)_8$

1 1 0 1

$\begin{array}{r} 2^3 \\ 2^2 \\ 2^1 \\ 2^0 \end{array}$

$8 + 4 + 0 + 1$

8 | 13

1 - 5

(1 5) $\textcircled{8}$

$8 | 8^0$

$8 + 5 = (13)_{10}$

$$(b) (1111111110)_2 \Rightarrow (?)_{10}$$

$$\begin{array}{cccccccccc} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 2^{10} & 2^9 & 2^8 & 2^7 & 2^6 & 2^5 & 2^4 & 2^3 & 2^2 & 2^1 & 2^0 \end{array}$$

$$256 + 128 + 64 + 32 + 16 + 8 + 4 + 2 + 0$$

$$2048 + 1024 + 512 +$$

Aus

$$\underline{(4094)} \quad 10$$

$$\begin{array}{r} 2 \longdiv{4094} \\ \underline{2} \quad 2047 \quad 0 \end{array}$$

$$\begin{array}{r} 2 \longdiv{1023} \quad 1 \end{array}$$

$$\begin{array}{r} 2 \longdiv{511} \quad 1 \end{array}$$

$$\begin{array}{r} 2 \longdiv{255} \quad 1 \end{array}$$

$$\begin{array}{r} 2 \longdiv{127} \quad 1 \end{array}$$

$$\begin{array}{r} 2 \longdiv{63} \quad 1 \end{array}$$

$$\begin{array}{r} 2 \longdiv{3} \quad 1 \end{array}$$

$$\begin{array}{r} 2 \longdiv{15} \quad 1 \end{array}$$

$$\begin{array}{r} 2 \longdiv{3} \quad 1 \end{array}$$

$$1 \quad 1$$

5

c)

$$(221201)_3 \Rightarrow (649)_{10}$$

$$\begin{array}{r} 2 \ 2 \ 1 \ 2 \ 0 \ 1 \\ \times 3^6 \quad 3^5 \quad 3^4 \quad 3^3 \quad 3^2 \quad 3^1 \end{array}$$

$$243 + 81 + 27 + 9 + 0 + 1$$

$$(649)_{10}$$

$$d) (76)_8 \Rightarrow (\quad)_{10}$$

7 6.

$8^1 \quad 8^0$

Ans

$$56 + 6 = (62)_{10}$$

$$\begin{array}{r} 8 \longdiv{62} \\ \underline{-7} \end{array} \quad \curvearrowright$$

$$e) (231)_8 \Rightarrow (\quad)_2$$

$$\begin{array}{r} 231 \\ 8^2 \quad 8^1 \quad 8^0 \end{array}$$

$$128 + 24 + 1 = (153)_{10}$$

$$\begin{array}{r} 153 \\ 2 \longdiv{153} \\ \underline{-1} \\ 14 \\ 2 \longdiv{14} \\ \underline{-1} \\ 3 \\ 2 \longdiv{3} \\ \underline{-2} \\ 1 \end{array}$$

$$\begin{array}{r} 128 + 16 + 8 + 1 \\ 10011001 \\ \hline 2^7 \quad 2^6 \quad 2^5 \quad 2^4 \quad 2^3 \quad 2^2 \quad 2^1 \quad 2^0 \end{array}$$

$$\begin{array}{r} 153 \\ 8 \longdiv{153} \\ \underline{-16} \\ -1 \\ 2 \longdiv{-1} \\ \underline{-2} \\ 1 \end{array} \quad \begin{array}{r} 9 - 1 \\ 2 \longdiv{9 - 1} \\ \underline{-8} \\ 1 \end{array}$$

$$(f) (\text{ox FOO})_{16} \Rightarrow (?)_8$$

FOO

1500

16² 16¹ 16⁰

3840 + 0 + 0

(3840)₁₀

16 | 3840
 6

16 | 240
 8

8 | 3840
 6

15-0

8 | 480 - 0

Any
↓

8 | 60 - 0

(7400)₈

7 - 4

7400

8³ 8² 8¹ 8⁰

384 + 256 + 0 + 0

$$g) (DACE)_{16} \Rightarrow (?)_{12}$$

$$(13\ 10\ 12\ 14)_{16} \Rightarrow (?)_{12}$$

$\begin{array}{cccc} x & x & x & x \\ 16^3 & 16^2 & 16^1 & 16^0 \end{array}$

$$(56014)_{10}$$

$$\begin{array}{r} 12 \overbrace{\left(\begin{array}{l} 56014 \\ \hline 4667 - 10 \end{array} \right)} \\ 12 \overbrace{\left(\begin{array}{l} 388 - 11 \end{array} \right)} \\ 12 \overbrace{\left(\begin{array}{l} 32 - 4 \end{array} \right)} \\ 2 - 8 \end{array}$$

$$\Rightarrow (56014)_{10} = (284BA)_{12}$$

$$(b) (10 \times 2B)_{16} \Rightarrow (?)_8$$

$$(211)_{16} \Rightarrow (?)_8$$

2 11

16¹ 16⁰

$$32 + 11 \quad (43)_{10}$$

$$\begin{array}{r} 8 \mid 43 \\ \hline 5 - 3 \quad (53)_8 \end{array} \quad \text{Ans}$$

53

8¹ 8⁰

40 + 3

16 | 43

2 - 11

$$\text{Ans} \therefore (43)_{10} = (53)_8$$

(6) Octal to decimal

a) $(3312)_8 \rightarrow 1738$ Ans

$$\begin{array}{r} 3312 \\ 8^3 8^2 8^1 8^0 \end{array}$$

$$1536 + 192 + 8 + 2$$

Ans

b) $(167)_8 \Rightarrow 119$

$$\begin{array}{r} 1 \ 6 \ 7 \\ 8^2 \ 8^1 \ 8^0 \end{array}$$

$$64 + 48 + 7$$

c) $(202103)_9$

$$2 \ 0 \ 2 \ 1 \ 0 \ 3$$

$$9^5 \ 9^4 \ 9^3 \ 9^2 \ 9^1 \ 9^0$$

$$118098 + 1458 + 81 + 0 + 3$$

$$(202103)_9 \Rightarrow (119640)_{10}$$

(*) $(3132334)_{16}$

$$\begin{array}{r} 3 \ 1 \ 3 \ 2 \ 3 \ 3 \ 4 \\ 16^6 \ 16^5 \ 16^4 \ 16^3 \ 16^2 \ 16^1 \ 16^0 \end{array}$$

$$+ 196,608 + 8192 + 968 + 48 + 4$$

$$1048576 + 50,331,648$$

(**) $(0 * F2)_{16}$

$$\begin{array}{r} 0 \ 15 \ 2 \\ 16^2 \ 16^1 \ 16^0 \end{array} \quad \text{Ans } 242$$

$$240 + 2$$

⑨ C. $(5610)_{10} \Rightarrow (?)_2$
 (a)

$$\begin{array}{r}
 2 \overline{)5610} \\
 2 \overline{)2850} \\
 2 \overline{)1440} \\
 2 \overline{)720} \\
 2 \overline{)360} \\
 2 \overline{)180} \\
 2 \overline{)90} \\
 2 \overline{)40} \\
 2 \overline{)20} \\
 2 \overline{)10} \\
 \end{array}$$

$$\begin{array}{r}
 2 \overline{)5610} \\
 2 \overline{)2805} \\
 2 \overline{)1402} \\
 2 \overline{)7010} \\
 2 \overline{)3501} \\
 2 \overline{)1750} \\
 2 \overline{)820} \\
 2 \overline{)430} \\
 2 \overline{)210} \\
 2 \overline{)100} \\
 2 \overline{)50} \\
 2 \overline{)20} \\
 \end{array}$$

$(1001000010)_2$

(101011101010)

$2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$16 + 8 + 4 + 2 + 1 = 31$

$+ 4096$

$+ 256 + 128 + 64 + 32 + 8 + 0 + 2 + 0$

$$(c) (5610)_{10} \Rightarrow (8)_8$$

$$\begin{array}{r} 5610 \\ 8 \longdiv{5610} \\ 8 \quad \boxed{71-2} \\ 8 \quad \boxed{8-7} \\ 1 \quad \boxed{0} \end{array}$$

$$\begin{array}{r} 5610 \\ 8 \longdiv{5610} \\ 8 \quad \boxed{701-2} \\ 8 \quad \boxed{80-5} \\ 8 \quad \boxed{010-7} \end{array}$$

(10722)₈

(12752)₈

~~(d)~~

$$(5610)_{10} \Rightarrow (10722)_8$$

12752

8 8 8² 8¹ 8⁰

4096 + 1024 + 448 + 40 + 2

7(d) $(5610)_{10} \rightarrow (32B6)_{12}$

$$\begin{array}{r} 12 \\ \overline{)5610} \\ 12 \\ \overline{)467 - 6} \\ 12 \\ \overline{)38 - 11} \\ 3 - 2 \end{array}$$

$$c) (5610)_{10} \Rightarrow (?)_{16}$$

$$16 \overline{)5610}$$

$$16 \overline{)350 - 10}$$

$$16 \overline{)21 - 14}$$

$$1 - 5$$

$$\begin{array}{r} 151410 \\ 16 \overline{)111116} \\ 16 \end{array}$$

$$4096 + 280 + 224 + 16$$

$$(2310)_{16}$$

$$(15 \text{ E A})_{16}$$

$$(P) (22110)_{10} \Rightarrow (?)_2$$

$$2 \overline{)22110}$$

$$2 \overline{)11,55 - 0}$$

$$2 \overline{(4 - 1)}$$

$$2 \overline{(2 - 0)}$$

$$1 - 0$$

$$2 \overline{)572 - 1}$$

$$2 \overline{)288 - 1}$$

$$2 \overline{)144 - 0}$$

$$2 \overline{)72 - 0}$$

$$2 \overline{)36 - 0}$$

$$2 \overline{)18 - 0}$$

$$2 \overline{)9 - 0}$$

$$7(g) \quad (22110)_10 \Rightarrow (1010022220)_3$$

$$\begin{array}{r} 3 \overline{)22110} \\ 7370 - 0 \\ \hline 2456 - 2 \\ \hline 818 - 2 \\ \hline 272 - 2 \\ \hline 90 - 2 \\ \hline 30 - 0 \\ \hline 10 - 0 \\ \hline 3 - 1 \\ \hline 1 - 0 \end{array}$$

$$(h) \quad (22110)_{10} \Rightarrow 1)_8$$

$$8 \overline{)22110} \quad \begin{matrix} & \\ & 6 \\ 6 & \overline{53} \end{matrix}$$

$$8 \overline{)2763-6} \quad \begin{matrix} & \\ & 3 \\ 3 & \overline{4} \end{matrix}$$

$$8 \overline{)345-3} \quad \begin{matrix} & \\ & 2 \\ & \overline{2} \end{matrix}$$

$$8 \overline{)43-4}$$

$$5 - 3$$

$$(i) \quad (92110) \Rightarrow 1)$$

$$x_1 \rightarrow (22110)_{10} \Rightarrow (10966)_{12}$$

$$\begin{array}{r} 12 \\ 12 \\ 12 \\ 12 \\ 12 \\ \hline 22110 \\ 1842 - 6 \\ 153 - 6 \\ 12 - 9 \\ \hline 1 - 0 \end{array}$$

(j) $(22110)_{10} \Rightarrow 0_{16}$

$$\begin{array}{r} 16 \\ \overline{)22110} \\ -6 \\ \hline 13 \\ \overline{-10} \\ \hline 3 \\ \overline{-5} \\ \hline 8 \\ \overline{-6} \\ \hline 2 \end{array}$$

$$5 - 6$$

$(565 \oplus)$
 16

(3)

(a) 9

 $(+)\underline{12}$ 21

1 0 0 1

 $(+)\underline{100}$ 1 0 1 0 1(b) $40 + 31$ [$64 + 4 \times 2 + 1$]

40

1 0 1 0 0 0

 $(+)\underline{31}$

0 1 1 1 1

711 0 0 0 1 1 1

(c) 1110 14

 $(+)\underline{0101} + 5$ 1001119[$64 + 2 + 1$]245 (d) 1111 0101 [$+ 32 + 16 + 4 + 1$]
64 + 32 + 16 + 41240 1 1 1 1 0 0[$4 + 8 + 16 + 32 + 64$]5691 0 1 1 1 0 0 0 1[$64 + 32 + 16 + 1$]

+ 256

(e) $195 \quad 110000011 [128 + 64 + 2 + 1]$

~~(+)~~ $94 \quad 01011110 [64 + 16 + 8 + 4 + 2]$

289 $100100001 [256 + 32 + 1]$



(9)

binary subtraction

(a)

$$8 \quad \begin{array}{r} & 1 & 1 & 1 \\ & \diagdown & \diagup & \diagdown \\ 1 & 0 & 0 & 0 \end{array}$$

$$\begin{array}{r} 3 \\ \overbrace{\quad\quad\quad}^{\text{(-)}} 0 \ 0 \ 1 \ 1 \\ \underline{-\quad\quad\quad} \\ 5 \quad \underline{0 \ 1 \ 0 \ 1} \end{array}$$

(b)

$$17 \quad \begin{array}{r} & 1 & 1 & 1 \\ & \diagup & \diagdown & \diagup \\ 1 & 0 & 0 & 0 \end{array} \quad 1$$

$$\begin{array}{r} 11 \\ \overbrace{\quad\quad\quad}^{\text{(-)}} -0 \ 1 \ 0 \ 1 \ 1 \\ \underline{-\quad\quad\quad} \\ 6 \quad \underline{0 \ 0 \ 1 \ 1 \ 0} \end{array}$$

(c)

$$25 \quad \begin{array}{r} & 1 & 1 & 1 \\ & \diagup & \diagdown & \diagup \\ 1 & 0 & 0 & 1 \end{array} \quad 1$$

$$\begin{array}{r} -07 \\ \overbrace{\quad\quad\quad}^{\text{(-)}} 0 \ 0 \ 1 \ 1 \\ \underline{-\quad\quad\quad} \\ 18 \quad \underline{1 \ 0 \ 0 \ 1 \ 0} \end{array}$$

(d)

$$86 \quad \begin{array}{r} & 1 & 1 & 1 & 1 & 1 \\ & \diagup & \diagdown & \diagup & \diagdown & \diagup \\ 1 & 0 & 1 & 0 & 1 & 0 \end{array} \quad 0$$

$$\begin{array}{r} 31 \\ \overbrace{\quad\quad\quad}^{\text{(-)}} 0 \ 0 \ 1 \ 1 \ 1 \ 1 \\ \underline{-\quad\quad\quad} \\ 55 \quad \underline{0 \ 1 \ 1 \ 0 \ 1 \ 1} \end{array}$$

(e)

11010001

1 1

~~10001~~

01000111

209

-71

10001010

138

(a)

(a)

12

1100

3

X 11

36

1100

—

1100 X
—
1

100100

(b)

20

10100

5

101

← —

100

10100

000000X

10100XX

1100100

(c)

$$\begin{array}{r}
 0\ 1\ 1\ 1 \\
 \times 0\ 0\ 1\ 0 \\
 \hline
 0\ 0\ 0\ 0
 \end{array}
 \quad
 \begin{array}{r}
 7 \\
 \times 2 \\
 \hline
 14
 \end{array}$$

$$\begin{array}{r}
 0\ 1\ 1\ 1\ X \\
 0\ 0\ 0\ 0\ X\ X \\
 0\ 0\ 0\ 0\ X\ X\ X \\
 \hline
 0\ 0\ 0\ 1\ 1\ 1\ 0
 \end{array}
 \quad
 \begin{array}{l}
 (8+4+2) \\
 \hline
 8\ 4\ 2
 \end{array}$$

(d)

$$0\ 1\ 1\ 0\ 0\ 1\ 1\ 1 \quad 103$$

$$\begin{array}{r}
 \times 1\ 0\ 1 \\
 \hline
 0\ 1\ 1\ 0\ 0\ 1\ 1\ 1 \\
 0\ 0\ 0\ 0\ 0\ 0\ 0\ X \\
 0\ 1\ 1\ 0\ 0\ 1\ 1\ 1\ X\ X \\
 \hline
 1\ 0\ 0\ 0\ 0\ 0\ 0\ 1\ 1
 \end{array}
 \quad
 \begin{array}{l}
 5 \\
 \hline
 515 \\
 (512+2+1)
 \end{array}$$

(e)

$$1\ 0\ 1\ 0\ 1\ 0\ 1\ 0 \quad 170$$

$$\begin{array}{r}
 \times 0\ 1\ 0\ 1 \\
 \hline
 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0 \\
 0\ 0\ 0\ 0\ 0\ 0\ 0\ X \\
 1\ 0\ 1\ 0\ 1\ 0\ 1\ 0\ X\ X \\
 0\ 0\ 0\ 0\ 0\ 0\ 0\ X\ X\ X \\
 \hline
 1\ 1\ 0\ 1\ 0\ 0\ 1\ 0
 \end{array}
 \quad
 \begin{array}{l}
 5 \\
 \hline
 850 \\
 (512+256+64 \\
 +16+2)
 \end{array}$$

11

Binary division

Divisor Dividend

$$2) 15 \text{ (} \underline{\quad} \text{)}$$

$$\underline{-14}$$

$$\boxed{15 / 2}$$

$$10) 1111 \text{ (} \underline{\quad} \text{)}$$

$$\boxed{4+2+1}$$

$$\begin{array}{r} 10 \\ \hline 11 \end{array}$$

$$\begin{array}{r} 11 \\ -10 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 11 \\ -10 \\ \hline 1 \end{array}$$

(b) $45/5$

8+3

$5) 45(9$

45

(0)

$101) 101101(1001$

1011

0001

0000

10

00

101

101

(0)

(c) $121/14$

$14) 1\overset{10}{2}4(8$

112

(09)

$110) 1111001(1000$

110

10

00

100

000

1001

0000

1001

(d) $101 \overline{) 11010100} (10\cancel{0}010$

$$\begin{array}{r} 101 \\ \times 101 \\ \hline 0011 \\ 0000 \\ \hline 110 \\ 101 \\ \hline 011 \\ 000 \\ \hline 110 \end{array}$$

212
4 + 16 + 64 + 128

5) $212(42$

$$\begin{array}{r} 20 \\ \hline 12 \\ 10 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 101 \\ \times 42 \\ \hline 010 \\ 600 \\ \hline 10 \end{array}$$

(c) $\begin{array}{r} 0111 \\ \times 1010 \\ \hline 011111 \end{array}$ 168°

$\begin{array}{r} 00111 \\ -00000 \\ \hline 01 \end{array}$

$\begin{array}{r} 00 \\ -0 \\ \hline 00 \end{array}$

$\begin{array}{r} 10 \\ -0 \\ \hline 10 \end{array}$

$\begin{array}{r} 10 \\ -1 \\ \hline \end{array}$

$$(12) \quad (34 \cdot 34)_{10} \rightarrow (?)_2$$

a)

$$\begin{array}{r} 34 \\ 2 \overline{)17^0} \\ -2 \overline{)8^1} \\ -2 \overline{)4^0} \\ -2 \overline{)2^0} \\ \hline 1 \end{array}$$

$$34 = (100010)_2$$

$$0.34 \times 2 = 0.68 \Rightarrow 0$$

$$0.68 \times 2 = 1.36 \Rightarrow 1$$

$$0.36 \times 2 = 0.72 \Rightarrow 0$$

$$0.72 \times 2 = 1.44 \Rightarrow 1$$

$$0.44 \times 2 = 0.88 \Rightarrow 1$$

$$\text{Ans} \rightarrow (100010.01011)_2$$

$$34 = (1021)_3 \Rightarrow^{\text{Ans}} (1021.1000)_3$$

$$0.34 \times 3 = 1.02 \quad \underline{1}$$

$$0.02 \times 3 = 0.06 \quad 0$$

$$0.06 \times 3 = 0.18 \quad 0$$

$$0.18 \times 3 = 0.54 \quad 0$$

$$34 \Rightarrow (42)_{18}$$

$$0.34 \times 8 = 2.72 \rightarrow 2$$

$$0.72 \times 8 = 5.76 \rightarrow 5$$

$$0.76 \times 8 = 6.08 \rightarrow 6$$

$$0.08 \times 8 = 0.64 \rightarrow 0$$

$$\text{Ans} \rightarrow (42.2560)_8$$

$$34 \Rightarrow (22)_{16}$$

$$0.34 \times 16 = 5.44 \rightarrow 5$$

$$0.44 \times 16 = 7.04 \rightarrow 7$$

$$0.04 \times 16 = 0.64 \rightarrow 0$$

$$(b) \quad \text{Ans} \rightarrow (22.570)_{16}$$
$$(125.125)_{10}$$

$$125 = (111101)_2$$

$$0.125 \times 2 = 0.250 \rightarrow 0$$

$$0.250 \times 2 = 0.500 \rightarrow 0$$

$$0.500 \times 2 = 1.00 \rightarrow 1$$

$$Ans \rightarrow (111101, 001)_2$$

$$125 = (\cancel{100010} \cancel{0})_3$$

$$\begin{array}{r} 3 | 125 \\ 3 | 41 - 2 \\ 3 | 13 - 2 \\ 3 | 4 - 1 \\ \hline & 1 \end{array}$$

$$125 = (11122)_3$$

$$0.125 \times 3 = 0.375 \Rightarrow 0$$

$$0.375 \times 3 = 1.125 \Rightarrow 1$$

$$0.125 \times 3 = 0.375 \Rightarrow 0$$

$$0.375 \times 3 = 1.125 \Rightarrow 1$$

$$125 = (125)_8$$

$$0.125 \times 8 = 1 \Rightarrow 1$$

Ans

$$125 = (7D)_{16}$$

$$0.125 \times 16 = 2 \Rightarrow 2$$

$$(125, 125)_{10} \Rightarrow (111101, 001)_2 \rightarrow (11122, 0101)_3$$

$$\rightarrow (125, 1)_8 \rightarrow (10, 2)_6$$

$$(c) (10.16)_{10} \Rightarrow (1010.0010)_2 \rightarrow (10.0110)_3 \rightarrow$$

$$(12.1217)_8 + (A.28F5)_{16}$$

~~(10.0110)~~

$$10 = (101)_3$$

$$0.16 \times 2 = 0.32 \Rightarrow 0$$

$$0.32 \times 2 = 0.64 \Rightarrow 0$$

$$0.64 \times 2 = 1.28 \Rightarrow 1$$

$$0.28 \times 2 = 0.56 \Rightarrow 0$$

$$0.16 \times 3 = 0.48 - 0$$

$$0.48 \times 3 = 1.44 - 1$$

$$0.44 \times 3 = 1.32 - 1$$

$$0.32 \times 3 = 0.96 - 0$$

$$10 = (12)_8$$

$$0.16 \times 8 = 1.28 \Rightarrow 1$$

$$0.28 \times 8 = 2.24 \Rightarrow 2$$

$$0.24 \times 8 = 1.92 \Rightarrow 4$$

$$0.92 \times 8 = 7.36 \Rightarrow 7$$

$$10 = (A)_{16}$$

$$0.16 \times 16 = 2.56 \Rightarrow 2$$

$$0.56 \times 16 = 8.96 \Rightarrow 8$$

$$0.96 \times 16 = 15.36 \Rightarrow 15$$

$$0.36 \times 16 = 5.76 \Rightarrow 5$$

⑬ The largest positive number one can represent in a 12-bit 2's complement code is

$$0111\ 1111\ 1111 = (1023)_{10}$$

(14)

CODE / THS 2022

Character

~~000~~

Hex → Dec → Binary

67 0100011

C

43

29

0100111

O

4F

68

01000100

D

44

69

01000101

E

45

47

0010111

I

2F

84

01010100

T

54

72

01001000

H

48

83

01010011

S

53

32

01000000

Span

2

32

50

00110010

O

48

30

00110000

2

32

50

00110010

2

32

50

00110010

The 8 bit pattern

01000011 01001111 01000100 01000101
00101111 01010100 01001000 01010011
00100000 00110010 00110000 00110010
00110000 00110010 00110010 00110010

(15) Biggest binary number with 5 bit

Biggest binary number with 5 bit is

$$(1111)_2 = (31)_{10}$$

(16) In hex, $2BFC + 54A7$

$$(54A7)_{16} = (14260)_{10}$$

$$(2BFC)_{16} = \underline{+ (11260)_{10}} \\ (32931)_{10}$$

(17)

$$ABC7 \rightarrow (11110010111)_2$$

10 11 12 7

 $16^3 \quad 16^2 \quad 16^1 \quad 16^0$

$$40960 + 2816 + 192 + 7$$

 $(43975)_{10}$

$$(43975)_{10} \rightarrow (?)_2$$

$$\begin{array}{r} 43975 \\ \hline 2 | 21987 - 1 \\ \hline 2 | 1993 - 1 \\ \hline 2 | 996 - 1 \\ \hline 2 | 498 - 1 \\ \hline 2 | 249 - 0 \\ \hline 2 | 124 - 1 \\ \hline 2 | 62 - 0 \\ \hline 2 | 31 - 0 \\ \hline 2 | 15 - 1 \\ \hline 2 | 7 - 1 \\ \hline 2 | 3 - 1 \\ \hline 1 - 1 \end{array}$$

(18)

In hex, AC74 - B3F

$$(AC74)_{16} = 44148$$

$$(B3F)_{16} = \underline{\hspace{2cm}} \rightarrow (41269)_{10}$$

$$- 2879$$

(19)

convert the following binary fractions to ordinary fractions

$$(a) (0.1001)_2 = (0.5625)_{10} \Rightarrow 9/16$$

$$\Rightarrow \begin{array}{r} 1 & 0 & 0 & 1 \\ \downarrow & \downarrow & \downarrow & \downarrow \\ \frac{1}{2} & \frac{0}{2^2} & \frac{0}{2^3} & \frac{1}{2^4} \end{array}$$

$$\Rightarrow 0.5 + 0 + 0 + 0.625$$

$$= (0.5625)_{10}$$

$$(b) (1.0011)_2 \Rightarrow (1.1875)_{10} \Rightarrow 19/16$$

$$1.0011_2 = \frac{1}{2^0} + \frac{1}{2^1} + \frac{0}{2^2} + \frac{1}{2^3} + \frac{1}{2^4}$$

$$2^0 \times 1 = 1$$

~~$$0 + 0 + 0 + 0 = 0.$$~~

$$0 + 0 + 0.125 + 0.0625 = 1.1875$$

$$(c) 1.1111_2 = (1.9375)_{10}$$

$$1.1111_2 = \frac{1}{2^0} + \frac{1}{2^1} + \frac{1}{2^2} + \frac{1}{2^3} + \frac{1}{2^4}$$

~~$$2^0 \times 1 = 1$$~~

$$0.5 + 0.25 + 0.125 + 0.0625$$

$$(1.9375)_{10}$$

(20) The decimal expansion of $\frac{11}{17}$ is
 0.647. Find the binary expansion
 of fraction $\frac{11}{17}$

$$0.647 \times 2 = 1.294 \rightarrow 1$$

$$0.294 \times 2 = 0.588 \rightarrow 0$$

$$0.588 \times 2 = 1.176 \rightarrow 1$$

$$0.176 \times 2 = 0.352 \rightarrow 0$$

$$0.352 \times 2 = 0.704 \rightarrow 0$$

$$0.704 \times 2 = 1.408 \rightarrow 1$$

$$0.408 \times 2 = 0.816 \rightarrow 0$$

$$0.816 \times 2 = 1.632 \rightarrow 1$$

Binary expansion is $(0.10100101)_2$

(21)

Find the decimal expansion of
 $3/11$ is 0.2727 . Find the binary
 expansion of $3/11$

$$0.2727 \times 2 = 0.5454 \rightarrow 0$$

$$0.5454 \times 2 = 1.0908 \rightarrow 1$$

$$0.0908 \times 2 = 0.1816 \rightarrow 0$$

$$0.1816 \times 2 = 0.3632 \rightarrow 0$$

$$0.3632 \times 2 = 0.7264 \rightarrow 0$$

$$0.7264 \times 2 = 1.4528 \rightarrow 1$$

$$0.4528 \times 2 = 0.9056 \rightarrow 0$$

$$0.9056 \times 2 = 1.8112 \rightarrow 1$$

Binary expansion is

$$(0.01000101)_2$$