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EXAMPLE 6:-

FIND BINARY EXPANSION.

$(241)_{10}$.

$241 = 2 \cdot 120 + 1$.

$120 = 2 \cdot 60 + 0$

$60 = 2 \cdot 30 + 0$

$30 = 2 \cdot 15 + 0$

$15 = 2 \cdot 7 + 1$

$7 = 2 \cdot 3 + \underline{1}$.

$3 = 2 \cdot \underline{1} + \underline{1}$

$1 = 2 \cdot 0 + \underline{1}$

↘ MSB.

$(11110001)_2$

CONVERT YOUR REG NO into HEXADECIMAL.

$202342_8 = 16 \cdot 12646 + 4$

$12646 = 16 \cdot 790 + 6$.

$790 = 16 \cdot 49 + 6$

$49 = 16 \cdot 3 + 1$

$3 = 16 \cdot 0 + 3$.

1, 14, 14, 0, 0, 4.

$(1EE004)_{16}$.

BINARY, OCTAL, HEXA, DECIMAL INTERCONVERSONS.

EXAMPLE 7:-

$(111110\ 1011\ 1100)_2$

Octal ← To

$(\underline{111}\ \underline{110}\ \underline{101}\ \underline{100})_2$

start from LSB.

3, 7, 2, 7, 4

$\Rightarrow (37274)_8$

Similarly group to 4 for hexa.

$(765)_8 \rightarrow$ to $\rightarrow$ Binary

7 = 111
6 = 110
5 = 101

} give each digit its 3-Bit Binary equivalent

$\therefore (111110101)_2$

$$\begin{array}{r} 7 \\ 8 \\ \hline 15 \end{array} \Rightarrow 1\times10+5$$

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$(A8D)_{16}$ into Binary

A = 1010
8 = 1000
D = 1101

$(101010001101)_2$.

ADDITION ALGORITHM.

Adding pairs of Binary digits together with carries when they occur; to compute the sum of two integers.

$a = (a_{n-1}, a_{n-2} \text{ --- } a_1, a_0)_2$

$b = (b_{n-1}, b_{n-2} \text{ --- } b_1, b_0)_2$

Now using (a) & (b) are 2 Binary No.s using logic described

$a_0 + b_0 = C_0 . 2 + S_0$.
$a_1 + b_1 + C_0 = C_1 . 2 + S_1$
$a_2 + b_2 + C_1 = C_2 . 2 + S_2$.
⋮
$a_{n-1} + b_{n-1} + C_{n-2} = (C_{n-1}) . 2 + S_{n-1}$

→ this is carryover flow and will be considered MSB. $\Rightarrow S_n$

The summed result in Binary will be

$(S_n\ S_{n-1}\ S_{n-2} \text{ ---- } S_1\ S_0)$

—— x ——

$a = (1110)_2$

$b = (1011)_2$.

start from LSB.

$a_0 + b_0 \Rightarrow 0+1 = 0.2+1$.

$a_1 + b_1 \Rightarrow 1+1+0 = 1.2+0$

$a_2 + b_2 \Rightarrow 1+0+1 = 1.2+0$

$a_3 + b_3 \Rightarrow 1+1+1 \Rightarrow 1.2+1$.

$(11001)_2$.

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EXERCISE 4.2.

Question no.1.

Convert decimal expansion of each in to Binary expansion.

$(97644)_{10}$

97644 = 2.48822 + 0
48822 = 2.24411 + 0
24411 = 2.12205 + 1
12205 = 2.6102 + 1
6102 = 2.3051 + 0
3051 = 2.1525 + 1
1525 = 2.762 + 1
762 = 2.381 + 0.
381 = 2.190 + 1
190 = 2.95 + 0
95 = 2.47 + 1
47 = 2.23 + 1
23 = 2.11 + 1
11 = 2.5 + 1
5 = 2.2 + 1
2 = 2(1) + 0
1 = 2(0) + 1.

$(10111110101101100)_2$

Ans!

Question no.2.

100632.

100632 = 2.50316 + 0
50316 = 2.25158 + 0
25158 = 2.12579 + 0
12579 = 2.6289 + 1.
6289 = 2.3144 + 1
3144 = 2.1572 + 0
1572 = 2.786 + 0
786 = 2.393 + 0
393 = 2.196 + 1
196 = 2.98 + 0
98 = 2.49 + 0
49 = 2.24 + 1
24 = 2.12 + 0
12 = 2.6 + 0
6 = 2.3 + 0
3 = 2.1 + 1
1 = 2(0) + 1.

$(11000100010001100000)_2$

Ans!

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Question. 3

Binary expansion to decimal expansion.

(d) $(110\ 1001\ 0001\ 0000)_2$.

$1\times2^{14} + 1\times2^{13} + 1\times2^{11} + 1\times2^{8} + 1\times2^{4}$

$\Rightarrow 16384 + 8192 + 2048 + 256 + 16$

$\Rightarrow (26896.)_{10}$.

Question no. 4:-

(d) $(111\ 1100\ 0001\ 1111)_2$.

$\Rightarrow 1\times(2)^{14} + 1\times(2)^{13} + 1\times(2)^{12} + 1\times(2)^{11} + 1\times(2)^{10} + 1\times2^{4} + 1\times2^{3} + 1\times2^{2} + 1\times2^{1} + 1\times2^{0}$.

$\Rightarrow 16384 + 8192 + 4096 + 2048 + 1024 + 16 + 8 + 4 + 2 + 1$.

$\Rightarrow (31775)_{10}$

Question 5

Convert these octals into Binary expansion.

(c) $(423)_8$

We need it in decimal for long method to convert into octal.

$= 4.8^2 + 2.8^1 + 3.8^0$

$= 275$.

$275 = 2.137 + 0$
$137 = 2.68 + 1$
$68 = 2.34 + 0$
$34 = 2.17 + 0$
$17 = 2.8 + 1$
$8 = 2.4 + 0$
$4 = 2.2 + 0$
$2 = 2(1) + 0$
$1 = 2(0) + 1$

$(100010010)_2$.

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(d) $(2417)_8$.

$2.8^3 + 4.8^2 + 1.8^1 +$

$7.8^0 \Rightarrow 1295$.

$1295 = 2.647 + 1$

$647 = 2.323 + 1$

$323 = 2.161 + 1$

$161 = 2.80 + 1$

$80 = 2.40 + 0$

$40 = 2.20 + 0$

$20 = 2.10 + 0$

$10 = 2.5 + 0$

$5 = 2.2 + 1$

$2 = 2(1) + 0$

$1 = 2(0) + 1\emptyset$.

$(101\ 00001111)_2$.

Question no.6

Convert Binary → Octal.

(c) $(111\ 0111\ 0111\ 0111)_2$

Start from LSB

7, 3, 5, 6, 7

$(73567)_8$. Ans!

(d) $(110\ 100\ 100\ 010\ 000)_2$.

6, 4, 4, 2, 0

$(64420)_8$

Convert the hexadecimal expansion of each of these into Binary expansion.

(c) $(ABBA)_{16}$.

$A \times 16^3 + B \times 16^2 + B \times 16^1$

$A \times 16^0$.

$12 \times 16^3 + 11 \times 16^2 + 11 \times 16^1$

$10 \times 16^0 \Rightarrow 43962$.

(d) $(DEFACED)_{16}$

D, E, C, A, F $\Rightarrow$ 13, 14, 12, 10, 15

$D \times 16^6 + E \times 16^5 + F \times 16^4 +$

$A \times 16^3 + C \times 16^2 + E \times 16^1$

$D \times 16^0 \Rightarrow 233811181$

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$2338111181 = 2.1169055590 + 1$
$1169055590 = 2.58452795 + 0$
$58452795 = 2.29226397 + 1$
$29226397 = 2.14613198 + 0$
$14613198 = 2.7306599 + 0$
$7306599 = 2.3653299 + 1$
$3653299 = 2.1826649 + 1$
$1826649 = 2.913324 + 1$
$913324 = 2.456662 + 0$
$456662 = 2.228331 + 0$
$228331 = 114165 + 1$

$114165 = 2.57082 + 1$
$57082 = 2.28541 + 0$
$28541 = 2.1470 + 1$
$1470 = 2.7135 + 0$
$7135 = 2.3567 + 1$
$3567 = 2.1783 + 1$
$1783 = 2.891 + 1$
$891 = 2.445 + 1$
$445 = 2.222 + 1$
$222 = 2.111 + 0$
$111 = 2.55 + 1$.

and so on...

(1101 1110 1111 1010 1100 1110 1101)

hence proved!

Q no. 12. Convert (11000 0110 0011) from its Binary expansion to its hexadecimal expansion.

0001 1000 0110 0011

$(1863)_{16}$ Ans!

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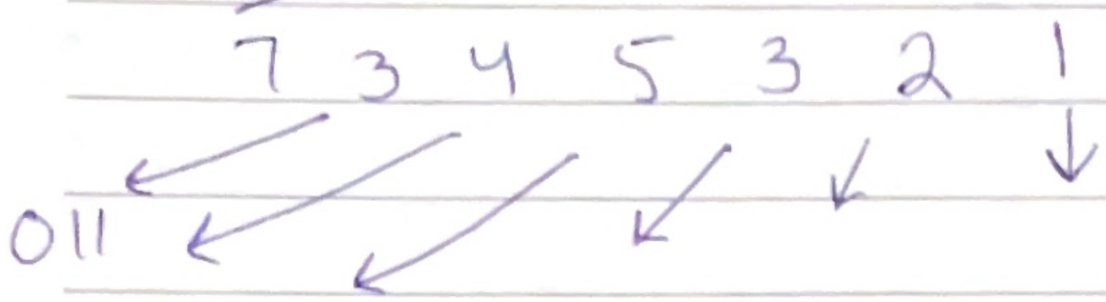
Q no. 17

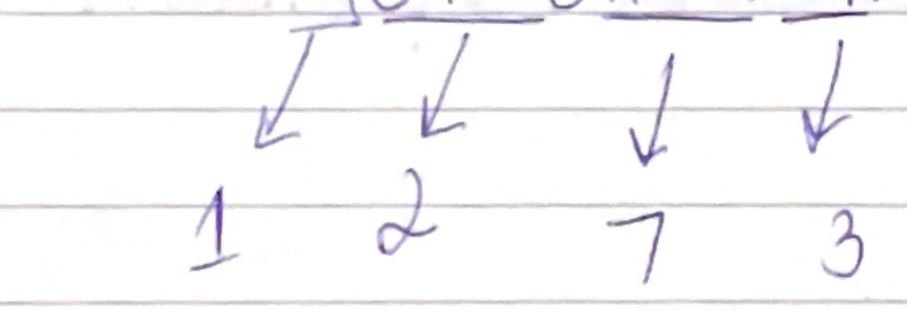
Convert $(7345321)_8$ to its Binary expansion and $(101011\ 1011)_2$ to its octal expansions.

$(7345321)_8$ to Binary.



$(111\ 011\ 100\ 101\ 011\ 010\ 001)_2$.

and



$(1273)_8$ Ans!.

Question no. 18.

Give procedure for converting from hexa-decimal expansion of an integer to its octal expansion using Binary notation as an immediate step.

⇒ write answer in algorithm.

The procedure follows as:

(i) Convert hexadecimal expansion to Binary expansion by writing 4-Bit Binary equivalent of each hexa-decimal digit.

(ii) Group the bits from right to left in groups of 3.
If the left most group doesn't have 3 digits, append 0s before the first digit until the group has 3 digits.

(iii) Substitute each group with a 3-group's equivalent in Octal.

Example: give e.g of $(F)_{16}$.