# LAB-6

Q.1) (1)

| | | |
|---|---|---|
| 2 | 51 | |
| 2 | 25 | 1 |
| 2 | 12 | 1 |
| 2 | 6 | 0 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

| | | |
|---|---|---|
| 2 | 77 | |
| 2 | 38 | 1 |
| 2 | 19 | 0 |
| 2 | 9 | 1 |
| 2 | 4 | 1 |
| 2 | 2 | 0 |
| 2 | 1 | 0 |
| | 0 | 1 |

8 bit representation

$(51)_2 = 00110011$

$(77)_2 = 01001101$

$$
\begin{array}{r}
00110011 \\
+\ 01001101 \\
\hline
(10000000)_2 = (128)_{10} \\
\hline
\end{array}
$$

(2)

| | | |
|---|---|---|
| 2 | 53 | |
| 2 | 26 | 1 |
| 2 | 13 | 0 |
| 2 | 6 | 1 |
| 2 | 3 | 0 |
| 2 | 1 | 1 |
| | 0 | 1 |

| | | |
|---|---|---|
| 2 | 112 | |
| 2 | 56 | 0 |
| 2 | 28 | 0 |
| 2 | 14 | 0 |
| 2 | 7 | 0 |
| 2 | 3 | 1 |
| 2 | 1 | 1 |
| | 0 | 1 |

$(53)_2 = 00110101$
in 8 bit

$(112)_2 = 01110000$
in 8 bit

~~2's complement of 112~~

2's complement of 112 $\Rightarrow (10001111 + 00000001)$

2's complement of 112 ⇒ 10010000 ⇒ (-112)

53 + (-112) ⇒

$$
\begin{array}{r}
00110101 \\
+\ 10010000 \\
\hline
(11000101)_2
\end{array}
$$

$-2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$= -2^7 + 2^6 + 4 + 1$

$= -64 + 4 + 1 = -59$

$\Rightarrow (-59)_{10}$

$(59)_2 = 00111011$

$(-59)_2$ = 2's complement of

$$
\begin{array}{r}
11000100 \\
+\ 00000001 \\
\hline
11000101
\end{array}
$$

⇒ -59

③

| | |
|---|---|
| 2 | 35 |
| 2 | 17 ① |
| 2 | 8 ① |
| 2 | 4 ⓪ |
| 2 | 2 ⓪ |
| 2 | 1 ⓪ |
| | 0 ① |

$(35)_2 = 00100011$

in 8 bit

| | |
|---|---|
| 2 | 23 |
| 2 | 11 ① |
| 2 | 5 ① |
| 2 | 2 ① |
| 2 | 1 ⓪ |
| | 0 ① |

$(23)_2 = 00010111$

in 8 bit

$(-23)_{10}$ = 2's complement of $(23)_2$

$$= \begin{pmatrix} 11101000 \\ + \\ 00000001 \end{pmatrix}$$

$\boxed{-23 = 11101001}$

$35 + (-23) \Rightarrow$ 0 0 1 0 0 0 1 1
+ 1 1 1 0 1 0 0 1
$\cancel{1}$ (0 0 0 0 1 1 0 0) $\Rightarrow (12)_{10}$

out of 8 bit
so, no meaning

$2^3 + 2^2 = 12$

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(4)

| | |
|---|---|
| 2 | 87 |
| 2 | 43 (1) |
| 2 | 21 (1) |
| 2 | 10 (1) |
| 2 | 5 (0) |
| 2 | 2 (1) |
| 2 | 1 (0) |
| | 0 (1) |

$(87)_2$ = 0 1 0 1 0 1 1 1
in 8 bit

| | |
|---|---|
| 2 | 12 |
| 2 | 6 (0) |
| 2 | 3 (0) |
| 2 | 1 (1) |
| | 0 (1) |

$(12)_2$ = 0000 11 00
in 8 bit

87 + 12 $\Rightarrow$ 0 1 0 1 0 1 1 1
+ 0 0 0 0 1 1 0 0
$(0 1 1 0 0 0 1 1)_2 \Rightarrow (99)_{10}$

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(5) $(75)_2$ = 0 1 0 0 1 0 1 1
in 8 bit

$(-75)$ = 2's complement of $(75)_2$
= 1 0 1 1 0 1 0 0
+ 0 0 0 0 0 0 0 1
1 0 1 1 0 1 0 1

$(54)_2$ = 0 0 1 1 0 1 1 0
in 8 bit

$(-54)$ = 2's complement of $(54)_2$
= 1 1 0 0 1 0 1 0

$(-75) + (-54) \Rightarrow$ 1 0 1 1 0 1 0 1
+ 1 1 0 0 1 0 1 0
$\cancel{1}$ 0 1 1 1 1 1 1 1

out of 8 bit

The resulting number (−129) can't be represented in 8 bits

~~The no~~

The resulting number $(-75-54=-129)$ can't be represented in 8 bit's,

because, the range of 2's complement is $-2^{n-1}$ to $+(2^{n-1}-1)$

so $-2^{7}$ to $(2^{7}-1)$

$\Rightarrow \boxed{-128 \text{ to } 127}$

so in 9 bits, $(-129)$ can be represented as

$\underset{\text{in 9 bits}}{(-129)} = (1\ 0\ 1\ 1\ 1\ 1\ 1\ 1\ 1)$

# LAB-6

Q.2)

① $(1)_{10} = (0000\,0001)_2 = 1.0 \times 2^0$

in 8 bit

$\Rightarrow$ sign $\rightarrow$ positive $\rightarrow$ 0

$\Rightarrow$ Exponent $\rightarrow$ $0+127 = (127)_{10}$

$= (01111111)_2$

mantissa $\Rightarrow$ $\underbrace{0000\cdots0}_{23 \text{ zeroes}}$

$\longleftarrow$ 32 bits $\longrightarrow$

| sign | exponet | mantissa |
|---|---|---|
| 1 bit | 8 bits | 23 bits |

output $\Rightarrow$ $\underline{0} - \underline{01111111} - \underbrace{00\cdots0}_{23 \text{ zeroes}}$

② $(12.375)_{10} = (0000\,1100.011)_2 = 1.100011 \times 2^3$

$0.375 \times 2 = 0.75$

$0.75 \times 2 = 1.5$

$0.5 \times 2 = 1.0$

$.011$

~~in 8~~

$\Rightarrow$ sign $\rightarrow$ (+ve) $\rightarrow$ 0

$\rightarrow$ Exponent $\rightarrow$ $127+3 = (130)_{10}$

$= (10000010)_2$

$\Rightarrow$ mantissa $\Rightarrow$ $100011\underbrace{00\cdots0}_{17 \text{ zeroes}}$

output $\Rightarrow$ $\underline{0} - \underline{10000010} - \underline{100011\underbrace{00\cdots0}_{17 \text{ zeroes}}}$

$0.25 \times 2 = 0.5$
$0.5 \times 2 = 1.0$ $\Big\} .01$

Q.2)

3 $(0.25)_{10} = (00000000.01)_2$

$= 1.0 \times 2^{-2}$

mantissa

sign $\Rightarrow$ negetive $\Rightarrow$ 1

exponent $\Rightarrow$ 127 - 2 $\Rightarrow (125)_{10}$

$= (01111101)_2$

mantissa $\Rightarrow \underbrace{000 -- 0}_{\text{23 zeros}}$

$\boxed{\text{output} \Rightarrow \underline{1} - \underline{01111101} - \underbrace{00 -- 0}_{\text{23 Zeros}}}$