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Section: C8

Lab#1

(a) $(10100110)_2 = (\ )_{10}$

$2^7\times1 + 2^6\times0 + 2^5\times1 + 2^4\times0 + 2^3\times0 + 2^2\times1 + 2^1\times1 + 2^0\times0$

$= (166)_{10}$

(b) $(11101011)_2 = (?)_8$

$\underbrace{011}\ \underbrace{101}\ \underbrace{011}$

$= (353)_8$

(c) $(00110111)_2 = (?)_{16}$

$\underbrace{0011}\ \underbrace{0111}$

$= (37)_{16}$

(d) $(3741)_8 = (?)_{10}$

$= (2017)_{10}$

(e) $(7372)_8 = (?)_{16}$

itx binary → 3-bit

111 011 111 010

$(111011111010)_2$

now divid into 4-bit

$(EFA)_{16}$

~~2) $(71532)_{10} = ( )_8$~~

f) $(1B2CA)_{16} = (?)_{10}$

$1\times16^4 + 11\times16^3 + 2\times16^2 + 12\times16^1 + 10\times16^0$

$= (111306)_{10}$

g) $(7E5E2)_{16} = (?)_2$

$(0111\ 1110\ 0101\ 1110\ 0010)_2$

h) $(853325)_{10} = ( )_2$

2	853325	
2	426662	1
2	213331	0
2	106665	1
2	53332	1
2	26666	0
2	13333	0
2	6666	1
2	3333	0
2	1666	1
2	833	0
2	416	1
2	207	0
2	104	0
2	52	0
2	26	0
2	13	0
2	6	1
2	3	0

$(1101\ 0000\ 0101\ 0100\ 1101)_2$

2)

i) $(71552)_{10} = (?)_8$

8	71552
8	8944 – 0
8	1118 — 0
8	139 — 6
8	17 — 3
	2 – 1

So $(213600)_8$

Task-2:

(a) $(1010010)_2 + (1011011)_2$

$$\begin{array}{r} 1010010 \\ +\ 1011011 \\ \hline 10101101 \end{array}$$

$= (10101101)_2$

b) $(1101001)_2 \times (101)_2$

$$\begin{array}{r} 1101001 \\ 101 \\ \hline 1101001 \\ 0000000\times \\ 1101001\times\times \\ \hline 1000001101 \end{array}$$

$(1000001101)_2$ Ans

~~(c) 01~~

(c) $(1110011)_2 / (11)_2$

```
        0100110
     ___________
  11 | 1110011
      -0
      ---
       11
      -11
      ---
       001
      -00
      ----
       0010
      -  00
      -----
       00100
      -   11
      ------
       000011
      -    11
      -------
       0000001
       0000000
      -------
       0000001
```

$$\boxed{(1110011)_2 / (11)_2 = (0100110)_2}$$

d) $(BCD)_{16} + (386)_{16}$

$(1011\ 1100\ 1101)_2 + (0011\ 1000\ 0110)_2$

$$\begin{array}{r} 1011\,1100\,1101 \\ +\ 0011\,1000\,0110 \\ \hline 011 \end{array}$$

$$\begin{array}{r} B\ C\ D \\ 3\ 8\ 6 \\ \hline F\ 5\ \cancel{2}\ 3 \end{array}$$

$13+6=19$

$15 \ \ > 18$

$18-16=2$

$12+9=21$

$21-16=$

$=(F53)_{16}$

e) $(4737)_8 + (121)_8$

$$\begin{array}{r} 4737 \\ 121 \\ \hline 5060 \end{array}$$

$8-8=1$

$=(5060)_8$

3)

Task 3:

(a) $57+(-38)$

Using sign magnitude:

$57 = (00111001)_2$

$38 = 100110$

$38 = 00100110$

$\boxed{-38 = 10100110}$

~~using~~

$$
\begin{array}{r}
\cancel{00111001} \\
00111001 \; (57) \\
+\; 10100110 \; (-38) \\
\hline
(11011111)_2 = (223)_{10}
\end{array}
$$

Singned magnitude doesn't support binary arithmatic well due to sign handling. Must compare magnitude and assign seperately.

Using One's Complement.

$57 = 00111001$

$-38 =$ invert bits of $38 = 11011001$

Add

$$
\begin{array}{r}
00111001 \\
11011001 \\
\hline
100010010 = ([illegible])_{10}
\end{array}
$$

by adding carry bit

$$
\begin{array}{r}
00010010 \\
+\quad\quad 1 \\
\hline
(00010011) = (35)_{10}
\end{array}
$$

which it's also invalid.

Using two's complement:

38's 1's Complement $= 11011001$

$$
\begin{array}{r}
11011001 \\
+\quad\quad 1 \\
\hline
(11011010)_2
\end{array}
$$

```
  00111001
+ 11011010
----------
 100010011
```

Here's the result is 9 bit but the final bit is discarded because we are working on 8-bit system.

So 00010011 = $(19)_{10}$ which is correct

(b) 100+(-51)

$(100)_{10} = (01100100)$

-51 in sign-magnitude = 10110011

One's Complement = 11001100

Two's Complement = 11001101

Now let's addition

1) Sign Magnitude:

```
  ~~01100100 (100)~~          01100100 (100)
+ ~~10110011 (-51)~~        + 10110011
  ~~(11111011)~~ = 251        100010111
```

but if we consider sign-magnitude then ~~1 1111011~~ 100010111 it would be -23 which is invalid.

2) One's Complement Addition

```
  01100100
  11001100
----------
 100110000
```

~~(304)~~ So it is incorrect

adding the carry out bit

$$\begin{array}{r} 00110000 \\ +\quad 1 \\ \hline 00110001 \end{array}$$

$(00110001)_2 = (49)_{10}$. which is correct

3) **Two's Complement Addition**

$$\begin{array}{rl} \overset{1}{0}11\overset{1}{0}\overset{1}{0}100 & (100) \\ +\ 11001101 & (-51) \\ \hline 100110001 & \end{array}$$

Discarding the carry out the result is

$(00110001)_2 = (49)_{10}$, which is correct.

(c) (-42) + (-84)

-42 :

Sign-magnitude : 10101010

One' magnitude : 11010101

Two's Complement : 11010110

-84

Sign-Magnitude : 11010100

One's magnitude : 10101011

Two's compliment : 10101100

Addition

1) Sign-magnitude :

```
    10101010
  + 11010100
  ----------
  1 01111110
```

-126 correct

2) One's Complement

```
    11010101
  + 10101011
  ----------
  1 10000000
```

Adding carry out

```
  10000000
         1
  --------
  10000001
```

129 incorrect

3) 2's Complement:

$$\begin{array}{r} 11010110 \\ +\ 10101100 \\ \hline 110000010 \end{array}$$

Discarding carry-out bit the result is $(10000010)_2 =$ ~~130 invalid.~~

so first bit is 1 which means its negative let's find its value, performing two's complement

01111101

adding 1:

~~01111101~~
~~1~~
~~1111111~~

$$\begin{array}{r} 01111101 \\ 1 \\ \hline (01111110)_2 = 126 \end{array}$$

so it's correct.

Task-4

a) $(6178)_{BCD} + (4933)_{BCD}$

$$\begin{array}{r} 6178 \\ +4933 \end{array}$$

So add digits

~~8(1000) + 3(0011) = 11(00~~

$$\begin{array}{r} 1\,1\,1\;\;1\;\; \\ 6\,1\,7\,8 \\ +4\,9\,3\,3 \\ \hline 1\,1\,1\;\;1 \end{array}$$

$$\begin{array}{r} 8 \\ +3 \\ \hline 11 \end{array}$$

$11-10=1$

$\boxed{(6178)_{BCD}+(4933)_{BCD}=1111}$ Ans

(b) $(2901)_{BCD} + (4734)_{BCD}$

$$\begin{array}{r} 1\;\;\;\;\;\;\; \\ 2901 \\ +4734 \\ \hline 7635 \end{array}$$

$16-10=6$

$(2901)_{BCD} + (4734)_{BCD} = (7635)_{BCD}$

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