ASSIGNMENT 1

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Q1 Convert

a) $(4310)_5 = (\quad)_8 = (\quad)_{BCD}$

$(4310)_5 = 0\times5^0 + 1\times5^1 + 3\times5^2 + 4\times5^3$

$= (580)_{10}$

8	580	
8	72	4
8	9	0
8	1	1
	0	1

$\Rightarrow (580)_{10} = \underline{(1104)_8}$

$\Rightarrow (580)_{10} = \underline{(0101\ 1000\ 0000)_{BCD}}$

b) $(110.010)_{12} = (\quad)_2 = (\quad)_8$

$(110.010)_{12} = 0 + 1\times12 + 1\times(12)^2 + 0 + 1\times12^{-2} + 0$

$= (156.00694)_{10} = \underline{(10011100.000000011)_2}$

2	156	
2	78	0
2	39	0
2	19	1
2	9	1
2	4	1
2	2	0
	1 →	0

$12^{-2}\times2 = 0 + (1/72)$

$(1/72)\times2 = 0 + (1/36)$

$(1/36)\times2 = 0 + (1/18)$

$(1/18)\times2 = 0 + (1/9)$

$0.111 \times 2 = 0 + 0.222$

$0.222 \times 2 = 0 + 0.444$

$0.444 \times 2 = 0 + 0.888$

$0.888 \times 2 = 1 + 0.776$

$(010011100.000000011)_2 = (234.003)_8$

c) $(DADA.B)_{16} = (\quad)_5$

$(DADA.B)_{16} = (1101\ 1010\ 1101\ 1010.\ 1011)_2$

D = 13
A = 10

$= 10 \times 16^0 + 13 \times 16^1 + 10 \times 16^2 + 13 \times 16^3 + 11 \times 16^{-1}$

$= (56026.6875)_{10}$

5	56026	
5	11205	1
5	2241	0
5	448	1
5	89	3
5	17	4
5	3	2
	0	3

$0.6875 \times 5 = 3 + 0.4375$

$0.4375 \times 5 = 2 + 0.1875$

$0.1875 \times 5 = 0 + 0.9375$

$0.9375 \times 5 = 4 + 0.6875$

$(56026.6875)_{10} = (3243101.3204)_5$

Q2 Evaluate 9's and 10's complement of 54760, 003497.

9's complement of $(54760)_{10} = (10^5 - 1) - 54760$

$= 45239$

10's complement of $(54760)_{10}$ = 9's complement + 1

$= 45240$

9's complement of $(003497)_{10} = (10^6 - 1) - (003497)$

$= 996502$

10's complement of $(003497)_{10}$ = 9's complement + 1

$= 996503$

Q3 2's complement of 1001100, 0011010

2's complement of $(1001100)_2 = (0110011) + 1 = 0110100$

2's complement of $(0011010) = (1100101) + 1 = 1100110$

Q4 Perform binary subtraction with complements.

X = 1011100 , Y = 1001011

a) X - Y

2's complement of $(1001011)_2 = (0110101)$

```
  1 1 1 1
  1 0 1 1 1 0 0
+ 0 1 1 0 0 1 0 1
-------------------
1 0 0 1 0 0 0 1
```

Discard

Ans = $(0010001)_2$

(b) Y-X : 2's complement of X = $(10100011) + 1$

$= (10100100)_2$

```
 01001011
+10100100
----------
 11101111
```

⇒ Ans = −(2's complement of 11101111) = −00010001

(c) −X−Y : 2's complement of X = $(10100100)_2$

2's complement of Y = $(10110101)_2$

```
  10100100
+ 10110101
-----------
 1 01011001
```

⇒ Ans = −(2's complement of 10101100 1)

= −(01 0100111)

Q5 Perform BCD addition and subtraction:

a) X = 0100 , Y = 0101

(i)

```
  0100
+ 0101
------
  1001
```

(ii) 2's complement of Y = 1011

```
  0100
+ 1011
------
  1111
```

Ans = −(2's complement of 1111)

= −0001

(b) X = 1000 , Y = 1001

(i)
```
 01000
+01001
-------
 10001
+ 0110   (Adding 6)
-------
 10111
```

⇒ Ans = 0001 0111

≡ $(17)_{10}$

(ii) 2's complement of Y = 10111

```
 01000
+10111
-------
 11111
```

Ans = -(2's complement of 11111)

= -00001

Q6 $(+49)_{10} \equiv (0110001)_2$, $(29)_{10} \equiv (0011101)_2$

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

2	29	
2	14	1
2	7	0
2	3	1
2	1	1
	0	1

(i) (+29) + (-49) , Expected ans = $-(20)_{10}$

2's complement of $(0110001)_2 = (1001111)_2$

```
  1 1 1 1
  0011101
+ 1001111
---------
 11 01100
```

⇒ Ans = -(2's complement of 1101100)

= $-(0010100)_2 \equiv -(20)_{10}$

(ii) $(-29) + (49)$, expected ans $= (20)_{10}$

2's complement of $(0011101)_2 \equiv (1100011)_2$

$$\begin{array}{r} {\scriptstyle 1\quad\quad 1} \\ 1100011 \\ +\ 0110001 \\ \hline 1)\ 0010100 \end{array} \Rightarrow \text{Ans} = (0010100)_2$$

Discarded

$\equiv (20)_{10}$

verified

(iii) $(-29) + (-49)$ $\quad (29)_{10}$

2's complement of $(0011101)_2 \equiv (1100011)_2$

2's complement of $(0110001)_2 \equiv (1001111)_2$

$(49)_{10}$

$$\begin{array}{r} {\scriptstyle 11\ 1} \\ 1100011 \\ +\ 1001111 \\ \hline 1)0110010 \end{array} \Rightarrow \text{Ans} = -(\text{2's complement of } 0110010)$$

or Discard

$= -(1001110)_2$

Q7 (a) 16's complement of C3DF

= 15's complement +1 − C3DF

= FFFF − C3DF +1

= 3C21

$$\begin{array}{r} FFFF \\ -C3DF \\ \hline 3C20 \end{array}$$

(b) Convert C3DF to binary:

$(C3DF)_{16} \equiv (1010\ 0011\ 1011\ 1111)_2$

(c) 2's complement of $(1010\ 0011\ 1011\ 1111)_2$

$\equiv (0101\ 1100\ 0100\ 0001)_2$

(d) $(0101\ 1100\ 0100\ 0001)_2 \equiv (5C41)_{16}$

$(C3DF)_{16} > (5C41)_{16}$

Q8 $111011 \div 101 = 001011$ remainder: 0100

```
     001011
101 ) 111011
    -101
     1001
    -101
     01001
      -101
       0100
```

Q9 111011×101

$$
\begin{array}{r}
111011 \\
\times\ 101 \\
\hline
111011 \\
000000\times \\
111011\times\times \\
\hline
100100111
\end{array}
$$

Q10 let Base $= r$

$(x-3)(x-6) = x^2 - (r+1)x + (2r+2)$

$r+1 = 9 \quad ; \quad 2r+2 = 18$

$r = 8$