College of Computer Sciences & Engineering
Department of Computer Engineering
COE: 202: Fundamentals of Computer Engineering (071)

Quiz I (Solution)

Qn. 1.

Find the value of X that satisfies the following equations.

a. $(173)_{16} - (X)_2 = (2123)_4$

$(X)_2 = (173)_{16} - (2123)_4$
$(173)_{16} = 1 \times 16^2 + 7 \times 16^1 + 3 \times 16^0 = (371)_{10}$
$(2123)_4 = 2 \times 4^3 + 1 \times 4^2 + 2 \times 4^1 + 3 \times 4^0 = (155)_{10}$
Therefore,
$(X)_2 = (371)_{10} - (155)_{10}$
$(X)_2 = (216)_{10}$
Thus, $\underline{X = 11011000}$

b. $(739)_{10} = (X)_7$

7	739	4
7	105	0
7	15	1
7	2	

Thus, $\underline{X = 2104}$

c. $(11010.101)_2 = (X)_{10}$

$(11010.101)_2 = 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 + 1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3}$
$= 16 + 8 + 0 + 2 + 0 + 0.5 + 0 + 0.125 = 26.625.$
Thus, $\underline{X = 26.625}$

d. $(1010.0101)_4 = (X)_{16}$

$(1010.0101)_4 = 1 \times 4^3 + 0 \times 4^2 + 1 \times 4^1 + 0 \times 4^0 + 0 \times 4^{-1} + 1 \times 4^{-2} + 0 \times 4^{-3} + 1 \times 4^{-4}$
$= 1 \times (2^2)^3 + 1 \times (2^2)^1 + 1 \times (2^2)^{-2} + 1 \times (2^2)^{-4}$
$= 1 \times 2^6 + 1 \times 2^2 + 1 \times 2^{-4} + 1 \times 2^{-8} = (01000100.00010001)_2$
$= (\underline{0100}\ \underline{0100}\ .\ \underline{0001}\ \underline{0001})_2 = (44.11)_{16}$
Thus, $\underline{X = 44.11}$

e. $(1101010.00101)_2 = (X)_{16}$

$= (\ \underline{0110}\ \underline{1010}\ .\ \underline{0010}\ \underline{1000})_2 = (6A.28)_{16}$
Thus, $\underline{X = 6A.28}$

f. $(BEE)_X = (2699)_{10}$

$B \times X^2 + E \times X^1 + E \times X^0 = 11X^2 + 14X + 14 = 2699$
Thus,
$11X^2 + 14X - 2685 = 0$
The above is a quadratic equation in X. Solving for X we get,

$$X = \frac{-14 \pm \sqrt{14^2 + 44 * 2685}}{22}$$

Thus, <u>X=15</u>

Qn.2

Without converting to decimal, compute using *rs* complement method:

a. $(11010.01)_4 - (111.101)_2 = (Y)_2$

$(11010.01)_4 = (000101000100.0001)_2$
$(111.101)_2 = (000000000111.1010)_2$
The 2's complement of the above number is $(111111111000.0110)_2$
Thus Y=

```
  0001 0100 0100 . 0001
  1111 1111 1000 . 0110
-----------------------
1 0001 0011 1100 . 0111
```

Disregarding any carry bit, <u>Y= 000100111100.0111</u>

b. $(AE.F3)_{16} - (103.111)_4 = (Z)_{16}$

$(AE.F3)_{16} = (1010\ 1110\ .\ 1111\ 0011)_2$
$(103.111)_4 = (0001\ 0011\ .\ 0101\ 0100)_2$
The 2's complement of the above number is $(1110\ 1100\ .\ 1010\ 1100)_2$
Thus, Z=

```
  1010 1110 . 1111 0011
  1110 1100 . 1010 1100
-----------------------
1 1001 1011 . 1001 1111
```

Thus, <u>Z = 9B.9F</u>

Qn.3

a. Perform $(694)_{10} + (835)_{10}$ using BCD addition. That is, convert the two decimal numbers to BCD code, and add the two to get the result.

$(694)_{10}$ represented in BCD is (0110 1001 0100)
$(835)_{10}$ represented in BCD is (1000 0011 0101)

Thus the addition is:

```
     0110  1001  0100
     1000  0011  0101
  -----------------------
     1111  1100  1001
       110   110
---------------------
   1  0101  0010  1001
```

Thus, $(694)_{10} + (835)_{10} = (1529)_{10}$

b. Write numbers 0 to 7 in Gray Code

0	000
1	001
2	011
3	010
4	110
5	111
6	101
7	100

(Any other sequence where one bit change takes at a time place is also correct.)

c. Add even parity bit to the 5-bit binary numbers 10001P, 11001P, 11111P. That is, replace P by 0 or 1 in each of the three strings.

For even parity, the idea is to make the number of 1's even.

10001P → 100010

11001P → 110011

11111P → 111111