Homework 1

Shiyu Wang

1.

a. 53_{10}
   53 / 8 = 6……5 5
   6 / 8 = 0 …….6 65
   0 done
   So $53_{10} = 65_8$

b. FA_{16}
   FA_{16} = 1111(F) 1010(A) = 1111 1010_2
   $_{1111}$ 0_2 = 011(3) 111(7) 010(2) = 372_8

2.

a. 19_{10}
   19 / 2 = 9…..1 1
   9 / 2 = 4…..1 11
   4 / 2 = 2…..0 011
   2 / 2 = 1…..0 0011
   1 / 2 = 0…..1 10011
   0 done
   So $19_{10} = 10011_2 = 00010011_2$ (2's comp)

b. -13_{10}
   13 / 2 = 6…..1 1
   6 / 2…..3 01
   3 / 2 = 1……1 101
   1 / 2 = 0……1 1101
   0 done
   So $13_{10} = 1101_2 = 00001101_2$
   $-13_{10} = 11110010_2$ (1's comp) = 11110011_2 (2's comp)

c. -23_{10}
   23 / 2 = 11……1 1
   11 / 2 = 5…...1 11
   5 / 2 = 2……1 111
   2 / 2 = 1……0 0111
   1 / 2 = 0……1 10111
   0 done
   So $23_{10} = 10111_2$

$-23_{10} = 11101000_2$ (1's comp) = 11101001_2 (2's comp)

d. ED_{16}
$ED_{16} = 1110(E)\ 1101(D) = 11101101_2$ (2's comp)
$11101101_2 - 1 = 11101100_2$ (1's comp)
11101100_2 (1's comp) = - 00010011_2 = -19_{10}

3.

a. 0xABCD OR 0x9876
$ABCD_{16} = 1010(A)\ 1011(B)\ 1100(C)\ 1101(D) = 1010\ 1011\ 1100\ 1101_2$
$9876_{16} = 1001(9)\ 1000(8)\ 0111(7)\ 0110(6) = 1001\ 1000\ 0111\ 0110_2$

$1010\ 1011\ 1100\ 1101_2$

OR

$1001\ 1000\ 0111\ 0110_2$

= $1011\ 1011\ 1111\ 1111_2$

= $BBFF_{16}$

= 0xBBFF

b. 0xFEED AND (NOT(0xBEEF))
$FEED_{16} = 1111(F)\ 1110(E)\ 1110(E)\ 1101(D) = 1111\ 1110\ 1110\ 1101_2$
$BEEF_{16} = 1011(B)\ 1110(E)\ 1110(E)\ 1111(F) = 1011\ 1110\ 1110\ 1111_2$

Not(0xBEEF) = $0100\ 0001\ 0001\ 0000_2$

$1111\ 1110\ 1110\ 1101_2$
AND
$0100\ 0001\ 0001\ 0000_2$

= $0100\ 0000\ 0000\ 0000$

= 4000_{16}

= 0x4000

4.

a. 01000010 01100101 01110011 01110100 00100000 01101111 01100110

01000010_2 01100101_2 01110011_2 01110100_2 00100000_2 01101111_2 0110011_2

= 66_{10} 101_{10} 115_{10} 116_{10} 111_{10} 51_{10}

By ASCII table

= B e s t o 3

b. 01001100 01110101 01100011 01101011 00100001
01001100_2 01110101_2 01100011_2 01101011_2 00100001_2

= 76_{10} 117_{10} 99_{10} 107_{10} 33_{10}

By ASCII table

= L u c k !

5.

a. 5 bits
14 / 2 = 7……0 0
7 / 2 = 3……1 10
3 / 2 = 1……1 110
1 / 2 = 0……1 1110
0 done
14_{10} = 01110
-14_{10} = 10010 (2's comp)

b. 6 bits
14_{10} = 001110
-14_{10} = 110010 (2's comp)

c. 7 bits
14_{10} = 0001110
-14_{10} = 1110010 (2's comp)

From the experiments, I found two's complement is easier to store ints, when you need to extend the width of the register the value is being stored in. With two's complement, storing a less bit number in a high bit register is a matter of repeating its most significant bit. On the other hand, if we just simply flip the first bit, we would need to clear the existing bit, which is an extra operation in addition to padding.

6. Code is attached

Test:

```
Enter 2 positive integers for calculation:
2 10
Please choose an operation from (+ or -)+
2+10 = 12
2's comp: 00000000000000000000000000001100
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```
Enter 2 positive integers for calculation:
4 50
Please choose an operation from (+ or -)-
4-50 = -46
2's comp: 11111111111111111111111111010010
```

```
Enter 2 positive integers for calculation:
2 2
Please choose an operation from (+ or -)-
2-2 = 0
2's comp: 00000000000000000000000000000000
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