Assignment 1

Name: Junchen Li

Student ID: 301385486

1. Convert each of the **unsigned** decimal values below into its corresponding binary value (w = 8), then convert the binary value into its corresponding hexadecimal value.
   1. 15710
   2. 24810
2. Convert each of the **signed** decimal values below into its corresponding **two’s complement** binary value (w = 8), then convert the binary value into its corresponding hexadecimal value.

I. 12310

III. **-**7410

c. Interpret each of the binary values below first as an **unsigned** decimal value, then as a **signed** decimal value (using the **two’s complement** encoding scheme).

1. 111010012
2. 100101102

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1. Convert **2471**0 into a **signed** value directly, without converting it first to its corresponding binary value (w = 8).
2. Convert **-15210** into a **unsigned** value directly, without converting it first to a binary number (w = 8).

2. [6 marks] Unsigned and signed arithmetic operations and overflow

For **a.** below, convert each of the operands (**unsigned** decimal values) into its corresponding binary value (w = 8).

For **b.** below, convert each of the operands (**signed** decimal values) into its corresponding **two’s complement** binary value (w = 8).

For **a.** and **b.** below, perform both the decimal addition and the binary addition and indicate the **true sum** and the **actual sum** and whether they are the same or different.

For the binary addition, clearly label all **carry in bits** (by using the label “carry in”) and the **carry out bit** (by using the label “carry out”).

Finally, indicate whether or not an overflow occurred (for **signed** values, specify whether the overflow is positive or negative). If an overflow occurred, explain how addition overflow can be detected ...

1. at the bit level, and
2. using the decimal operands.
3. **Unsigned addition:** 
   1. **7410 + 6310**
   2. **12310 + 15710**
4. **Signed (two’s complement) addition:** 
   1. **28**10 **+ -7410**
   2. **-117**10**+ 126**10
   3. **74**10 **+ 63**10
   4. **-119**10 **+ -105**10

**1.**

a. I. 15710 100111012 0X9D

II. 24810 111110002 0XF8

b. I. 12310 011110112 0X7B

III. -7410 101101102 0XB6

1. I. 111010012 For the unsigned decimal values it is 23310 and for the signed decimal it is -2310

II. 100101102 For the unsigned decimal values it is 15010 and for the signed decimal it is -10610

d. 247-2^8=-910

e. -112+2^8=14410

2.

a.

I. 7410  + 6310 = 13710  (true sum and actual sum are same)

1111111 carry in (front six bits)

010010102 + 001111112 = 100010012 not an overflow occurred

II. 12310 + 15710  = 28010 (true sum) ≠ 280-2^8=280-256=24(actual sum)

carry out 1111111 carry in (front six bits)

011110112 + 100111012 = (1)000110002 overflow occurred, the overflow is positive. For the bit level the word size is eight however, we need use ten bits to show the whole decimal. The range for unsigned decimal is 0~2w-1 (when w=8 the biggest number it can get is 255) the true sum is 280>255 so it must have bit overflow occurred.

b. I. 2810 + -7410 = -4610 (true sum and actual sum are same)

1111 carry in (from second to fifth)

000111002 + 101101102 = 110100102 not an overflow occurred

II. -11710  + 12610  = 910 (true sum) and actual sum -247)

carry out 111111 carry in (from first to sixth)

100010112 + 011111102 = (1)000010012  an overflow occurred, the overflow is negative.

III. 7410 + 6310 = 13710 (true sum) and actual sum is -119

carry out 1111111 carry in (from first to sixth)

010010102 + 001111112 = (0)100010012 overflow occurred, the overflow is positive. For the bit level the word size is eight however, we need use nine bits to show the whole decimal. The range for signed decimal is -2w-1~2w-1-1 (when w=8 the biggest number it can get is 127) the true sum is 137>127 so it must have overflow occurred. Or it could be changed to negative decimal.

IV. -11910  + -10510 = -22410 (true sum) ≠ -224+2^8=32(actual sum)

carry out 11111 carry in (from third to seventh)

100010012 + 100101112= (1)001000002 overflow occurred, the overflow is negative. For the bit level the word size is eight however, we need use ten bits to show the whole decimal. The range for signed decimal is -2w-1~2w-1-1 (when w=8 the biggest number it can get is -128) the true sum is -224<-128 so it must have bit overflow occurred.

For the Assn1\_Q3, my CSIL computer is using a little endian. For example, when I run the code for the decimal 12345, it gives me the answer: 39 30 00 00. By the definition of little endian, the lower Address stores the lower value, higher address stores the higher value. The output is exactly what the definition describes.

Another example: 2550 f6 09 00 00

3450 7a 0d 00 00

22500 e4 57 00 00 ...