ID _____ Name _____

Assume all operations are based on 64-bit instruction operated on the Intel CPU and represent a number in a hexadecimal form unless specified.

1. For each of the following sentences, you are to indicate whether or not the expression always yields "**true**" or "**false**". If you write no answer you will get **-1** points. If you write the right answer, you will get **+2** points. You write the wrong answer, you will get **-2** points. Justify your answer if you choose false.

   a) Every unsigned value u has an additive inverse and its inverse is always $-u$.

   b) Every Two's complement value x has an additive inverse and its inverse is always $-x$.

   c) Truncating to w bits is equivalent to taking mod 2^w.

```
1.  short int sx = random( );
2.  int tx = sx;
3.  unsigned ux = tx;
4.  unsigned short usx = sx;
5.  unsigned ux1 = sx;
6.  int tx2 = tx >> 8;
7.  int tx3 = tx / 2^8;
8.  int tx4 = tx << 16;
9.  unsigned ux2 = tx >> 8;
10. unsinged ux3 = ux1 << 16;
11. float  fx = (float)tx;
```

   d) **sx** and **tx** are always the same value.

   e) **ux** and **tx** are always the same value.

   f) **usx** and **sx** are always the same binary representation.

   g) **tx** and **ux** are always the same binary representation.

   h) **tx2** and **ux2** are always the same binary representation.

   i) **tx** and **fx** are always the same binary representation.

   j) **tx** and **fx** are always the same value.

   k) **tx4** and **ux3** are always the same value.

   l) **tx2** and **tx3** are always the same value.

Address	0x73C6	0x73C7	0x73C8	0x73C9	0x73CA	0x73CB
Value						

2. You have four-byte data of **0x9D43B76** to represent in a hexadecimal form. Assign the value at the smallest address as possible.

   a) Represent the data in the memory, assuming that they are a type of two's complement integers.

   b) Represent this data, assuming that they are a type of two's complement short integers.

   c) Represent this data, assuming that they are a type of strings.

   d) Represent this data, assuming that they are a type of instructions.

   e) Compute the result of && operations between this data and **0xF348AA1B**.

3. Sort the following two's complement integers in increasing order.

```
12. 0x7, 0xFFE7912, 0xA188034F, 0xFFF1A923, 0x61231211, 0x8001DEB1
```

4. Consider a 5-bit two's complement representation. Fill in the empty boxes in the following table. Addition and subtraction should be performed based on the rules for 5-bit, two's complement arithmetic.

Number	Decimal Representation	Binary Representation
Zero	0	
	−2	
	9	
	14	
		0 1100
		1 0100
T_{Max}		
$-T_{Max}$		
T_{Min}		
$-T_{Min}$		
$T_{Min} + T_{Min}$		
$T_{Min} + 1$		
$T_{Max} + 1$		