Name:

UID:`

Integer encoding. Assume we are running code on two machines using two's complement arithmetic for signed integers. Machine 1 has 4-bit integers and Machine 2 has 6-bit integers. Fill in the empty boxes in the table below. The following definitions are used in the table:

```
int x = -5;
unsigned ux = x;
```

Expression	4-bit decimal	4-bit binary	6-bit decimal	6-bit binary
-8	-8		-8	
$-$TMin				
$x >> 1$				
$(-x\hat{}(-1)) >> 2$				

Integer C Puzzles

Assume that x, y, and ux are initialized as follows:

int x = rand();

int y = rand();

unsigned ux = (unsigned) x;

Are the following statements always true? If false, provide a counter example.

(Note: "statement1 => statement2" means that if we are given statement1 is true, it implies that statement2 is also true.)

a. ~x + x >= ux

b. x > 0 => ((x << 5) >> 6) > 0

c. y < 0 => ux > y

d. $(ux*uy) == (x*y)$

e. $((x\&8) \mid y) == y) \quad \Rightarrow \quad (x<<28)>0$

f. $(x\hat{}y)\hat{}x + z == y+z$

g. x >> 3 == x/3

Operand Form Practice (see page 181 in textbook for more)

Assume the following values are stored in the indicated registers/memory addresses.

Address	Value	Register	Value
0x104	0x34	%rax	0x104
0x108	0xCC	%rcx	0x5
0x10C	0x19	%rdx	0x3
0x110	0x42	%rbx	0x4

For each instruction, write the value stored in `%rdi` after it is executed:

Note: when a movl instruction is performed on %edi, the top 32 bits of %rdi are filled with zeros.

	Value		Value
a) `movl $0x110, %edi`	____	f) `leaq (%rax, %rcx), %rdi`	_____
b) `movl %rax, %edi`	____	g) `movl 3(%rax, %rcx), %edi`	_____
c) `movl (0x110), %edi`	____	h) `leaq 256(, %rbx, 8), %rdi`	_____
d) `movl (%rax), %edi`	____	i) `movl 4(%rax, %rbx, 2), %edi`	_____
e) `movl 4(%rax), %edi`	____		

Endianness

a. Suppose we declared the following 4 byte int:

```
int x =309 ;
```

and we stored this in memory location 0x100 on a little-endian system. What values would be stored in the following memory locations?

0x100	0x101	0x102	0x103

b. Suppose we declared an array of ints:

```
int arr[] = {5, 8 };
```

and we stored this in memory location 0x100 on a little endian system. What values would be stored in the following memory locations?

0x100	0x101	0x102	0x103	0x104	0x105	0x106	0x107

c. Suppose we declared a string:

```
char * s = "hello";
```

and we stored this in memory location 0x100 on a little endian system. What values would be stored in the following memory locations?

note: it's a good idea to get familiar with hex encodings of alphabetical characters, but for convenience, the hexadecimal encodings of the characters are: h (0x68), e (0x65), l (0x6c), and o (0x6f)

0x100	0x101	0x102	0x103	0x104	0x105