CS 31 Homework 3: IA32 Arithmetic

Due at the start of class Thursday, Feb. 24, 2022

Your Name(s)/Lab Section(s):

1. Assume the CPU is executing a program and the state of some of its registers is given in the table below. Show how the registers would be updated by the sequence of IA32 instructions also listed below, i.e. fill in the `Final Value` column. Show your work by listing the intermediate values of the registers.

Register	Initial Value	Final Value
%eax	0	
%ebx	1	
%ecx	2	
%edx	3	

Here are the IA32 instructions:

```
addl    $20, %eax
addl    %eax, %ebx
subl    %ecx, %ebx
addl    $3, %ecx
subl    %edx, %ecx
addl    %edx, %edx
decl    %edx
shrl    $4, %ebx
andl    $0xfffffffe, %edx # this is tricky
xorl    %eax, %eax        # this is tricky
orl     $0x0, %ecx
# think about these next two before answering
notl    %ebx
addl    $1, %ebx
```

2. Assume the CPU is executing a function that has local variables `x`, `y`, and `z` allocated on the stack, and that `x` is allocated at the memory address that is `-12` bytes from the address value stored in register `%ebp`, or `-12(%ebp)`. Assume `y` is stored at `-8(%ebp)`, and `z` is at `-4(%ebp)`.
   For the assembly code and register values listed below:
   (1) Show the values that will be stored in the registers and in memory when execution of these instructions is complete. If the value is unknown, write "?".
   (2) Write a C code translation of the assembly code sequence. You may assume that `x`, `y`, and `z` have already been declared as `int` variables in the C code. You do not need to write the entire function, just the lines of C that might have generated the IA32 instructions. Hint: our solution is 5 lines of C code.

```
movl    $2, -4(%ebp)
movl    $3, -8(%ebp)
movl    -4(%ebp), %edx
movl    -8(%ebp), %eax
addl    %edx, %eax
movl    %eax, -12(%ebp)
incl    -4(%ebp)
sall    $1, -8(%ebp)
```

C Code Translation

Memory Address	Final Value
0xff38	
0xff3c	
0xff40	
0xff44	
0xff48	
0xff4c	
0xff50	

Register	Initial Value	Final Value
%eax	4	
%edx	7	
%ebp	0xff44	