<table>
<tr><td>35 pts</td></tr>
<tr><td></td></tr>
</table>

Name: _____

Class Day / Time: _____

Due Date: _____

# Lab #10 – Integer Arithmetic

1) In the following code sequence, show the value of AL after each shift or rotate instruction has executed:

```
mov al,0D4h
shr al,1                        ; a. _____
mov al,0D4h
sar al,1                        ; b. _____
mov al,0D4h
sar al,4                        ; c. _____
mov al,0D4h
rol al,1                        ; d. _____
```

2) One way to calculate the parity of a 32-bit number in EAX is to use a loop that shifts each bit into the Carry flag and accumulates a count of the number of times the Carry flag was set. Write a code that does this, and set the Parity flag accordingly.

3) Logical Shifts

   a) Write a logical shift instruction that multiplies the contents of EAX by 16.

   b) Write a logical shift instruction that divides EBX by 4.

4) In the following code sequence, show the value of AL after each shift or rotate instruction has executed:

```
mov al,0D4h
ror al,3                        ; a. _____
mov al,0D4h
rol al,7                        ; b. _____
stc
mov al,0D4h
rcl al,1                        ; c. _____
stc
mov al,0D4h
rcr al,3                        ; d. _____
```

5) Write a series of instructions that shift the lowest bit of AX into the highest bit of BX without using the SHRD instruction. Next, perform the same operation using SHRD.

    a) Without SHRD

    b) Using SHRD

6) Using only SUB, MOV, and AND instructions, show how to calculate x = n mod y, assuming that you are given the values of n and y. You can assume that n is any 32-bit unsigned integer, and y is a power of 2.

7) Write a sequence of instructions that shift three memory bytes to the right by 1 bit position. Use the following data definition:

byteArray BYTE 81h,20h,33h

8) Write ASM instructions that calculate EAX * 21 using binary multiplication.
Hint: $21 = 2^4 + 2^2 + 2^0$.

9) The time stamp field of a file directory entry uses bits 0 through 4 for the seconds, bits 5 through 10 for the minutes, and bits 11 through 15 for the hours. Write a set of instructions that extract the minutes and copy the value to a byte variable named **bMinutes**.

10) Suppose the instruction set contained no rotate instructions. Show how we might use SHR and a conditional jump instruction to rotate the contents of the AL register one position to the right.