

## CIS 350 – INFRASTRUCTURE TECHNOLOGIES

### SMALL GROUP ACTIVITY #3

Names of group

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**Topic:** Operation of the Computer, Assembler Language – The Little Man Computer (LMC)

Logistics

1. Get in touch with your group of 4 or 5 students. (See Groups folder on Blackboard.)
2. Discuss and complete the assignment together via E-mail, Discussion Forum, Blackboard Collaborate Ultra, and/or MS Teams.
3. Choose a recorder to prepare the final copy (one per group) and submit it via the Blackboard Assignments/Small Group Activities folder to the instructor.
4. Be sure all group members' names are on final copy. Do not add names of your group classmates who did not participate in the assignment.

#### Assignment One

Write the LMC program that reads in four numbers (one at a time) and places them in memory locations 50, 51, 52, 53 symbolically denoted by variables *a*, *b*, *c*, and *d*, respectively, in the C# like program segment below. The LMC program should subtract the second number from the first number and add the third number and the fourth number to the difference ( $e=a+b-c-d$ ). Next, the program should store the result in memory location 54, symbolically denoted by variable *e*, and print it out. Write the LMC instructions in the mnemonic form. Note that your LMC program will actually implement the following statements written in the C# pseudocode below. The LMC instructions start at address 00.

```
int a, b, c, d, e;
read a, b, c, d;
e=a+b-c-d;
print e;
```

address	instruction
00	IN
01	STO 50
02	IN
03	STO 51
04	IN
05	STO 52
06	IN
07	STO 53
08	LDA 50
09	ADD 51
10	SUB 52
11	SUB 53
12	STO 54
13	OUT
14	HLT
....	
....	
....	
....	
50	DAT A
51	DAT B
52	DAT C
53	DAT D
54	DAT E

What addresses represent the program area and the data area, respectively?

Program area: addresses 00-14      Data area: addresses 50-54

## Assignment Two

Write an LMC program (one program) that reads in two numbers, stores them in memory locations 61 and 62, finds the **larger** of the two numbers, stores the larger number in memory location 63, and outputs the larger number. (Note that the program will be similar, not the same, to the one that finds the positive difference of two numbers that we discussed in the lecture notes for Chapter 6 recorded on Panopto and MS Teams). You may trace in your memory or on paper the program execution for the two scenarios below:

scenario 1: you enter 5 and 7; and

scenario 2: you enter 7 and 5.

In both cases, your program should output 7.

Address	Instruction		Memory locations			Your program returns
			61	62	63	
00	IN	scenario 1	5	7	<b>7</b>	_____
01	STO 61	scenario 2	7	5	<b>7</b>	_____
02	IN					
03	STO 62					
04	SUB 61					
05	BRP 10					
06	LDA 62					
07	BR 10					
08	LDA 61					
09	STO 63					
10	OUT					
11	HLT					
...						

Address	
61	DAT
62	DAT
63	DAT

What range of addresses represents the program area?   \_\_00-11\_\_

What range of the addresses represents the data area?   \_\_61-63\_\_