CMSC B240 Computer Organization - Spring 2024
Lab Activity #6 – Two LC-3 Machine Language Programs

In lectures, we designed two LC-3 programs to sum up a bunch of numbers contained in sequential memory locations. In this lab you will study the two programs, implement, and run them in the LC-3 Simulator. For both the programs, we will run them on the following:

```
Dataset#1: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Dataset#2: 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22
```

Program#1 (Counter-driven Loop): The first program sums up 12 numbers contained in memory locations x3100 through x310B. Implement the program we wrote in class in the LC-3 Simulator. Run the program using the two data sets. **Confirm that you are getting the correct results**.

Program#2 (Sentinel Controlled Loop): The first program used a counter to count the number of integers to be added. In the second version, you will use a sentinel value to indicate the end of input (marked by a -1). Below, we outline the algorithm:
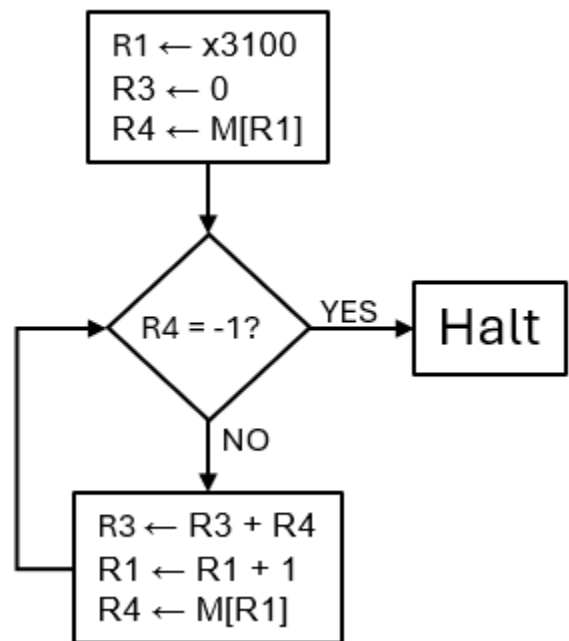
```
sum ← 0
n ← first number
while n != -1 do
    sum ← sum + n
    n ← next number
```

Let us do register allocation. We will use the following registers:

```
R1: starting address of data (x3100)
R3: sum
R4: n
```

The flowchart is shown on the right.

Next, code the flowchart, **on paper**, in LC-3 machine language.

Finally, Implement it in the LC-3 Simulator. Run the program using the two data sets. Use -1 as the sentinel value. **Confirm that you are getting the correct results**.

	15 14 13 12	11 10 9	8 7 6	5	4 3	2 1 0
ADD+	0001	DR	SR1	0	00	SR2
ADD+	0001	DR	SR1	1	imm5	
AND+	0101	DR	SR1	0	00	SR2
AND+	0101	DR	SR1	1	imm5	
BR	0000	n z p	PCoffset9			
JMP	1100	000	BaseR	000000		
JSR	0100	1	PCoffset11			
JSRR	0100	0 00	BaseR	000000		
LD+	0010	DR	PCoffset9			
LDI+	1010	DR	PCoffset9			
LDR+	0110	DR	BaseR	offset6		
LEA	1110	DR	PCoffset9			
NOT+	1001	DR	SR	111111		
RET	1100	000	111	000000		
RTI	1000	000000000000				
ST	0011	SR	PCoffset9			
STI	1011	SR	PCoffset9			
STR	0111	SR	BaseR	offset6		
TRAP	1111	0000	trapvect8			
reserved	1101					