CMSC B240 Computer Organization - Spring 2025
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**.

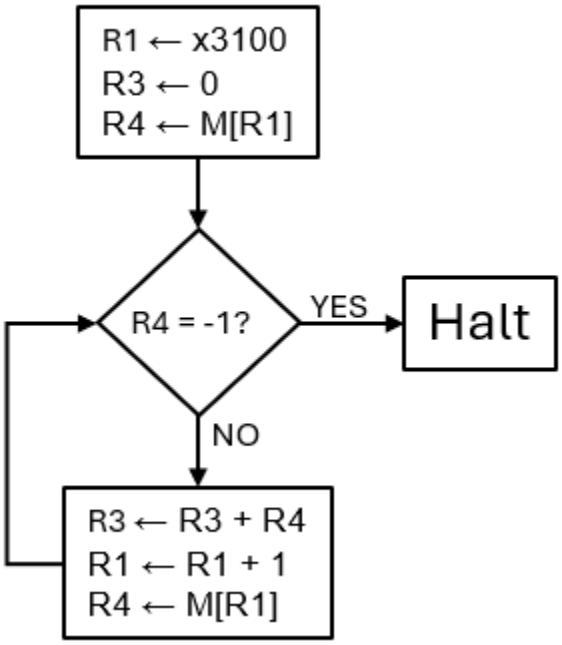
Program#2 (Sentinel Controlled Loop): The first program used a counter to count the number of integers to be added. In the second version, you will use a sentinel value to indicate the end of input (marked by a -1). Below, we outline the algorithm:

```
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:

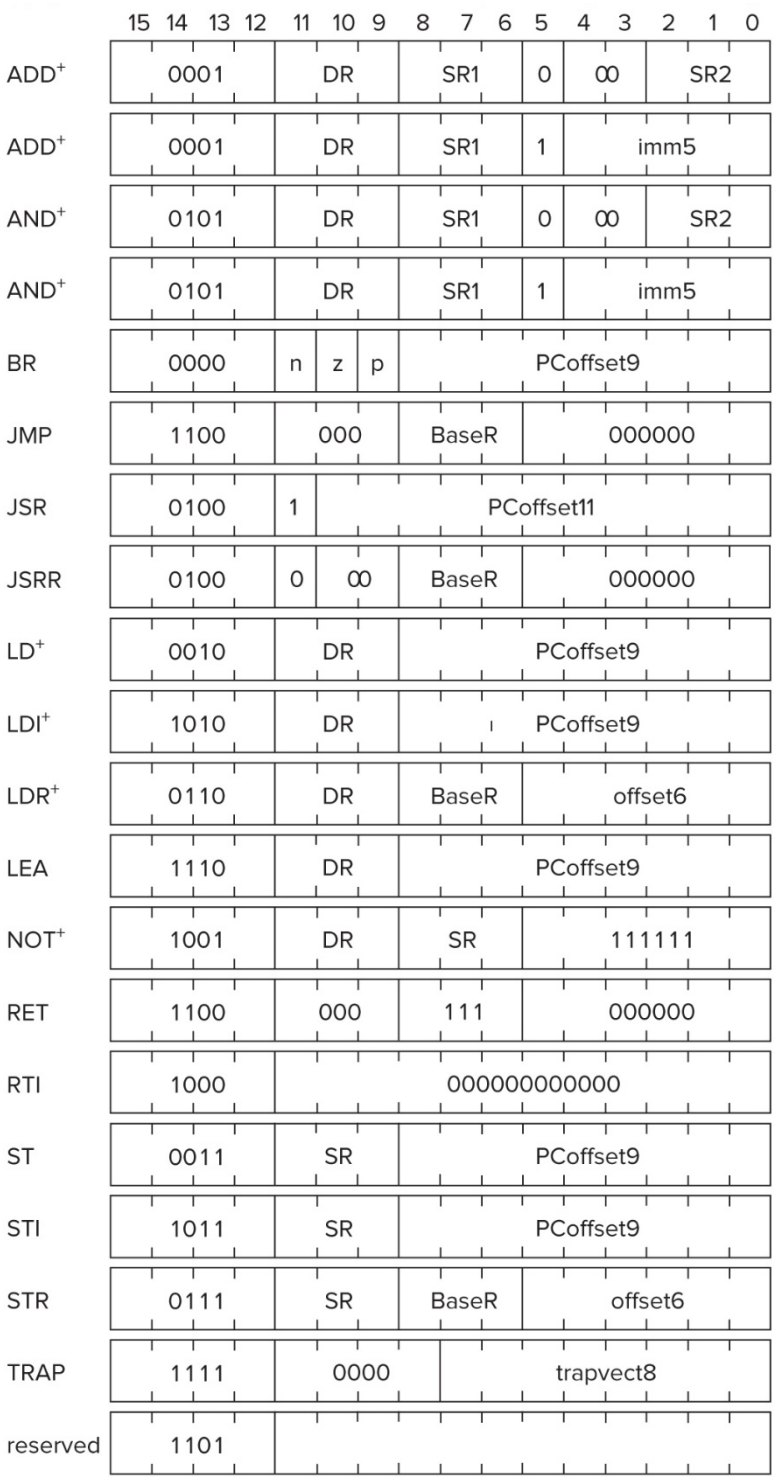
```
R1: starting address of data (x3100)
R3: sum
R4: n
```

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