Instruction:

Complete all questions in 2 hours.

1. Von Neumann Simulator. This program simulates a very simple computer with the von Neumann architecture.

    a. Download the von Neumann Simulator (VonNeumann.exe) program from google classroom in the Week-7 folder. Save it in your Documents folder and run it. You will see a window similar to this:

    The simulator has a small program memory area which is available for programming. To enter your program instructions simply click on the “Available” instruction on the list on the right and then click on the “Memory” location you wish to put it in.

    This simulator understands only the following ten instructions:

NOP	No Operation, i.e. do nothing.
LOAD TEMP	Get a number from the keypad, completed by the Enter key, into the Temporary Register.
LOADLOOP	Get a number from the keypad, completed by the Enter key, into the Loop Register.
CLRDSP	Clear the Display.
ADD	Add the Temporary Register to the Accumulator
SUB	Subtract the Temporary Register from the Accumulator
DISPACC	Display the contents of the Accumulator
STRTBLK	Start of Loop Block
ENDBLK	End of Loop Block
HALT	Halt. Stop Program

b. Load the following program in the memory and explain what the program does?

LOAD TEMP(3)

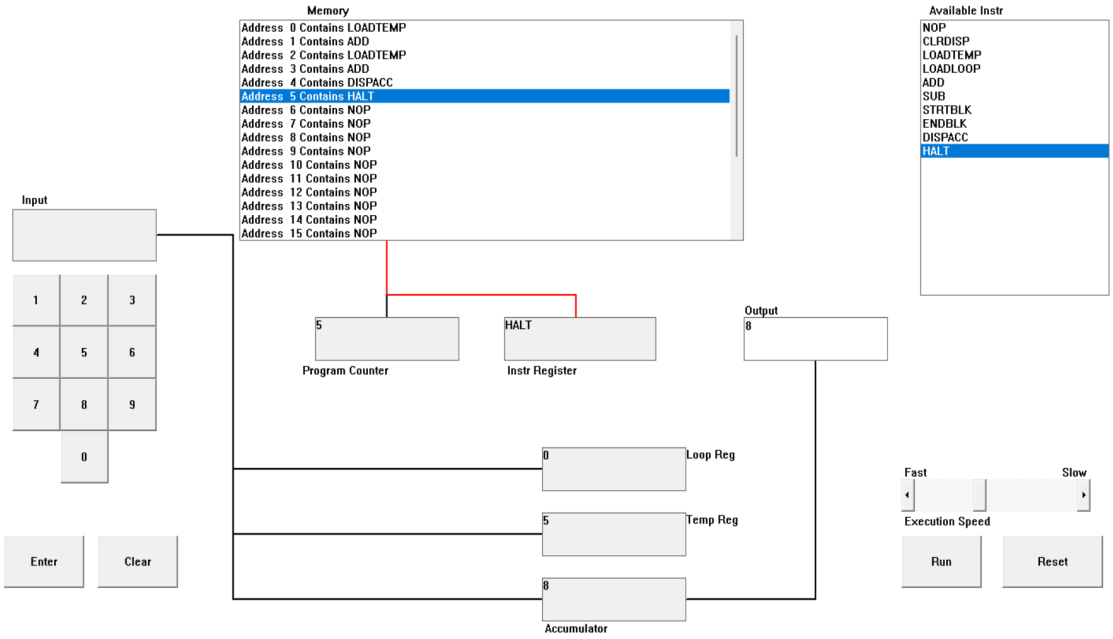
ADD(3)

LOAD TEMP(5)

ADD(8)

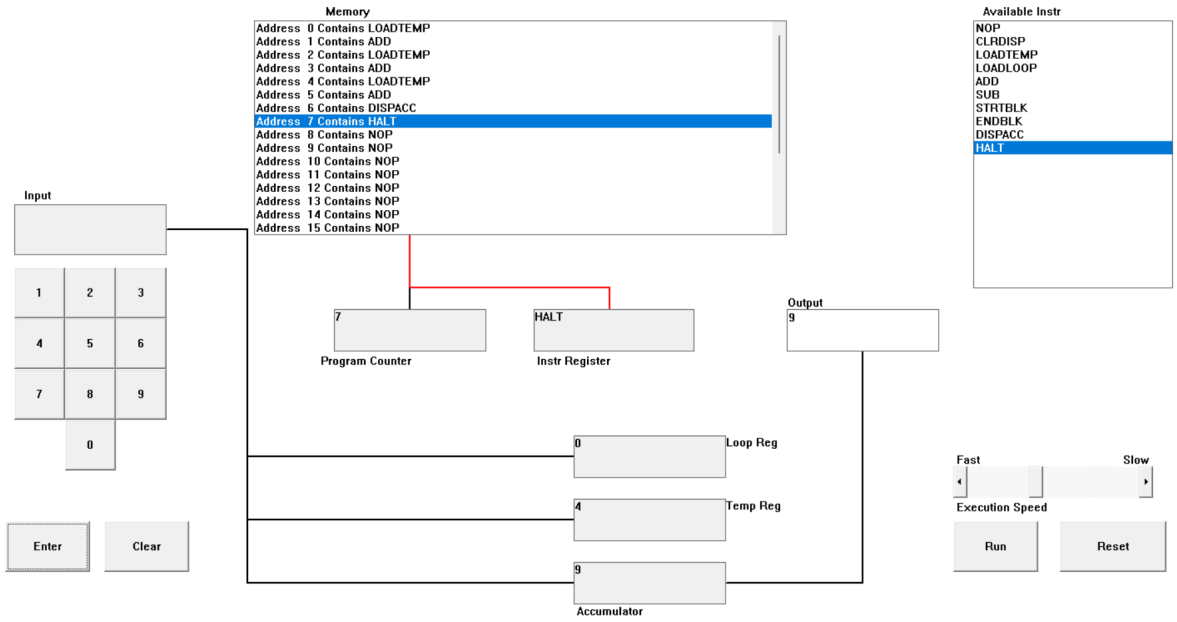
DISPAAC(8)

HALT



In this program, we entered input 3 in the first load temp. Then, in address 1, the program adds 3 to 0. Again, address 2 takes 5 as input in load temp and address 3 adds 5 to 3 which displays 8 in address 4 i.e. in DISPACC. Lastly, address 5 halts the program.

c. Write the program to add three numbers together and explain how your code works?



LOAD TEMP(2)

ADD(2)

LOAD TEMP(3)

ADD(5)

LOAD TEMP(4)

ADD(9)

DISPAAC(9)

HALT

In this program, we entered input 2 in the first load temp. Then, in address 1, the program adds 2 to 0. Again, address 2 takes 3 as input in load temp and address 3 adds 2 to 3 and in address 4, it takes 4 as input and adds 4 to 5 which displays 9 in address 6 i.e. DISPACC. Finally, the program halts in address 7.

d. Write the program to perform

7+3-9

LOAD TEMP(7)

ADD(7)

LOAD TEMP(3)

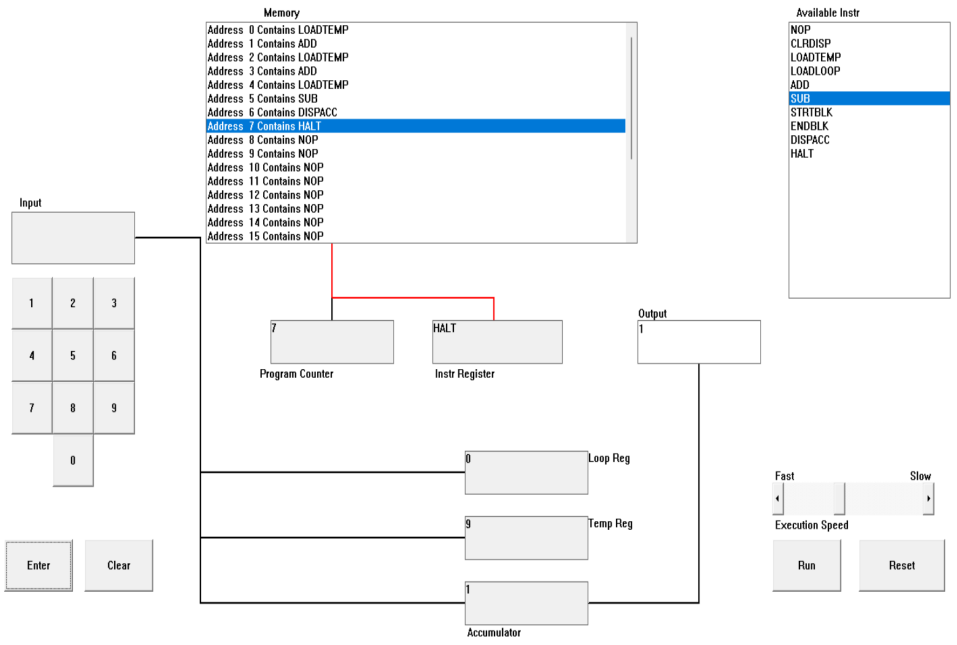
ADD(10)

LOAD TEMP(9)

SUB(1)

DISPAAC(1)

HALT



-9+3-7

LOAD TEMP(9)

SUB(-9)

LOAD TEMP(3)

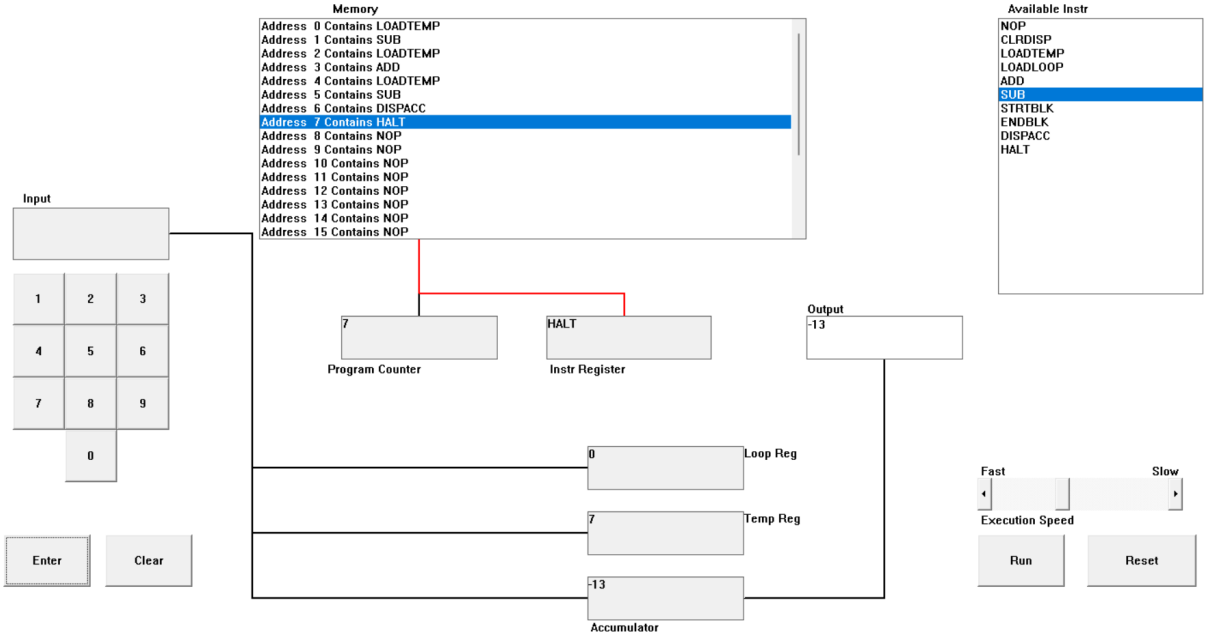
ADD(-6)

LOAD TEMP(7)

SUB(-13)

DISPAAC(-13)

HALT



13-7+19

LOAD TEMP(13)

ADD(13)

LOAD TEMP(7)

SUB(6)

LOAD TEMP(19)

ADD(25)

DISPAAC(25)

HALT

e. Write a program to perform
7+(7*3)

LOAD TEMP(7)

ADD(7)

LOAD TEMP(7)

LOADLOOP(3)

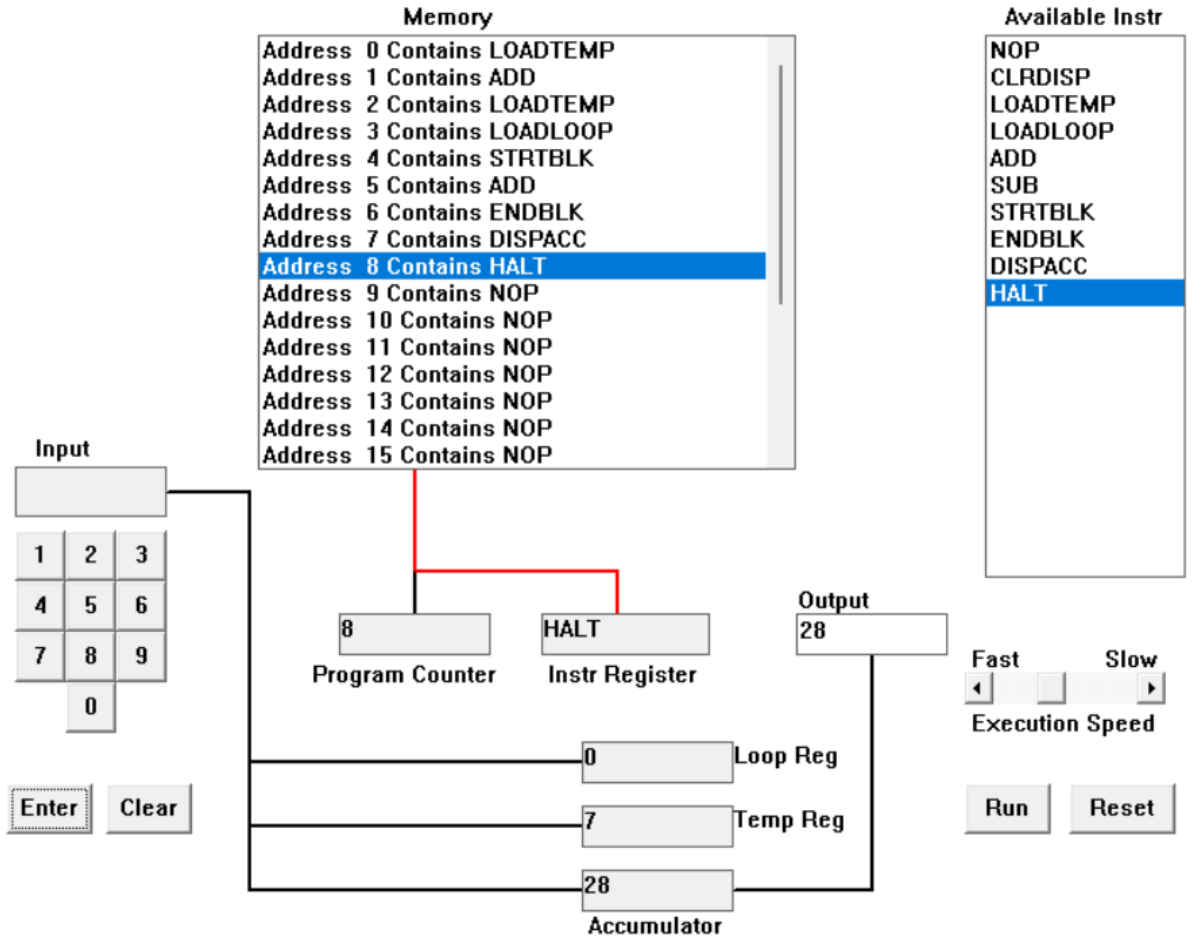
STRTBLK

ADD(21)

ENDBLK

DISPAAC(28)

HALT



3+(3*7)

LOAD TEMP(3)

ADD(3)

LOAD TEMP(3)

LOADLOOP(7)

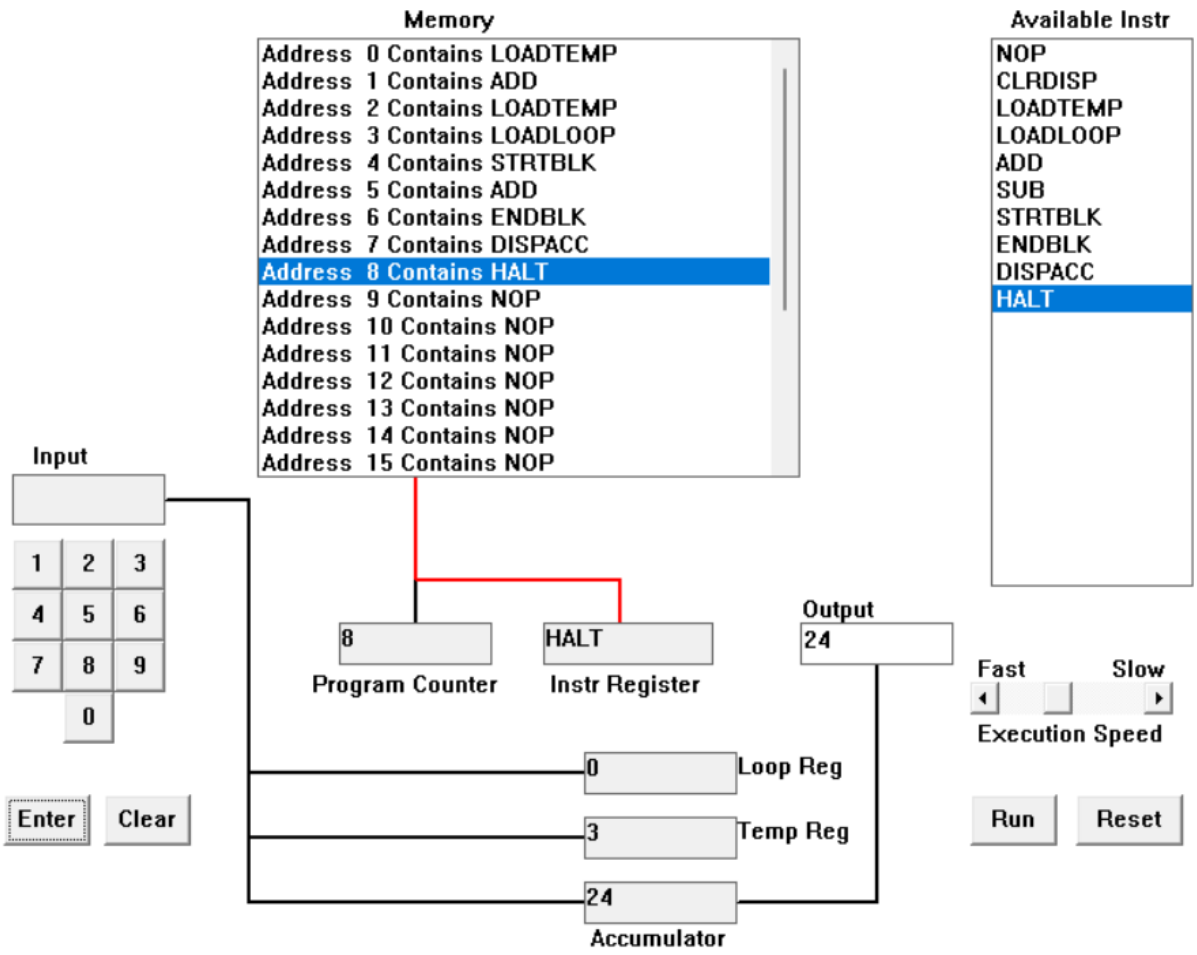
STRTBLK

ADD(21)

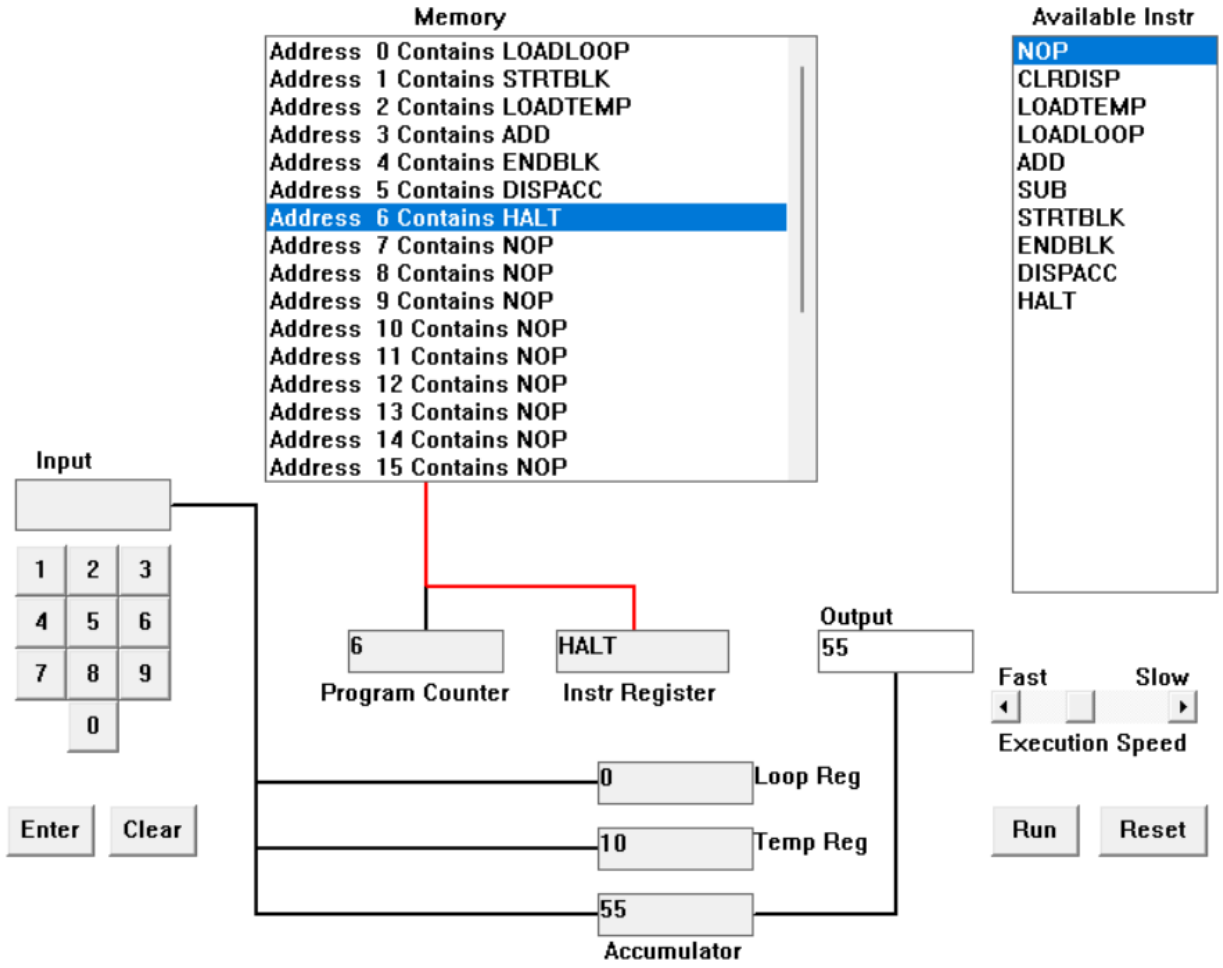
ENDBLK

DISPAAC(24)

HALT



f. Write a program to add the first 10 natural numbers.


Memory
Address 0 Contains LOADLOOP
Address 1 Contains STRTBLK
Address 2 Contains LOADTEMP
Address 3 Contains ADD
Address 4 Contains ENDBLK
Address 5 Contains DISPACC
Address 6 Contains HALT
Address 7 Contains NOP
Address 8 Contains NOP
Address 9 Contains NOP
Address 10 Contains NOP
Address 11 Contains NOP
Address 12 Contains NOP
Address 13 Contains NOP
Address 14 Contains NOP
Address 15 Contains NOP
Available Instr
NOP
CLRDISP
LOADTEMP
LOADLOOP
ADD
SUB
STRTBLK
ENDBLK
DISPACC
HALT
Input
1 2 3
4 5 6
7 8 9
0
Enter
Clear
6
Program Counter
HALT
Instr Register
Output
55
Fast
Slow
Execution Speed
0
Loop Reg
10
Temp Reg
55
Accumulator
Run
Reset