Name:
Advanced Programming in C++
Lab Exercise 5/2/2024

A Practice Exercise With MARIE

Machine Architecture that is Really Intuitive and Easy (MARIE)

1. Copy the entire folder named Marie from the \\Ada\data files\C++\ to your desktop.
2. Open the folder and double-click on MarieSim.jar (an executable Java Archive)
3. From the File Menu Select Edit to open up the Marie Assembler Code Editor
4. Type in the following program into the editor:

```
        ORG 100
        Load     Addr
        Store    Next
        Load     Num
        Subt     One
        Store    Ctr
        Clear
Loop,   Load     Sum
        AddI     Next
        Store    Sum
        Load     Next
        Add      One
        Store    Next
        Load     Ctr
        Subt     One
        Store    Ctr
        Skipcond 800
        Jump     Loop
        Halt
Addr,   Hex      118
Next,   Hex      0
Num,    Dec      5
Sum,    Dec      0
Ctr,    Hex      0
One,    Dec      1
        Dec      10
        Dec      15
        Dec      20
        Dec      25
        Dec      30
```

5. Assemble the code by selecting Assemble/Assemble Current File from the Editor menu (Note you must Save your file first before you can Assemble).
6. Select Assemble/Show Assembly Listing and view what the assembler created. You should see an assembly listing that shows what is loaded into memory.
7. Record the range of memory that is used for this program. ________
8. Now load your assembled program into the MARIE simulator.
9. Step through your program until it is completed. If you are in a hurry, just Run the program.
10. Record the contents of the Accumulator, Instruction Register, Memory Address Register, Memory Buffer Register, and Program Counter:

AC _______

IR _______

MAR _______

MBR _______

PC _______

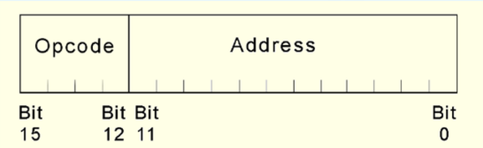
Now try look at some other programs. In the Marie folder, there are three example programs. You should open these in the MARIE Assembler Code Editor, examine them, assemble them and run them in MARIE.

Challenge:

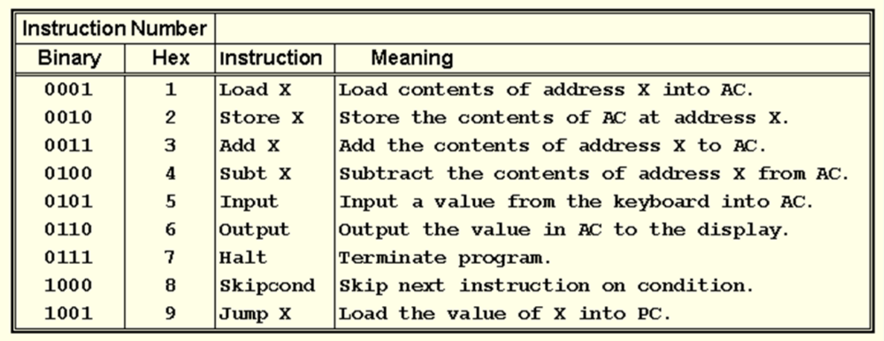
1. Write a program that adds the numbers from 1 to 10.

2. Write a program that will allow the user to enter two numbers and displays the product of those two numbers.

- This is the format of a MARIE instruction:

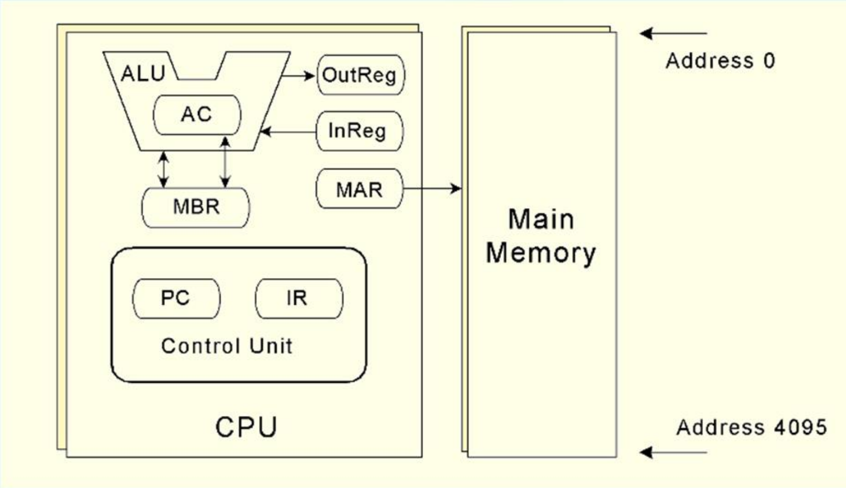


- The fundamental MARIE instructions are:



Instruction Number			
Binary	Hex	Instruction	Meaning
0001	1	Load X	Load contents of address X into AC.
0010	2	Store X	Store the contents of AC at address X.
0011	3	Add X	Add the contents of address X to AC.
0100	4	Subt X	Subtract the contents of address X from AC.
0101	5	Input	Input a value from the keyboard into AC.
0110	6	Output	Output the value in AC to the display.
0111	7	Halt	Terminate program.
1000	8	Skipcond	Skip next instruction on condition.
1001	9	Jump X	Load the value of X into PC.

This is the MARIE architecture shown graphically.


ALU
AC
OutReg
InReg
MAR
MBR
PC
IR
Control Unit
CPU
Main Memory
Address 0
Address 4095