Homework 4: MARIE: Part 1

Due Date: Before 11:59 p.m. on Friday, March 4th

You will write assembly programs for the MARIE architecture. Make sure you put `halt` instructions at the end of your programs.

If-Else

Create a file named *marie1.mas*. Convert the following to MARIE assembly:

```
if X <= 12:
    Y += X
elif X > 20:
    Z += X + X
else:
    Y = X + Z

Z = X + Y + Z
```

Your program should define variables X, Y, and Z. Test it with different values of X, Y, and Z.

While

Create a file named *marie2.mas*. Convert the following to MARIE assembly:

```
X = 10
Y = 20
Z = 0

while x > 0 and y < 25:
    Z += X + Y
    X -= 1
    Y += 1
```

Multiplication Subroutine

Create a file named *marie3.mas*.

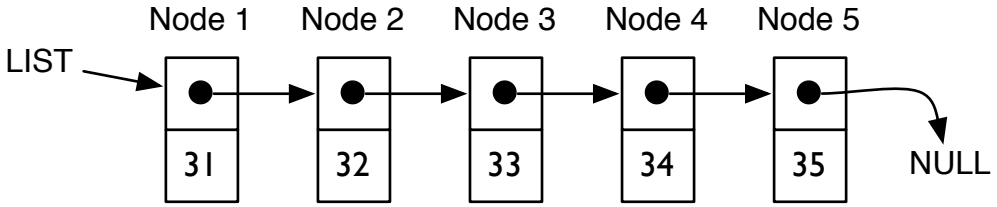
1. Write code that multiplies two positive numbers by using repeated addition. For example, to multiply 3 × 6, the program would add 3 six times, or 3 + 3 + 3 + 3 + 3 + 3.
2. Move that code into a subroutine. Use the subroutine to do the multiplication. Using the subroutine should look like this:

    1. Copy the first argument to a memory location ARG0.
    2. Copy the second argument to a memory location ARG1.
    3. Jump to the subroutine using the JnS instruction.
    4. The subroutine multiplies the numbers in ARG0 and ARG1, finishing with the answer in the AC.
    5. The subroutine returns to the call point using the JumpI instruction.
3. Use your multiplication subroutine to calculate:

```
Q = A × B + C × D
```

Linked List

Create a file named *marie4.mas*.



The picture above shows a linked list. Each node has data: the ASCII code for the node number. Each node also has a pointer to the next node. These nodes have been scrambled and placed in the code below.

```
        ORG     100

/ Jump past the definition of the list
/ to the program below.

        JUMP    MAIN

/ This is the pointer with the address
/ of the first node of the list.

LIST,   HEX     0104

/ The definition of the linked list nodes

NODE2,  HEX     010A    / pointer to node 3
        HEX     0032    / data of node 2
NODE1,  HEX     0102    / pointer to node 2
        HEX     0031    / data of node 1
NODE4,  HEX     0108    / pointer to node 5
        HEX     0034    / data of node 4
NODE5,  HEX     0000    / null pointer, end of list
        HEX     0035    / data of node 5
NODE3,  HEX     0106    / pointer to node 4
        HEX     0033    / data of node 3

/ You should write your program below this line.

MAIN,   HALT
```

Write a MARIE program to traverse the list and print the data in order as stored in each node. You "print" the data by loading it into AC and using the OUTPUT command.

Turning it in

1. Go to your turn-in directory in gdrive.
2. Create a folder labeled "Homework 4" inside your turn-in directory.
3. Copy all four of your *.mas* files into the directory.