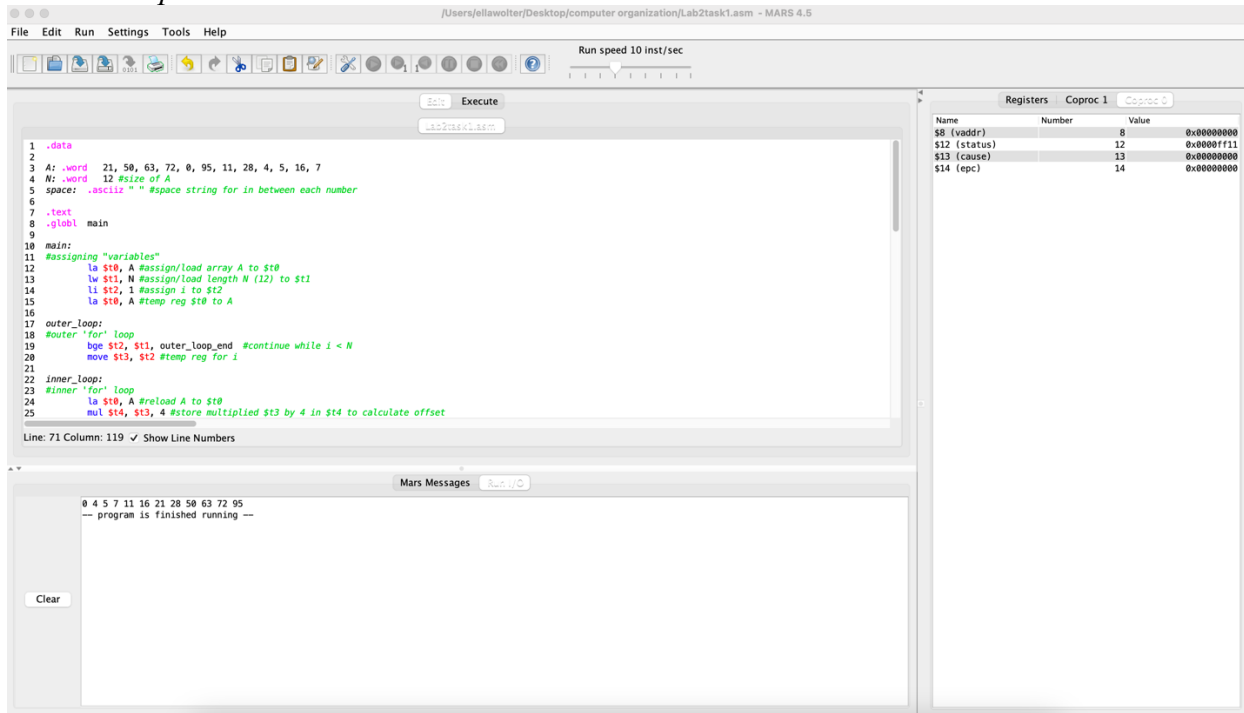


**Jewels Wolter**  
**Lab 2 – COMP 3350**  
**April 8, 2024**

Task 1:

*Console output:*



The screenshot shows the MARS MIPS simulator interface. The main window displays assembly code for a program that prints an array. The code includes data declarations, variable assignments, and nested loops for printing. The console window at the bottom shows the output of the program, which is the array elements: 0 4 5 7 11 16 21 28 50 63 72 95. The registers window on the right shows the values of registers \$8, \$12, \$13, and \$14.

```
1 .data
2
3 A: .word 21, 50, 63, 72, 0, 95, 11, 28, 4, 5, 16, 7
4 N: .word 12 #size of A
5 space: .asciiz " " #space string for in between each number
6
7 .text
8 .globl main
9
10 main:
11 #assigning "variables"
12 la $t0, A #assign/load array A to $t0
13 lw $t1, N #assign/load length N (12) to $t1
14 li $t2, 1 #assign i to $t2
15 la $t3, A #temp reg $t3 to A
16
17 outer_loop:
18 #outer 'for' loop
19 bge $t2, $t1, outer_loop_end #continue while i < N
20 move $t3, $t2 #temp reg for i
21
22 inner_loop:
23 #inner 'for' loop
24 la $t4, A #reload A to $t4
25 mul $t4, $t3, 4 #store multiplied $t3 by 4 in $t4 to calculate offset
```

Line: 71 Column: 119 ✓ Show Line Numbers

Mars Messages

```
0 4 5 7 11 16 21 28 50 63 72 95
-- program is finished running --
```

Clear

Registers

Name	Number	Value
\$8 (vaddr)	8	0x00000000
\$12 (status)	12	0x0000ff11
\$13 (cause)	13	0x00000000
\$14 (epc)	14	0x00000000

*References:* (also included at bottom of code)

- <https://courses.missouristate.edu/kenvollmar/mars/help/syscallhelp.html>
  - o for syscall values
- <https://courses.cs.washington.edu/courses/cse378/02au/Lectures/07controlI.pdf>
  - o for clarification on branching and jumps
- <https://max.cs.kzoo.edu/cs230/Resources/MIPS/Conditions/LoopsInMIPS.html>
  - o for loops help
- <https://www.cs.cornell.edu/~tomf/notes/cps104/mips.html>
  - o to get spaces in between array (coupled with syscall values^)
- lecture slides
- MIPS Computer Organization and Design Textbook

## Task 2:

### Console output:

The screenshot shows the MARS 4.5 MIPS simulator interface. The title bar indicates the file is `/Applications/Lab2task2.asm* - MARS 4.5`. The menu bar includes File, Edit, Run, Settings, Tools, and Help. The toolbar contains various icons for file operations and execution. The main window displays assembly code for `mips2.asm` with line numbers 1 through 25. The code includes data declarations for array `A` and variable `N`, and assembly instructions for a `main` function and a `swap` function. The status bar at the bottom of the code window shows "Line: 118 Column: 22" and a checked "Show Line Numbers" option. Below the code window is the "Mars Messages" panel, which shows the output of the program: the sorted array `0 4 7 8 15 16 27 31 42 45` followed by the message `-- program is finished running --`. A "Clear" button is located to the left of the messages panel.

```
1 .data
2
3 A: .word 7, 42, 0, 27, 16, 8, 4, 15, 31, 45
4 N: .word 10
5 space: .asciiz " " #space string for in between each number
6
7 .text
8 .globl main
9
10 main:
11     #assigning/instantiating "variables"
12     la $a0, A #assign/load array A (v) to $a0
13     lw $a1, N #assign $a1 to length 10
14     #lw $t0, 0 #temp reg $t0 for temp variable
15
16     jal sort #jump to sort function
17     jal output #jump to output function
18     jal Exit
19     #li $v0, 10 #offset 10
20     #syscall
21
22 swap:
23 #swapping values
24     la $a0, A #assign/load array A (v) to $a0
25     lw $t0, 4($sp) #assign $a1 to variable k starting at 0
```

Line: 118 Column: 22 ☒ Show Line Numbers

Mars Messages Run I/O

```
0 4 7 8 15 16 27 31 42 45
-- program is finished running --
```

Clear

### References: (also included at bottom of code)

- <https://courses.cs.washington.edu/courses/cse378/02au/Lectures/07controll.pdf>
  - o clarification on branch instructions
- [https://www.cs.tufts.edu/comp/140/lectures/Day\\_3/mips\\_summary.pdf](https://www.cs.tufts.edu/comp/140/lectures/Day_3/mips_summary.pdf)
  - o instructions
- lecture slides
- MIPS Computer Organization and Design Textbook