COMP3350 Spring, 2024
Lab 1

Important Notes:

- Solutions turned in must be your own. Please, mention references (if any) at the end of each question.
- The code (if any) must be accompanied by adequate comments. Writing only the code could lead to **zero** credits. Likewise, the screenshots should be accompanied with adequate descriptions.
- Partial score may be provided based on the intermediate steps and results (even if they are not completely correct).
- All units must be mentioned wherever required.
- All submitted lab reports must be in the PDF format unless otherwise mentioned. Texts of the reports are expected to be typed in for which you could use software programs like LaTeX, Microsoft Word etc.

Please Follow the Lab Instructions and Complete the following Tasks.

1. Task 1: In Step 1 Download and Launch MARS, attach a screenshot after you have launched MARS. (35 points)

2. Task 2: In Step 2 Run Example Code. Change the values of the multiplicand and multiplier. Recompile and run. Observe the changes in the machine codes and register values. Please attach the following 2 screenshots: 1) a screenshot of the code with the changed values (30 points), 2) a screenshot that clearly shows the compiled code and register values after assembling and running (35 points).

3. Task 3 (Bonus Task): In Step 3, change the values of the operands based on the instructions. Compile and run the code in each case, then

   1) answer whether there are exceptions (Yes or no) and explain the reasons (15 points)

   Please answer whether there are exceptions and explain the reasons using the following format:

   a. (yes or no). Reason: …

   b. (yes or no). Reason: …

c. (yes or no). Reason: …

d. (yes or no). Reason: …

e. (yes or no). Reason: …

2) record the console output result as well as the hexadecimal values in registers $t0, $t1, and $t2 when there is no exception (15 points).

Attach a screenshot clearly showing values of registers $12, $13, $14 when there is an exception (10 points).

Lab Instructions

1. Download and Launch MARS

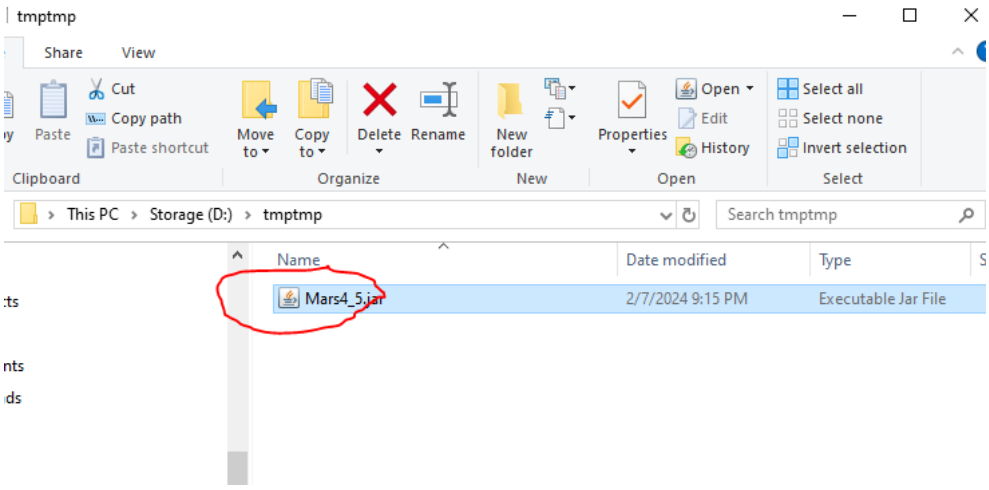
1. Download MARS from

   https://courses.missouristate.edu/kenvollmar/mars/download.htm

   If you don't have Java, install JDK 17

   http://www.oracle.com/technetwork/java/javase/downloads/index.html

You can launch the emulator by double clicking it (in Windows and Mac):



Alternatively, you can run the emulator from command line (terminal) by using the cd command to change the directory to where MARS is located, and then typing

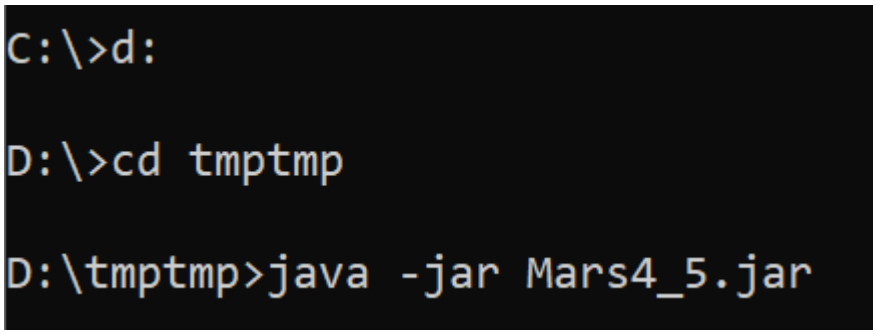
java -jar <MARS .jar name>

For example, if the file name is Mars4_5.jar

We type

java -jar Mars4_5.jar

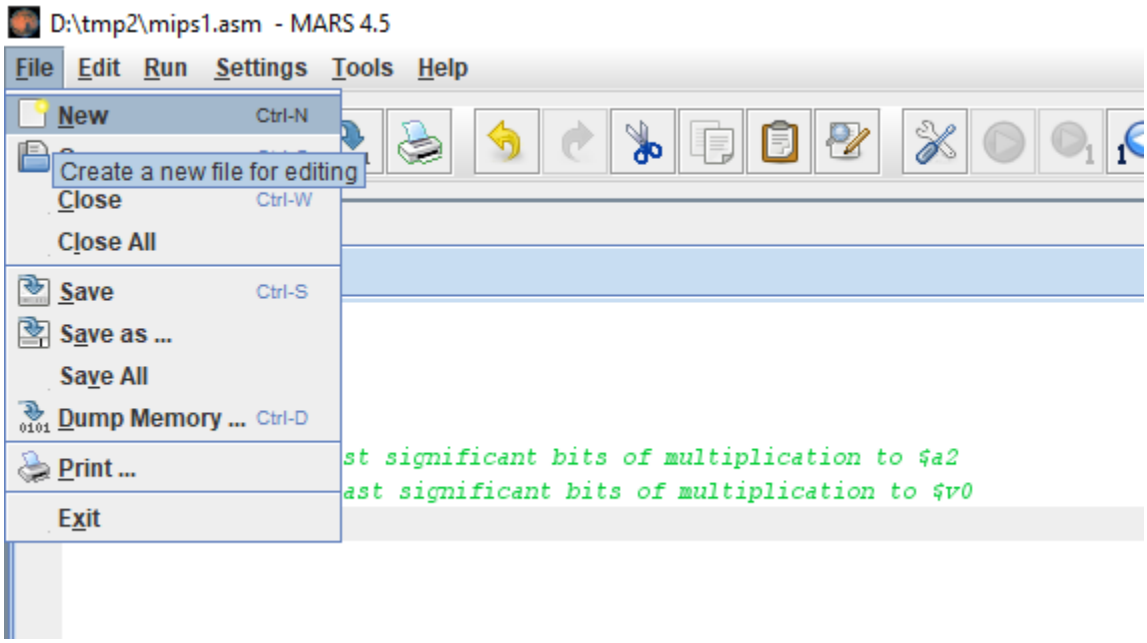
Here is an example of the steps in Windows:



In this example, the MARS executable file is located at D:\tmptmp directory.

2. Run Example Code to Multiply Two Numbers and Make Observations

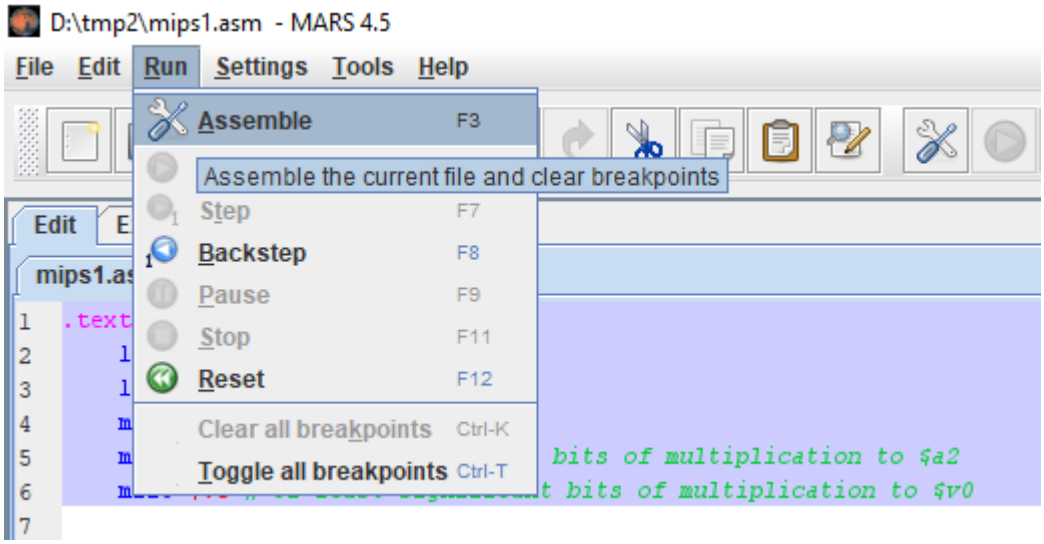
First, we will create a new file:



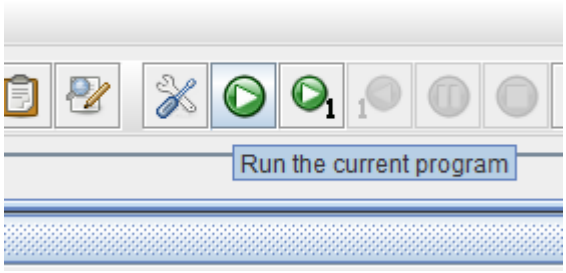
We then copy the following code into the editor:

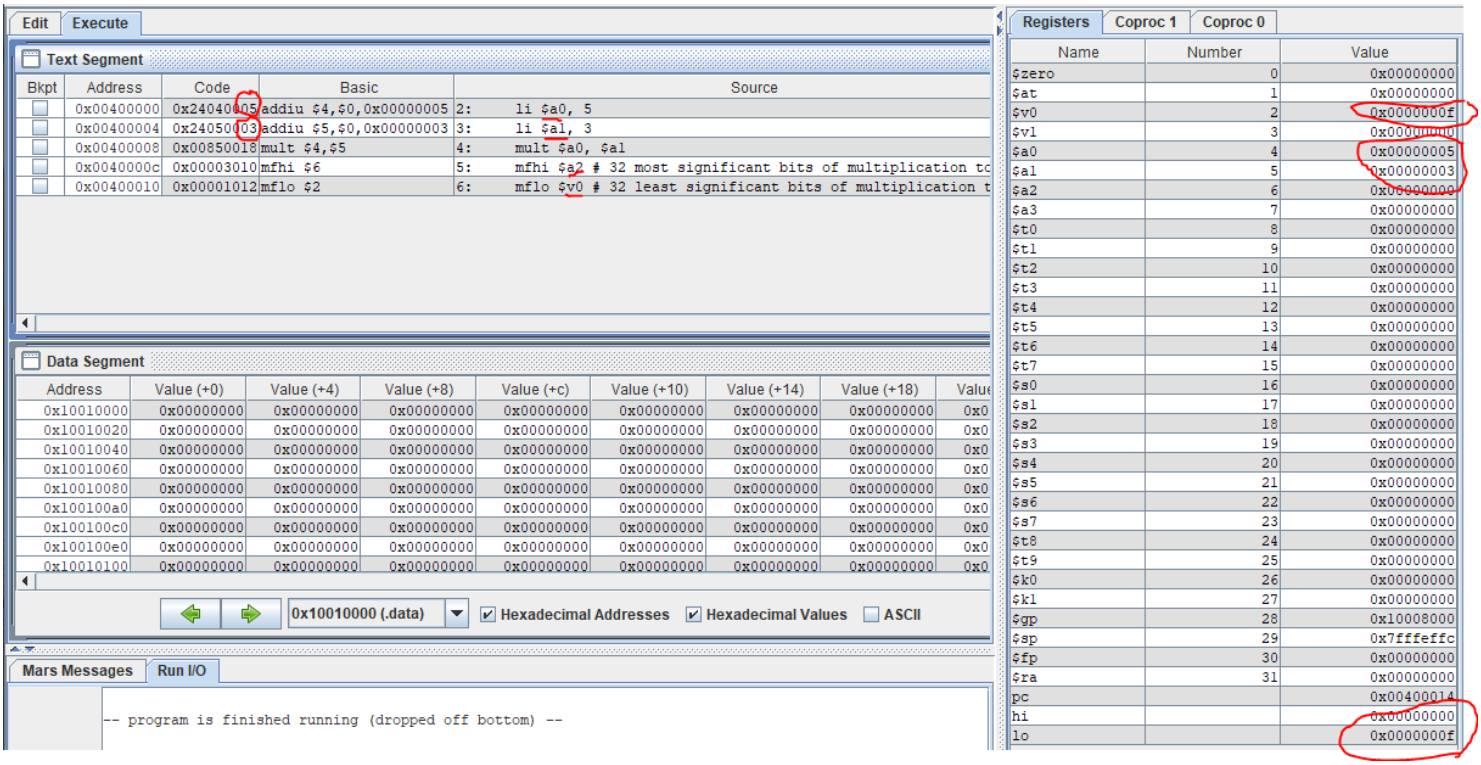
```
.text
    li $a0, 5
    li $a1, 3
    mult $a0, $a1
    mfhi $a2 # 32 most significant bits of multiplication to $a2
    mflo $v0 # 32 least significant bits of multiplication to $v0
```

After saving the file, we click assemble (or type F3)



We then click run the current program (or type F5)





We can see that the computations have been completed by observing corresponding register values.

In Task 2, try to change the values of the multiplicand and multiplier (highlighted in blue):

.text

li $a0, **5**

li $a1, **3**

mult $a0, $a1

mfhi $a2 # 32 most significant bits of multiplication to $a2

mflo $v0 # 32 least significant bits of multiplication to $v0

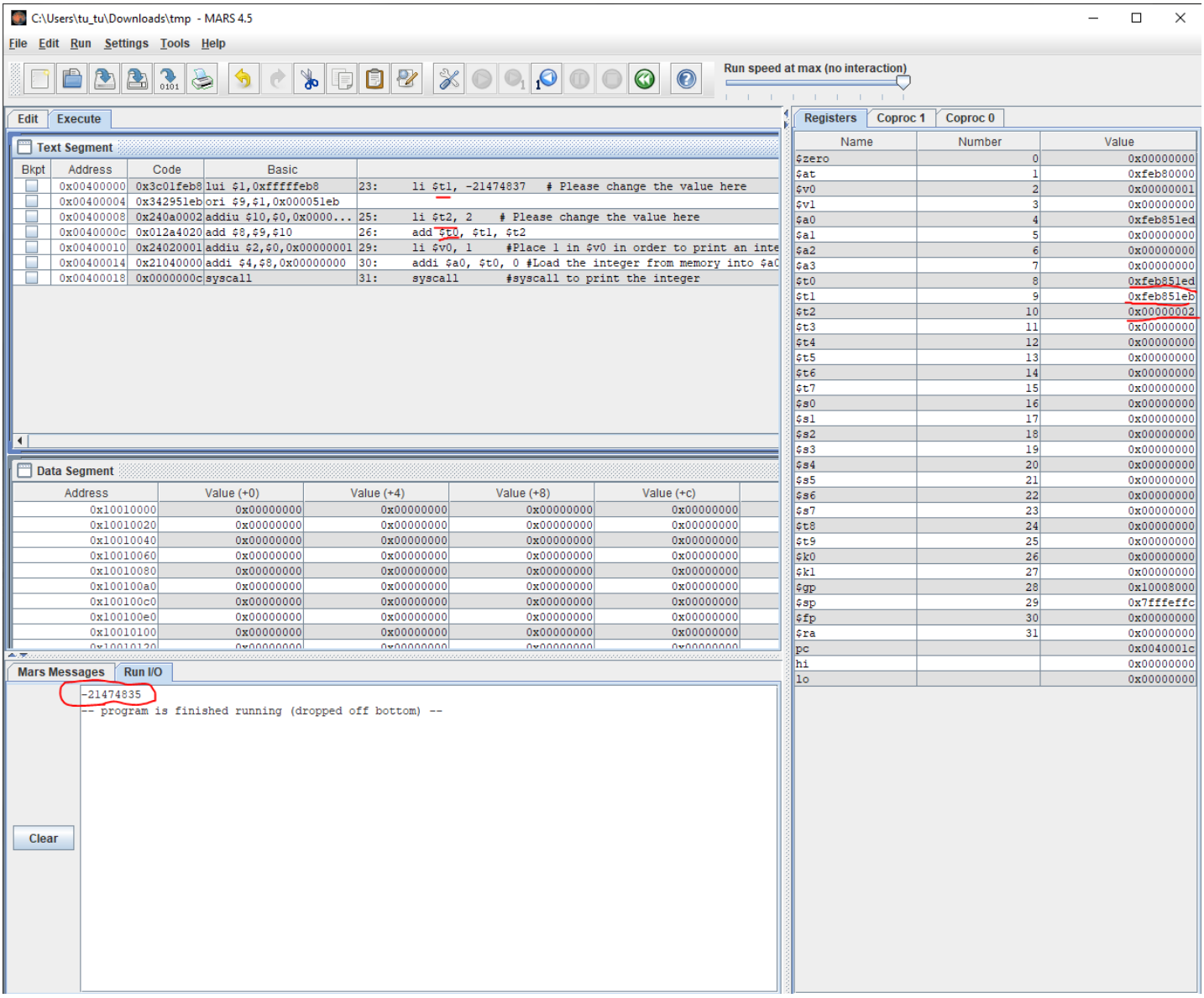
Record your observations and explain the reasons of the changes.

3. Run Example Code to Add Two Numbers and Make Observations on the Results

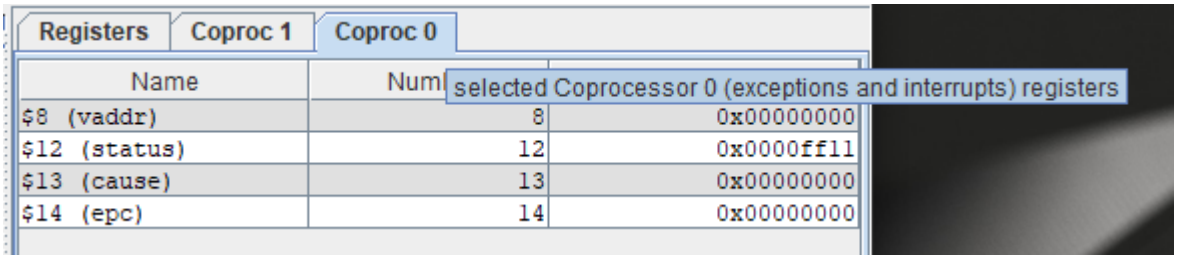
Copy the following code into the editor:

```
.text
 # load the 1st operand
   li $t1, -21474837   # Please change the value here
 # load the 2nd operand
   li $t2, 2    # Please change the value here
   add $t0, $t1, $t2
 # print the result
   li $v0, 1     #Place 1 in $v0 in order to print an integer
   addi $a0, $t0, 0 #Load the integer from memory into $a0
   syscall       #syscall to print the integer  # print the result
```

Assemble and Run, we observe that the program will compute the correct output in the console in this case:



We can also observe that there is no exception when we select and observe the Coproc 0 tab:



In Task 3, please replace the operands in the code with the operands in following 5 cases and record your answers/observations in each case:

a. 1073741824 + 1073741824 = ?
b. -2147483647+ 30 = ?
c. -2147483647 + (-1) = ?
d. -2147483648 + (-1) = ?
e. 38 + (-40) = ?