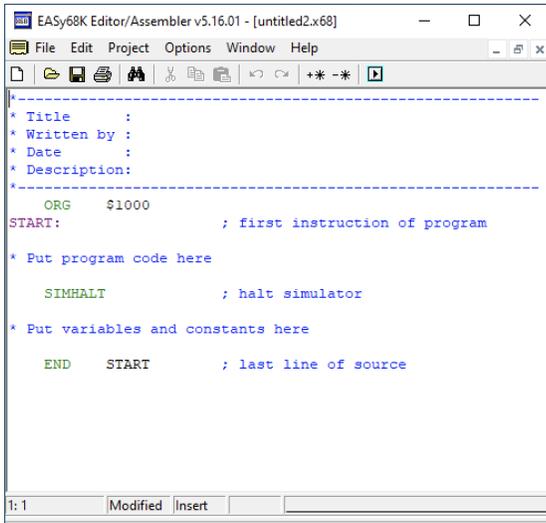


Homework 4

Due: February 16, 2022

Please submit your solution to each question as a separate assembly file.

1. (15 points) **Hello World:** Open Easy68k. You should get a window like the one below:



```
-----
* Title      :
* Written by :
* Date       :
* Description:
-----
      ORG     $1000
START:                ; first instruction of program

* Put program code here

      SIMHALT        ; halt simulator

* Put variables and constants here

      END     START   ; last line of source
```

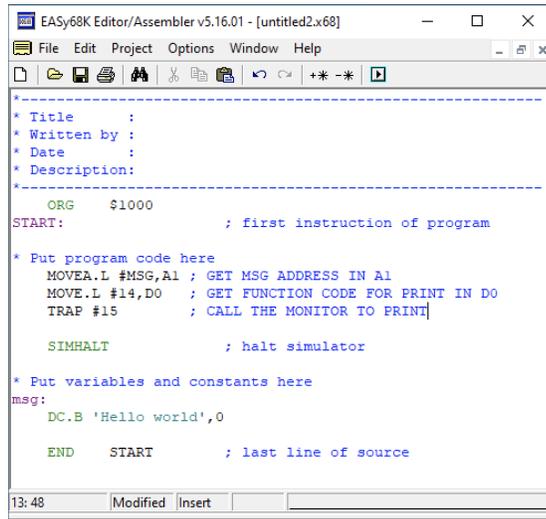
To write a hello world program in assembly, you need two things (i) a message to print, and (ii) instructions to tell the computer to print the message. Your message goes after the SIMHALT directive and before the END START directive where it says “Put variables and constants here.” Your program’s instructions go between the START and SIMHALT directives where it says “Put program code here.”

To define the message, we need two lines:

```
msg:                ; Define variable name
      DC.B 'Hello world',0 ; msg contents
```

The program to print the message consists of three instructions (comments begin with a ;):

```
MOVEA.L #MSG,A1 ; GET MSG ADDRESS IN A1
MOVE.L #14,D0   ; GET FUNC CODE FOR PRINT IN D0
TRAP #15        ; CALL THE MONITOR TO PRINT
```



```
-----
* Title      :
* Written by :
* Date       :
* Description:
-----
      ORG     $1000
START:                ; first instruction of program

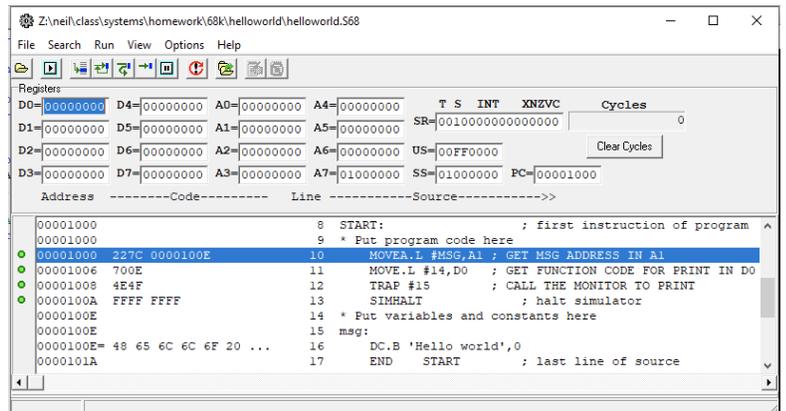
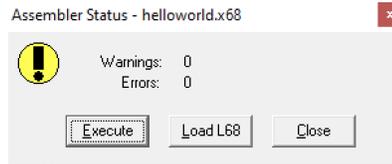
* Put program code here
MOVEA.L #MSG,A1 ; GET MSG ADDRESS IN A1
MOVE.L #14,D0   ; GET FUNCTION CODE FOR PRINT IN D0
TRAP #15        ; CALL THE MONITOR TO PRINT

      SIMHALT        ; halt simulator

* Put variables and constants here
msg:
      DC.B 'Hello world',0

      END     START   ; last line of source
```

The full program is shown at left. After you type your program in, click the  button to run it in the simulator. You will get a window that asks you if you want to run your program (see below). Click the **Execute** button, which will bring up the simulator (shown below). In the simulator, click the  button to run the program.



2. (15 points) **Jello World.** You will modify your hello world from Q. 1 to print “Jello World” by changing the H to a J just before printing the `msg`. After the first instruction (`MOVEA.L #MSG,A1`), register A1 holds the address of the H in “Hello world.” Modify the message by adding an instruction after the `MOVEA.L` that converts the H to a J. You can do this in one of two ways: (i) add two from the ASCII value of the H, or (ii) replace the H with a J by hand. In the first method, you can use the instruction `ADD.B #2,(A1)`. This adds two to the byte stored at the address pointed to by A1. In the second method, you can use the instruction `MOVE.B #'J',(A1)`. This replaces the byte at the address pointed to by A1 with the ASCII code for J.
3. (20 points) **Printing characters**
- (a) (10 points) Write a program that prints only the character ‘A’ to the terminal and then exits. You should be able to use the `TRAP #15` instruction (same as in Question 1) with two modifications. First, you need to use a `MOVE.B` instruction to put function code 6 in D0 instead of function code 14. Second, you need to use a `MOVE.B` instruction to put the character A into D1.
- For documentation of I/O in Easy68k, see: <http://www.easy68k.com/QuickStart/TrapTasks.htm>
- (b) (10 points) Modify your program from part (a) to print the character A continuously in an infinite loop. Use the `BRA` instruction to branch back to the beginning of the program after the `TRAP #15`.