Lab 3: ASCII-risks (Asterisks)

Due February 11, 2021, 11:59 PM

Minimum Submission Requirements

- Ensure that your Lab3 folder contains the following files (note the capitalization convention):
    - Lab3.asm
    - README.txt
- Commit and push your repository
- Complete the Google Form with the correct commit ID of your final submission

Objective

This lab will introduce you to the MIPS ISA using MARS. You will write a program with several nested loops to print variable-sized ASCII diamonds and a sequence of embedded numbers.

In addition, this lab will introduce you to several different syscalls to incorporate I/O into your program.

Resources

Read

Documentation Standards

Introduction To MIPS Assembly Language Programming
section 1.3, chapters 2, 3, and 7

Videos

Intro to MIPS
MIPS Instructions
Registers and Memory

Intro to MARS
Registers
Hello Assembly!
Getting User Input

Functionality

This program will print out a pattern with numbers and stars (asterisks).

1. It will first prompt for the height of the pattern. If the user enters an invalid input such as a negative number or zero, an error message will be printed and the user will be prompted again.

2. Each symbol(either a number or space) should be separated by a **tab (not space)**

3. Then your program should print the following pattern using numbers and stars with a tab between each of them.

Example Outputs

User inputs 0, -1, and then 5

```
Enter the height of the pattern (must be greater than 0):	0
Invalid Entry!
Enter the height of the pattern (must be greater than 0):	-1
Invalid Entry!
Enter the height of the pattern (must be greater than 0):	5
1
*	2	*
*	*	3	*	*
*	*	*	4	*	*	*
*	*	*	*	5	*	*	*	*

-- program is finished running --
```

For a triangle with height 5, see the figure below. Note that the '⊔' character indicates a tab. Also, note that there is a newline after the triangle is finished printing before the program terminates.

```
Enter the height of the pattern (must be greater than 0):⊔5
1
*⊔2⊔*
*⊔*⊔3⊔*⊔*
*⊔*⊔*⊔4⊔*⊔*⊔*
*⊔*⊔*⊔*⊔5⊔*⊔*⊔*⊔*

-- program is finished running --
```

To receive all possible points, **the output should match the sample format exactly**.

Syscalls

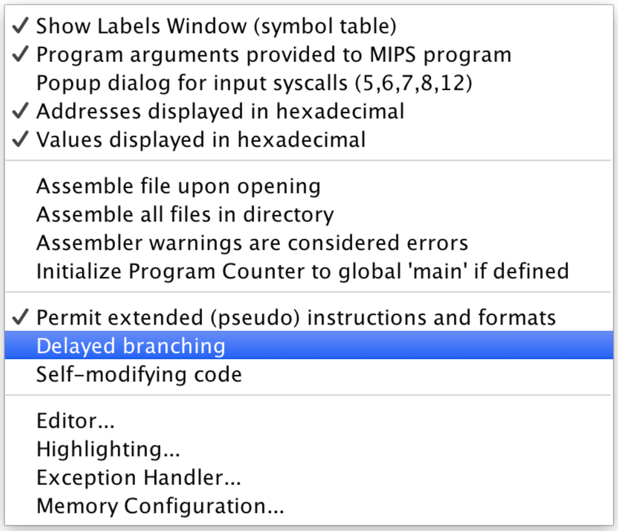
You may use **syscall 11** (print character), **syscall 4** (print string) and **syscall 1** (print integer) to print the triangle, **but you MUST use syscall 4 (print string) to print the prompt message.** You may collect user input using syscall 5 (read integer). When finished, your program should end by calling syscall 10 (exit). See below for a summary of syscalls and their uses.

SYSCALL #	FUNCTION	PURPOSE
1	Print integer	Prints an integer in ASCII
4	Print string	Print prompt
5	Read integer	Read user input
10	Exit	Successfully end the program
11	Print character	Prints an ASCII character

Table: Required Syscalls

Turn Off Delayed Branching

From the settings menu, make sure **Delayed branching is unchecked**


✓ Show Labels Window (symbol table)
✓ Program arguments provided to MIPS program
Popup dialog for input syscalls (5,6,7,8,12)
✓ Addresses displayed in hexadecimal
✓ Values displayed in hexadecimal
Assemble file upon opening
Assemble all files in directory
Assembler warnings are considered errors
Initialize Program Counter to global 'main' if defined
✓ Permit extended (pseudo) instructions and formats
Delayed branching
Self-modifying code
Editor...
Highlighting...
Exception Handler...
Memory Configuration...

Checking this option will insert a “delay slot” which makes the next instruction after a branch executes, no matter the outcome of the branch. To avoid having your program behave in unintended ways, make sure **"Delayed branching"** is turned **OFF**. In addition, add a NOP instruction after each branch instruction. The NOP instruction guarantees that your program will function properly even if you forgot to turn off delayed branching. For example:

```
      LI   $t1 2

LOOP: NOP
      ADDI $t0 $t0 1
      BLT  $t0 $t1 LOOP
      NOP                     # nop added after the branch instruction
      ADD  $t3 $t5 $t6
```

Automation

Note that our grading script is automated, so **it is imperative that your program's output matches the specification exactly**. The output that deviates from the spec will cause point deduction.

Files

README.txt

Instructions for the README can be found here.

Lab3.asm

This file contains your pseudocode and assembly code. Include a header comment as indicated in the documentation guidelines here.

Google Form

You are required to answer questions about the lab in this Google Form. Question answers, excluding the ones asking about resources used and collaboration, should total at the very least 150 words.

A Note About Academic Integrity

This is the lab assignment where most students get flagged for cheating. Please review the syllabus and look at the examples in the first lecture for acceptable and unacceptable collaboration.

You should be doing this assignment completely by yourself!

Grading Rubric (80 points total)

20 pt assembles without errors

50 pt output matches the specification

 5 pt exact wording and spacing of prompt (tab after colon) and error message
 5 pt error check zero and negative heights
 5 pt prompts user until a correct input is entered
 5 pt correct line indentation (must use tabs)
 5 pt number of levels match user input
 5 pt tabs between numbers and asterisks
 5 pt correct asterisks and numbers on each line
 15 pt uses correct syscalls
 Note: credit for this section **only** if program assembles without errors

10 pt documentation

 5 pt README file complete
 5 pt Google form complete with at least 150 words

-15 pt for incorrect naming convention