Programming Lab 1

Computer Architecture
CSCI 361, Fall 2014

Due: October 24, 2014 11:59 pm

Instructions: For this lab you are required to implement several programs using the MIPS programming language and test them with the simulator SPIM.

Exercise 1 [20 points]:

Go to page http://spimsimulator.sourceforge.net/ (click me!) and download the QtSpim simulator. Install it. Run it.

Exercise 2 [30 points]:

The following questions refer to the program in Figure 1. Type the code into a text file and save the file with extension ".s". Open your file in SPIM and run it. Then answer the following questions.

Question 1: What does this program do? What is the result? List the calculation.

Question 2: In hex, list the values located in R2, R8, R9, R11, and R12 after you execute the program.

Question 3: This code is inefficient. Which lines can be eliminated or modified to improve efficiency? Explain each choice you make.

Question 4: Rewrite this code using a minimum number of instructions while performing the same number of *necessary* arithmetic operations. Use proper indentation. Use register names and **not** register numbers. Comment every single line of your code.

As Figure 1 illustrates, poorly written code with no comments is difficult to read and understand. Always format and comment your code. Your grade depends on it.

You will submit the answers to questions 1-3 in a text file. Include your revised and commented code in the same text file as the answer to question 4.
Use the naming scheme:

`[lastname]_[firstname].prog1.txt`

```
1  .globl main
2  .data
3  a: .word 10
4  .text
5  main:
6  la   $t0, a
7  addi $8, -4
8  lw   $9, 4($t0)
9  li   $t4, 4
10 addi $t2, $12, 0
11 sub  $t0, $9, $t2
12 addi $t3, $8, 8
13 addi $11, $t3, 0
14 add  $4, $t3, $zero
15 addi $v0, $zero, 1
16 syscall
17 li $v0, 10
18 syscall
```

Figure 1: A Simple MIPS Program

Exercise 3 [50 points]:

Write a program in MIPS that:

- prompts the user for a first number,
- prompts the user for a second number,
- adds the two numbers,
- prints the sum to the console.

Your program should prompt the user for each number, such as:

```
Enter the first number:
```

Your program, if given 2 and 3, should output:

```
The result of 2 plus 3 is 5.
```

Your program should output exactly in this format. This requires printing a series of strings and integers. Failure to follow instructions will result in a lowered grade.

Save your well commented program using the file name scheme:

`[lastname]_[firstname].prog1.s`

Submission:

You will submit your two files `[lastname]_[firstname].prog1.txt` and `[lastname]_[firstname].prog1.s` to the D2L dropbox folder named Lab 1.

Do not archive your files but submit two (properly named) files. Submit your two files before 11:59pm on October 24. Late submissions will not be accepted.

Frequently Asked Questions (FAQ):

Q: Is Qt Spim cross-platform?
A: Yes, QtSpim is available for Windows, OS X, and Linux.

Q: I am having trouble lazily copying the SPIM code directly from the pdf.
A: Yes.

Q: You didn't really answer my last question.
A: No. And it wasn't a question.

Q: Why do I have to output `The result of 2 plus 3 is 5` instead of just 5?
A: Because it is more work and you'll learn stuff. Useful stuff.

Q: Do I need to include the brackets [ ] around my name in the file name?
A: No - **do not** include the brackets, merely replace [lastname] with your last name.

Q: Can you give me an example?
A: `donnelly_patrick.prog1.s` and `donnelly_patrick.prog1.txt`

Q: I ignored the file naming conventions given, why did I lose a bunch of points?
A: Yes.