ECE 452: Computer Organization and Design
Spring 2017
Homework 3: MIPS Assembly Programming and Computer Arithmetic

Assigned: 14 Feb 2017
Due: 25 Feb 2017

Instructions:

- **Please submit your assignment solutions via Canvas. Assembly program code for Q.1-3 should be submitted via Canvas as assembly files that can be executed and evaluated for grading on the MARS simulator. Q.4-5 should be submitted in a word or pdf file. You can submit all the files in a zip file (make sure it can be opened and is not corrupted before submission)**
- Some questions might not have a clearly correct or wrong answer. In such cases, grading is based on your arguments and reasoning for arriving at a solution.

Use the MARS simulator to write and test programs in questions 1, 2, and 3. MARS and related resources (including sample assembly programs and tutorials) can be found at:
http://www.engr.colostate.edu/~sudeep/teaching/resources_452.htm

Q1 (25 points) Write and test an adding machine program that repeatedly reads in integers and adds them into a running sum. The program should stop when it gets an input that is 0, printing out the sum at that point.

Q2 (40 points) Write and test a program that reads in a positive integer using the SPIM system calls. If the integer is not positive, the program should terminate with the message "Invalid Entry"; otherwise the program should print out the names of the digits of the integers, delimited by exactly one space. For example, if the user entered "728," the output would be "Seven Two Eight."

Q3 (50 points) Write and test a MIPS assembly language program to compute and print the first 100 prime numbers. A number n is prime if no numbers except 1 and n divide it evenly. You should implement two routines:

- test_prime (n)   Return 1 if n is prime and 0 if n is not prime.
- main () Iterate over the integers, testing if each is prime. Print the first 100 numbers that are prime. Test your programs by running them on SPIM.

Q4 (20 points) Answer the following:

a. **(5 points)** What decimal number does the bit pattern 0×0C000000 represent if it is a two's complement integer? An unsigned integer?
b. **(5 points)** If the bit pattern 0×0C000000 is placed into the Instruction Register, what MIPS instruction will be executed?

c. **(10 points)** What decimal number does the bit pattern 0×0C000000 represent if it is a floating point number? Use the IEEE 754 standard.

Q5 (20 points) Answer the following

a. **(10 points)** Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 single precision format.
b. **(10 points)** Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 double precision format.