22C:060: Computer Organization

Spring 2011

Assignment 4

Total points = 50

Assigned March 31, due April 7, 2011, 11:59:59 PM

Instructions to prepare and submit your homework

1. Explain the general plan of the program in Q. 1 using a **readme** file
2. Be generous about using comments to improve readability.
3. To submit, *zip* (or *tar*) all files into a single file, and drop it to ICON drop box

Question 1. (30 points) Write a *recursive* SPIM program that accepts an integer N ($0 \leq N \leq 255$) and computes

$$\text{Sum}(N) = 0+1+2+3+\ldots+N.$$

Using the recursive definition:

$$\text{Sum}(N) = \text{if } N=0 \text{ then } 0 \text{ else } N + \text{Sum}(N-1)$$

Your program should display a prompt "Enter N:" After you enter the integer N, it should show the result as "Sum(N) ="

Question 2. (20 points) Design a hardware system to compute

$$\text{Sum}(N) = 0+1+2+3+\ldots+N.$$

Assume that N is an 8-bit integer. Initially **a register R1** stores N, and **another 16-bit register R2** is designated to store the sum S(N). Use **two adders**: one to *decrement R1* and the other to *perform R2:= R2+R1*. Describe how the unit will work, how many clock pulses it will take to produce the result, and explain the role of the extra control signals if any. A legible diagram is essential for getting full credit.