22C:060: Computer Organization

Homework 1
Total points = 50


1. Read the handout (on ICON) about ARM assembly language programming and the ARMsim simulator. The simulator is available on the departmental Windows machines. If you want, you can download a personal copy free on your laptop using the link given in the handout.

2. Appendix D of the textbook contains details about the ARM processor and its assembly language. Study the sample programs given in the handout. Be familiar with the various system calls (using SWI: Software Interrupt) for performing input and output operations, and the assembler directives.

3. Be generous about using comments to improve readability. Ideally you should add a comment with each line of your program. Insufficient comments will lead to loss of grade. Include a comment at the beginning specifying the purpose of the program.

You should turn in an executable program with adequate comments about the use of the registers and the strategy that you used to solve the problem. To submit the program, zip (or tar) them into a single file, and submit your solution through ICON dropbox.

Problem 1. (10 points)

```
MOV r2, #10 @ Load the value 10 into register r2
MOV r3, #2 @ Load the value 2 into register r3
MUL r1, r2, r3 @ Compute r2*r3 and store in r1 (10*2 = 20)
MOV r0, #1 @ Load 1 into register r0 (stdout handle)
SWI 0x6b @ Print integer in register r1 to stdout
SWI 0x11 @ Stop program execution
```

(SWI stands for software interrupt, not yet discussed in the class. But that hardly matters. SWI followed by a 1-byte code transfers control to a location that helps the machine to carry out a designated operation. Thus SWI 0x6b transfers control to a subroutine used for printing a character (from register r1). To know more about the use of SWI for various input output operations, see Chapter 8 of the ARMsim user guide)

Study the above program whose goal is clearly explained. Now, write a program to compute $2^8$ and display it on the screen.

Problem 2. (15 points)

Write a program to generate and print the integers 1, 2, 3, ..., N. The program should ask for an input “Enter a positive integer N:” When you input a positive integer, the program
will output the list on the screen in the ascending order.

**Problem 3. (15 points)**
Write a program to compute $S=1+2+3+...+N$. Assume that the user can input a positive integer $N$ as in problem 2, and write a loop to compute $S$ (i.e. do not use the formula $S=N(N+1)/2$ to write your program).