

Assignment #6

**Instructions:** The assignment is due on the date shown above. Tips to remember: give the assignments to your TA in section, remember your name, section number, TA name, and assignment number (5 points). Also, make sure your assignment is neat, stapled, and is entirely **your own work**.

1. P&P 5.6
2. P&P 5.8
3. P&P 5.10
4. P&P 5.12
5. P&P 5.14
6. P&P 5.22
7. P&P 5.26
8. P&P 5.32
9. You are given the following program (already assembled into hex). Disassemble the program (i.e. write down the assembly code that corresponds the program below), and describe what the program does. What value is in R4 at the end of the program? Note that the code 0xf025 corresponds to the halt command.

```
0x5920
0xE406
0x6680
0x0403
0x1903
0x14A1
0x0FFB
0xF025
0x0010
0x0020
0x0030
0x0000
```

10. Write an LC-3 program that, using only ADD instructions, places the value of decimal 721 into register R2. Assume that the initial value of register R0 is zero (set by an LD in the given code). Use the file hw6-1.asm available on-line as a starting point. You should add no more than ten ADD instructions to this code (although you can probably do it with less). You should write, assemble, and run your program on the LC-3 simulator available on the departmental Linux workstations.

Turn in a printout of your code and your version of hw6-1.asm using the turnin script. Don't forget to comment your code using the comment character ";". You must turn in your code using the turnin program. In the linux world, use the following command:

```
sh> /lusr/bin/turnin --submit 'your ta's id' hw6 hw6-1.asm
```

e.g.

```
sh> /lusr/bin/turnin --submit aditya hw6 hw6-1.asm
```

While you may write your program using the LC-3 simulator on the departmental PCs in the microlab, we *highly* recommend using the Linux version instead. If you use the PCs, you are responsible for ensuring that your program runs correctly on the Linux simulator.

11. Using the template provided in hw6-2.asm (available on-line), write an LC-3 program that multiplies two arbitrary positive numbers. The template loads the numbers to multiply from memory (at labels op1 and op2) and places the result in memory at label Result. Your code will assume that the numbers to multiply are available in R0 and R1 and the result is placed back in R2.
  - a) Turn in a printout of your code. Don't forget to fill in the header with your name and section number.
  - b) Your program should run on the UNIX version of the LC-3 simulator, and should be submitted using the turnin command, where the source file is named hw6-2.asm
  - c) How many instructions are in your program? How many instructions must be executed to multiply the default numbers in the template program?
  - d) If you wanted to capture the complete magnitude of the number produced by multiplying two unsigned 16-bit numbers, how many bits would you need in the result?

Test your program on multiple values of op1 and op2, but make sure that in the version you turn in, the values for op1 and op2 are the same as in the original hw6-2.asm