

Homework 6 CS/ECE 252: Sec 1 & 2 [Due 11:59AM on Mon, Apr 7]
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Important Notes:

This homework must be submitted electronically to the Learn@UW dropbox. The files to be submitted include **binary code as binary files (*.bin)**, **pseudo-code in text files (*.txt)**, and **README.txt** (see the submission guidelines below). **Do not submit files in hex or assembly! Only machine language for LC-3 is accepted for submission.**

Your programs should **always** start at address **x3000** and end with a HALT instruction (0xF025).

README file:

Download the file: [README.txt](#).

Replace Lastname, Firstname, UWID, and Section#. Replace ADDRESS with the halt address for the corresponding problem (HALTP1 = halt address for problem 1, HALTP3 = halt address for problem 3, etc.).

Submission Guidelines:

1. Please submit only one compressed or archive file (*.zip or *.tar.gz) to the folder **homework6**.
2. Name the archive file with the following format: Lastname-Firstname with .zip or .tar.gz as suffix where Lastname is your last name with 1st letter capitalized and Firstname is your first name with 1st letter capitalized.
3. Your archive file should contain the following 8 files (the files MUST be named exactly like this):
 - A. hw6_p1.txt – Pseudo-code for problem 1
 - B. hw6_p1.bin – Binary code for problem 1
 - C. hw6_p2.txt – Your answers for problem 2
 - D. hw6_p3.txt – Pseudo-code for problem 3
 - E. hw6_p3.bin – Binary code for problem 3
 - F. hw6_p4.txt – Pseudo-code for problem 4
 - G. hw6_p4.bin – Binary code for problem 4
 - H. README.txt - Readme file that contains your name, student ID, and section number and the HALT addresses for problems 1, 3, and 4 (one HALT address for each problem).
4. You can submit your code and other files as many times as you would like until the due time on the due date indicated above.

Problem 1 (6 points)

Write a short LC-3 program in PennSim that compares the 2 numbers in R1 and R2, and then puts the smaller number in R0. If R1 is equal to R2, store 50 in R0. Finally, store the result to memory location 0x5000.

a) (2 points) Write the pseudo code for the algorithm. Please submit your pseudo code in a file exactly named as "hw6_p1.txt", without the double quotes, to dropbox.

b) (4 points) Write an LC-3 program based on pseudo-code from part a. Comment each line of the source code and submit the binary code to dropbox. The file name should be exactly "hw6_p1.bin", without the double quotes.

Problem 2 (6 points)

Load the below LC-3 program in PennSim, and answer the following questions. You can find the program's .obj file [here](#).

Address	Memory Content	Comment
x3000	0010 0100 0000 1010	
x3001	0010 0000 0000 1010	
x3002	0010 0010 0000 1010	
x3003	0000 0100 0000 0011	
x3004	0001 0100 0000 0010	
x3005	0001 0010 0111 1111	
x3006	0000 1111 1111 1100	
x3007	0010 0110 0000 0010	
x3008	0111 0100 1100 0000	
x3009	1111 0000 0010 0101	HALT
x300A	0100 0000 0000 0000	Data value x4000
x300B	0000 0000 0000 0000	Data value 0
x300C	0000 0000 0000 0111	Data value 7
x300D`	0000 0000 0000 1000	Data value 8

- a) (3 points) Fill in the comments column with a summary of what each instruction does.
- b) (1 point) How many times does the instruction at address x3003 execute?
- c) (1 point) What number does this program write to memory and in which location?
- d) (1 point) What is the purpose of this program? Describe its purpose in one sentence.

Problem 3 (9 points)

Write an LC-3 program that multiplies the number in R1 by the number in R2 and stores the result at memory location 0x5000. Furthermore, store a 1 at memory location 0x5001 if the product is odd or a 0 if it is even. (You can assume that the numbers in R1 and R2 will be positive.)

(3 points) Write the pseudo code for the algorithm. Please submit your pseudo code in a file exactly named as "hw6_p3.txt", without the double quotes, to dropbox.

(6 points) Write an LC-3 program in PennSim based on pseudo-code from part a. Comment each line of the source code and submit the binary code to dropbox. The file name should be exactly "hw6_p3.bin", without the double quotes.

Problem 4 (9 points)

Write an LC-3 program that determines whether the number stored at 0x4000 is divisible by n. Use the value stored at memory location 0x4001 for input n. If the number at 0x4000 is divisible by n, store the number at 0x4000 to 0x5000. If not, store the next smallest number that is divisible by n. (You can assume that both numbers given at 0x4000 and 0x4001 will be positive.)

(3 points) Write the pseudo code for the algorithm. Please submit your pseudo code in a file exactly named as "hw6_p4.txt", without the double quotes, to dropbox.

(6 points) Write an LC-3 program in PennSim based on pseudo-code from part a. Comment each line of the source code and submit the binary code to dropbox. The file name should be exactly "hw6_p4.bin", without the double quotes.