

PART 1 Due: Thursday, Apr. 5, beginning of class

PART 2 Due: Thursday, Apr. 5, 11:59pm

52 points

On homework, you may discuss with other students in the course about how to solve a problem, but the write-up should be your own. You **must include the names** of any students you consulted with. Give credit where credit is due. You will use JFLAP for some of the problems.

All the problems listed below referring to a book are from the JFLAP book.

PART 1: Written, Bring to class

1. (6 pts) Prove the following language is not context-free by using **the pumping lemma**. Show all steps (there are lots of cases).

$L = \{w \in \Sigma^* \mid n(a) > n(b), n(b) = n(c)\}$, $\Sigma = \{a, b, c\}$, $n(a)$ = number of a 's in w . For example, $abcacbaa \in L$.

2. (3 pts) Chapter 9.6, Problem 1b. Describe the language of the Turing machine.
3. (3 pts) Chapter 9.6, Problem 5a. Describe the language of the Turing machine.

PART 2: Submit online

Create a README file to also submit (see below).

1. (6 pts) Chapter 9.6, Problem 4b. Name the file hw7-prob1.jff
2. (6 pts) Write a one-tape TM for the following problem.

$\Sigma = \{1\}$, $f(x) = y$, where $x \in \Sigma^+$ and represents a unary number, and y is x divided by 3 using integer division.

For example, $f(11111111) = 11$ since $8/3 = 2$, and $f(111111) = 11$ since $6/3 = 2$.

Note your TM should end in a final state with the tape head pointing to the leftmost symbol in the output. Name the file hw7-prob2.jff

3. (8 pts) Write a TM using building blocks for the following problem.

Turing machine building blocks are not in your JFLAP book, but are described on the JFLAP web page (www.jflap.org). Also on these web pages you can download a

library of building blocks to use. You may also have to create a few building blocks. Create all the building blocks you need first before building your TM.

Problem: $f(w) = a^n b^m$ where $w \in \Sigma^*$, $\Sigma = \{a, b\}$. Basically this function takes a string of a's and b's and moves all the a's first and the b's last.

For example, $f(abbaa)$ writes $aaabb$ to the tape, and $f(bbbaa)$ writes $aabbb$ to the tape. The answer must be surrounded by blanks. It is ok to have other stuff still on the tape when the Turing machine halts.

Name the file hw7-prob3.jff

NOTE: JFLAP Turing Machine Building Blocks was modified this past summer. If you have problems, you can also turn in this problem on paper.

4. (5 pts) Chapter 10.4, Problem 3. Name the file for this L-system: hw7-prob4.jff
5. (5 pts) Chapter 10.4, Problem 5. Name the file for this L-system: hw7-prob5.jff
6. (10 points) Using JFLAP, create an interesting Lsystem that has at least one repeating pattern. This Lsystem must be different than the ones we have done in class, or the sample files given or from previous semesters.

Name this file "hw7-prob6-lastname". For example, if your last name is Smith, your file would be named hw7-prob6-smith.

You must include in your README file how to display the L-System (number of times to render, pitch, roll and yaw).

We will vote for the best L-system and the top three winners get a prize!

Submitting Part 2

To submit files, you can use Eclipse. Make sure you select *cps140* and *homework7* for the location to submit.

Submit a README file and all the .jff files at one time. You can submit more than once, if so, we only grade the last submission.

JFLAP

JFLAP is available www.jflap.org.