

CS350 – Lab 3

Due Date: February 26

Purpose: Turing machines comprise a computational model which is equivalent to Python programs. This means that everything that can be done in a Python program can be done on a Turing machine and everything that can be done on a Turing machine can be done with a Python program.

Due to their simplicity, we will sometimes find that it is easier to analyze the properties of computation with Turing machines rather than with a Python program. Now we know that we can view computation in either way. The purpose of this lab is to explore the Turing machine model of computation.

Knowledge: This lab will help you become familiar with the following content knowledge:

- How to use a Turing machine to accept a language
- How to use a Turing machine as a transducer in order to transform a string.
- How to use one model to simulate another different model of computation

Task: Follow the steps in this lab carefully to complete the assignments. You will need to use JFLAP to construct the Turing Machines.

Assignment 1:

Complete exercise 5.1 on p99 of the text.

Criteria for Success: You have a JFLAP file for a Turing Machine with one tape that swaps the characters "C" and "G" and leaves all other characters unchanged. Make sure you test your Turing machine on multiple inputs so you are confident that it will work for all strings.

Assignment 2:

Create an acceptor Turing machine with the following properties: the machine accepts strings containing at least three G's and at most two T's and any number of A's and C's; all other strings are rejected.

Criteria for Success: You have a JFLAP file for a Turing Machine with one tape that accepts the given language. Use the TM states to keep track of how many G's and T's have been seen rather than trying to create a counter.

It is important to make sure in your Turing machine preferences that you accept by final state only – so uncheck the accept by halting in the preferences window.

Assignment 3:

Complete exercise 5.7 on p100 of the text.

Criteria for Success: You have a JFLAP file for a transducer Turing Machine which modifies the original input string so that after the TM is finished executing all the G's have been deleted. You do not want any spaces in the output of the TM, so the string "TTGAGA" would be transformed into "TTAA". A two-tape machine will be useful for this task.

Assignment 4:

Complete exercise 5.12 on p100 of the text.

Criteria for Success: You need a clear explanation on how a TM with an alphabet of four characters can simulate a TM with an alphabet of five characters. Notice that we are assuming that the input and output only use the four characters but the computation on the inputs may use all five characters.

Hint: You need to figure out how the characters in the 5-symbol alphabet could be "coded-up" with a 4-symbol alphabet.

Submit your JFLAP files and written answers in Canvas for grading. You may turn in the written answers on paper if you prefer but the JFLAP files must be submitted in Canvas.