CpSc 3500 — Goddard — Fall24

Assignment 7

(Please work in groups of two or three and submit one answer sheet for the group.)

1. Draw a TM for concatenation. That is, it starts with two strings x and y separated by a special symbol `$` and ends with the string xy.

2. Consider a TM that is not allowed to write a blank on a cell that is not blank. Show that this version has the same power as a standard TM.

3. Describe in English how to construct a TM that halts if and only if the tape contains a nonempty cell. In this question the head can start anywhere on the tape.

4. Give an algorithm to determine on an input RE whether that RE generates at least one string containing `000`. Discuss the running time of your algorithm.

5. For a language L, the stretch language L^s is the set of all strings obtained by taking each string in L and duplicating each letter at least once. For example, if CAT is in L, then L^s contains CCAATT, CCAAAAATT, CCAAATTT, and many more.

   Assume one is given a boolean function F that always halts and accepts precisely some mystery language L. Explain how to use F as a subroutine to create code for a boolean function that always halts and accepts precisely L^s.

Due: Monday November 4