Theory of Computation, Fall 2022
Assignment 8 (Due November 14 Monday 10:00am)

Q1. Are the following statements true or false? Briefly explain your answer.

   (a) Every standard Turing machine semidecides some language.

   (b) Every standard Turing machine decides some language.

Q2. Let M be a Turing machine that decides some language. What is $L(M)$? (Recall that $L(M)$ is the language semidecided by M.)

Q3. Let $M = \{K, \Sigma_0, \Sigma, \Delta, s, \{y, n\}\}$ be a non-deterministic Turing machine. Are the following statements about M true or false? Briefly explain your answer.

   (a) M semi-decides exactly one language.

   (b) If M decides some language, then for any $w \in \Sigma_0^*$, every branch of the computation on w halts.

   (c) If for any $w \in \Sigma_0^*$, every branch of the computation on w halts, then M decides some language.

Q4. Let L be a recursive language. Prove that $\overline{L}$ is also recursive.

Q5. The encoding of an object O is represented as "O". Similarly, the encoding of several objects $O_1, \ldots, O_k$ is represented as "O_1""O_2"$\cdots$"O_k". Convert the following problems into the corresponding languages.

   (a) Given a DFA A and a string w, does A accept w?

   (b) Given two DFAs A and B, is $L(A) = L(B)$?