# Theory of Computation, Fall 2021
# 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 $L(A) = L(B)$?