

Theory of Computation, Fall 2022

Assignment 8 Solutions

Q1. (20 pts)

- (a) True. Every Turing machine semidecides exactly one language, which is $L(M)$.
- (b) False. If a Turing machine does not always halt, then it does not decide any language.

Q2. (20 pts)

Since M decides some language, it halts on every input. Therefore, $L(M)$ is the set of all strings over the input alphabet.

Q3. (20 pts)

- (a) True.
- (b) True.
- (c) There is something wrong with the statement.

Q4. (20 pts)

Since L is a recursive language, it is decided by some TM, which is $M = (K, \Sigma, \delta, s, \{y, n\})$.

We can construct a TM $M_1 = (K, \Sigma, \delta_1, s, \{y, n\})$ which can decide \bar{L} .

for every $q \in K - H, a \in \Sigma, b \in \Sigma \cup \{\rightarrow, \leftarrow\}$

- (i) If $\delta(q, a) = (y, b), \delta_1(q, a) = (n, b)$
- (ii) If $\delta(q, a) = (n, b), \delta_1(q, a) = (y, b)$
- (iii) else, $\delta_1(q, a) = \delta(q, a)$

Q5. (20 pts)

- (a) $A_{DFA} = \{ "A" w : A \text{ is a DFA that accepts } w \}$
- (b) $EQ_{DFA} = \{ "A" B" : A \text{ and } B \text{ are two DFAs, } L(A) = L(B) \}$