Quiz 3

CS 373: Theory of Computation

Date: October 19, 2010. Lecture Section AL2. Time limit: 15 minutes.

Name	
netid	
Discussion	Tu 2-2:50 Tu 3-3:50 Tu 4-4:50 W 4-4:50 W 5-5:50

Pick the correct alternative from among the choices (A), (B), and (C) provided for each question below. Each question is worth **1 point**.

1. Consider the following Turing Machine: $M = (\{q_0, q_1, q_2, q_{\mathsf{acc}}, q_{\mathsf{rej}}\}, \{0,1\}, \{0,1,\sqcup\}, \delta, q_0, q_{\mathsf{acc}}, q_{\mathsf{rej}})$, where

$$\delta(q_0,0) = (q_1,1,\mathsf{R}) \qquad \delta(q_1,1) = (q_2,1,\mathsf{L})$$
$$\delta(q_2,1) = (q_1,1,\mathsf{R}) \qquad \delta(q_1,\sqcup) = (q_{\mathsf{acc}},\sqcup,\mathsf{R})$$

As always, we assume for cases not mentioned above, $\delta(q,a) = (q_{\mathsf{rej}},\sqcup,\mathsf{R})$. Suppose the current configuration is $1q_00$. The next configuration is

(A) $1q_11$

(B) $11q_1\sqcup$

(C) $10q_11$

2. Consider the following Turing Machine: $M = (\{q_0, q_1, q_2, q_{\mathsf{acc}}, q_{\mathsf{rej}}\}, \{0,1\}, \{0,1,\sqcup\}, \delta, q_0, q_{\mathsf{acc}}, q_{\mathsf{rej}})$, where

$$\delta(q_0,0) = (q_1,1,\mathsf{R}) \qquad \delta(q_1,1) = (q_2,1,\mathsf{L})$$
$$\delta(q_2,1) = (q_1,1,\mathsf{R}) \qquad \delta(q_1,\sqcup) = (q_{\mathsf{acc}},\sqcup,\mathsf{R})$$

As always, we assume for cases not mentioned above, $\delta(q,a) = (q_{\mathsf{rej}},\sqcup,\mathsf{R})$. What can we say about the Turing machine M?

(A) M halts on all inputs

(B) M never halts on some inputs

(C) M does not halt on any input

3. How many Turing Machines are there with only three states q_0 q_{acc} and q_{rej}, with $\Sigma = \{0,1\}$ and $\Gamma = \{0,1,\sqcup\}$?

(A) 3

(B) 18^3

(C) infinitely many

4. Suppose M_1 and M_2 are two TMs such that $L(M_1) \subseteq L(M_2)$. Then

   (A) on every input on which M_1 does not halt, M_2 does not halt.

   (B) on every input on which M_1 halts, M_2 halts too.

   (C) on every input which M_1 accepts, M_2 halts.

5. If L_1 and L_2 are Turing-recognizable then $L_1 \cup L_2$ is

   (A) Decidable

   (B) Turing-recognizable but may not be decidable

   (C) May not be Turing-recognizable

6. If L is decidable, then

   (A) L and $\overline{L}$ must be Turing-recognizable.

   (B) L must be Turing-recognizable, but $\overline{L}$ need not be.

   (C) exactly one of L and $\overline{L}$ is Turing-recognizable.