Quiz # 2, B.Tech. V Sem 2011-12, IITR
Theory of Computation

Your Roll no:..

Instructions:

i. Tick the correct answer. Time: 30 minutes.

ii. Correct answer = 2 marks, wrong answer = $-\frac{1}{2}$ marks.

1. What is *Space Complexity* of multiplying x and y binary strings using standard TM? Assume that $|x| = m, |y| = n$.

2. What is *Time Complexity* of recognizing $L = \{w^R w w^R | w \in \{a,b\}^*\}$ on 3-tape TM? Write brief steps.

3. Let $G = (\{S\}, \{a,b\}, P, S)$ be a CFG where P is $S \to aSb|SS|\varepsilon$. Which of the following is true?

   (a) G is not ambiguous

   (b) There exists $x, y \in L(G)$ such that $xy \notin L(G)$.

   (c) There is deterministic PDA that accepts $L(G)$

   (d) We cannot find deterministic PDA that accepts $L(G)$.

4. Given TM M with $\Gamma = \{0,1,B\}$, $\Sigma = \{0,1\}$, B is for end of string, and δ is:

	Input 0	Input 1	input B
q_0	$(q_1,1,R)$	$(q_1,1,R)$	Halt
q_1	$(q_1,1,R)$	$(q_0,1,L)$	(q_0,B,L)

   Which of the following is true?

   (a) M cannot halt on any string $(0+1)^+$ (b) M cannot halt on any string $(00+1)^+$

   (c) M halts on any string ending in 00 (d) M halts on any string ending in 1

5. Let N_f and N_p denote the classes of languages accepted by non-deterministic finite automata and non-deterministic push-down automata, respectively. Let D_f and D_p denote the classes of languages accepted by deterministic finite automata and deterministic push-down automata respectively. Which one of the following is TRUE?

   (a) $D_f \subset N_f$ and $D_p \subset N_p$ (c) $D_f = N_f$ and $D_p = N_p$

   (b) $D_f \subset N_f$ and $D_p = N_p$ (d) $D_f = N_f$ and $D_p \subset N_p$

6. Consider the languages: $L_1 = \{a^n b^n c^m | n,m > 0\}$ and $L_2 = \{a^n b^m c^m | n,m > 0\}$. Which one of the following statements is FALSE?

   (a) $L_1 \cap L_2$ is a context-free language (b) $L_1 \cup L_2$ is a context-free language

   (c) L_1 and L_2 are context-free languages (d) $L_1 \cap L_2$ is recursively enumerable

7. Consider the languages:$L_1 = \{ww^R | w \in \{0,1\}^*\}$, $L_2 = \{w\#w | w \in \{0,1\}^*\}$, where # is a special symbol, $L_3 = \{ww | w \in \{0,1\}^*\}$. Which one of the following is TRUE?

   (a) L_1 is a deterministic CFL (b) L_2 is a deterministic CFL

   (c) L_3 is a CFL, but not a deterministic CFL (d) L_3 is a deterministic CFL

8. Let L_1 be a recursive language. Let L_2 and L_3 be languages that are recursively enumerable but not recursive. Which of the following statements is not necessarily true?

   (A) $L_2 - L_1$ is recursively enumerable (B) $L_1 - L_3$ is recursively enumerable

   (C) $L_2 \cap L_1$ is recursively enumerable (D) $L_2 \cup L_1$ is recursively enumerable