

Question Paper Code : R 3645

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fifth Semester

Computer Science and Engineering

CS 332 — THEORY OF COMPUTATION

(Regulation 2001)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

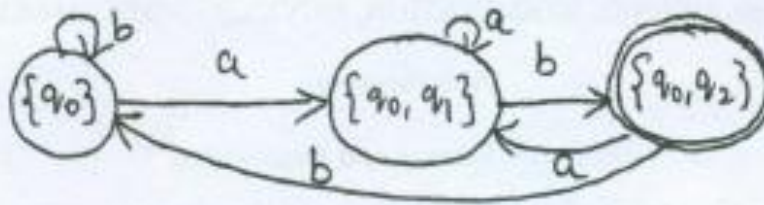
PART A — (10 × 2 = 20 marks)

1. Design a deterministic finite automata for the language $L = \{a^n b; n > 0\}$.
2. Check whether the strings ababba, baab are accepted by the DFA.



3. Define context free language.
4. If G is a grammar $S \rightarrow Sba$. Prove that G is ambiguous.
5. Define instantaneous description of a Push down Automata (PDA).
6. Check whether the CFL $L = \{a^n b^n; n \geq 0\}$ is a deterministic CFL.
7. Explain how a Turing machine can be regarded as a computing device to compute integer function.
8. Mention the usage of checking off symbol in Turing machine.
9. Define recursive (R) and recursively enumerable (RE) language.
10. Define Rice theorem.

11. (a) (i) Prove that for every NFA, there exists a DFA which simulates the behaviour of NFA. (10)
- (ii) Construct DFA equivalent to the NFA given below. (6)



Or

- (b) (i) Prove that for every regular expression r there exists a NFA with ϵ -transitions that accepts $L(r)$. (10)
- (ii) Construct the ϵ -NFA for the following regular expression $(0+1)^*010(11)^*$. (6)
12. (a) (i) Prove that $S \xrightarrow{*} \alpha$ if and only if there is a derivation tree for the context free grammar (CFG) which yields α . (12)
- (ii) Consider $G = (\{s\}, \{a, b\}, P, S)$ where, P consists of $S \rightarrow aAS | a, A \rightarrow SbA | SS | b$. Draw the derivation tree for the string $aabbaa$. (4)

- (b) (i) Find an equivalent grammar in Chomsky Normal Form (CNF).
 $S \rightarrow aAB \quad A \rightarrow aB | bAB \quad B \rightarrow b \quad D \rightarrow d$. (6)
- (ii) Convert the given Grammar into Greibach Normal Form.
 $A_1 \rightarrow A_2A_3, A_2 \rightarrow A_3A_1 | b \quad A_3 \rightarrow A_1A_2 | a$. (10)

13. (a) (i) Prove that if $A = (Q, \Sigma, \gamma, \delta, q_0, Z_0, F)$ is a PDA (A) accepting L by empty stack, then there exists an equivalent PDA (B), which accepts L by final state. (12)
- (ii) Design an NPDA accepting $\{w w^R; w \in \{0, 1\}^*\}$. (4)

Or

- (b) Prove that every language $N(m)$ recognized by a PDA m is a CFL.

14. (a) (i) Design a Turing Machine (TM) to recognize all strings consisting of even number of one's. (10)
(ii) Explain how the multiple tracks in TM can be used for testing given positive integer is prime or not. (6)

Or

- (b) (i) Design a TM that can compute multiplication with subroutine "copy". (10)
(ii) Show that if L is accepted by a multi tape TM then it is accepted by single tape TM also. (6)
15. (a) (i) Define the language L_d . Show that L_d is not recursively enumerable. (10)
(ii) Find whether the union of two recursive language is recursive. (6)

Or

- (b) Define the language L_n . Show that L_n is recursively enumerable but not recursive. (16)