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Question Paper Code : 27173

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fifth Semester

Computer Science and Engineering

CS 6503 — THEORY OF COMPUTATION

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is a finite automaton?

2. Write Regular Expression for the set of strings over {0,1} that have atleast one.

3. Let G be the grammar with

   $S \rightarrow aB \mid bA,$

   $A \rightarrow a \mid aS \mid bAA$,

   $B \rightarrow b \mid bS \mid aBB.$

   for the string aaabbabbba find the left most derivation.

4. Construct the context-free grammar representing the set of palindromes over $(0+1)^*$.

5. What are the different ways of language acceptances by a PDA and define them?

6. Convert the following CFG to a PDA.

   $S \rightarrow aAA,\ A \rightarrow aS \mid bS \mid a.$

7. Define a Turing machine.

8. What is a multitape turing machine?

9. State when a problem is said to be decidable and give an example of an undecidable problem.

10. What is a universal language Lu?

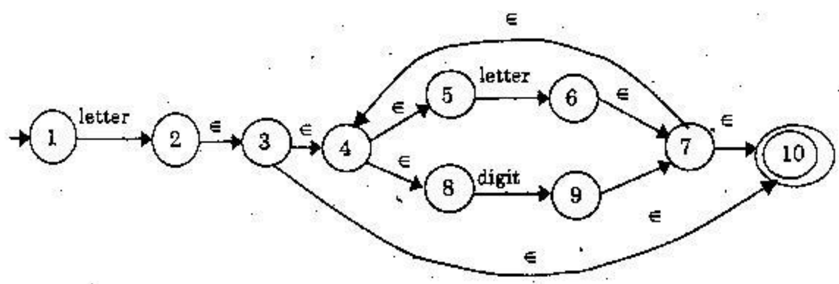
PART B — (5 × 16 = 80 marks)

11. (a) (i) Prove that "A language L is accepted by some DFA if and only if L is accepted by some NFA". (10)

(ii) Construct Finite Automata equivalent to the regular expression $(ab-a)^*$. (6)

Or

(b) (i) Consider the following ε−NFA for an indentifier. Consider the ε-closure of each state and find it's equivalent DFA. (10)



(ii) State the pumping lemma for Regular languages. Show that the set $L = \{0^{i^2} \mid i \geq 1\}$ not regular. (6)

12. (a) (i) Let G = (V, T, P, S) be a Context free Grammar then prove that if the recursive inference procedure tells us that terminal string W is in the language of variable A, then there is a parse tree with root A and yield w. (10)

(ii) Given the grammar $G = (V, \Sigma, R, E)$, where $V = \{E, D, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, +, -, *, /, (,)\}$, $\Sigma = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 0, +, -, *, /, (,)\}$, and R **contains the following rules** :

$E \to D \mid (E) \mid E+E \mid E-E \mid E*E \mid E/E$

$D \to 0 \mid 1 \mid 2 \mid \cdots 9$

find a parse tree for the string 1 + 2 * 3. (6)

Or

(b) (i) Construct a equivalent grammar G in CNF for the grammar G1 where

$G_1 = (\{S, A, B\}, \{a, b\}, \{S \to ASB \mid \epsilon, A \to aAS \mid a, B \to SbS \mid A \mid bb\}, S)$. (10)

(ii) What is an ambiguous grammar? Explain with an example. (6)

13. (a) (i) Design a PDA to accept $\{0^n1^n \mid n>1\}$. Draw the transition diagram for the PDA. Show by instantaneous description that the PDA accepts the string '0011'. (10)

(ii) State the Pumping lemma for CFL and Show that the language $L=\{a^nb^nc^n \mid n>=1\}$ is not a CFL. (6)

Or

(b) (i) Convert PDA to CFG. PDA is given by $P=(\{p,q\},\{0,1\},\{X,Z\},\delta,q,Z)$, δ is defined by $\delta(p,1,Z)=\{(p,XZ)\}$, $\delta(p,\epsilon,Z)=\{(p,\epsilon)\}$, $\delta(p,1,X)=\{(p,XX)\}$, $\delta(q,1,X)=\{(q,\epsilon)\}$, $\delta(p,0,X)=\{(q,X)\}$, $\delta(q,0,Z)=\{(p,Z)\}$. (10)

(ii) What are deterministic PDA's? Give example for Non-deterministic and deterministic PDA. (6)

14. (a) (i) Design a turing-machine to accept the language $L=\{0^n1^n \mid n>=1\}$. Draw the transition diagram. (Also specify the instantaneous description to trace the string 0011. (10)

(ii) State and describe the Halting problem for Turing machine. (6)

Or

(b) (i) Explain the programming techniques for Turing Machine construction. (10)

(ii) Describe the Chomsky hierarchy of languages. (6)

15. (a) (i) Prove that "MPCP reduces to PCP". (10)

(ii) Discuss about the tractable and intractable problems. (6)

Or

(b) (i) State and explain RICE theorem. (10)

(ii) Describe about Recursive and Recursively Enumerable languages with examples. (6)