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Question Paper Code : 57255

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

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. Draw a non-deterministic automata to accept strings containing the substring 0101.
2. State the pumping Lemma for regular languages.
3. What do you mean by null production and unit production ? Give an example.
4. Construct a CFG for set of strings that contain equal number of a's and b's over $\Sigma = \{a,b\}$.
5. Does a pushdown Automata has memory ? Justify.
6. Define a pushdown automaton.
7. What are the differences between a finite automata and a Turing machine ?
8. What is a Turing machine ?
9. When is a recursively enumerable language said to be recursive ?
10. Identify whether Tower of Hanoi' problem is tractable or intractable. Justify your answer.

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PART – B (5 × 16 = 80 Marks)

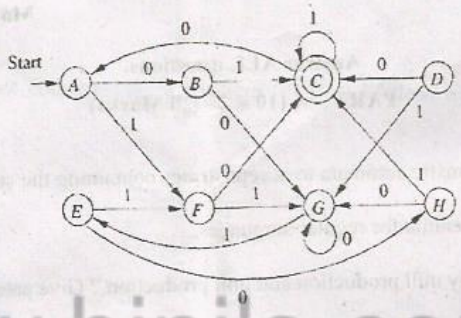
11. (a) (i) Construct a NFA that accepts all strings that end in 01. Give its transition table and the extended transition function for the input string 00101. Also construct a DFA for the above NFA using subset construction method. **(10)**

(ii) Prove the following by principle of Induction. $\Sigma_{x=1}^{n} x^2 = \frac{n(n+1)(2n+1)}{6}$. **(6)**

OR

(b) (i) What is a Regular Expression ? Write a regular expression for set of strings that consists of alternating 0's and 1's. **(8)**

(ii) Write and explain the algorithm for minimization of a DFA. Using the above algorithm minimize the following DFA. **(8)**



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12. (a) (i) Construct a reduced grammar equivalent to the grammar G = (N, T, S, P) where

N = {S, A, C, D, E}

T = {a, b}

P = {S → aAa, A → Sb, A → bCC, A→ DaA, C → abb, C → DD, E → aC, D → aDA} **(6)**

(ii) When is a grammar said to be ambiguous ? Explain with the help of an example. **(5)**

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(iii) Show the derivation steps and construct derivation tree for the string 'ababbb' **(5)**

by using leftmost derivation with the grammar

$S \rightarrow AB \mid \varepsilon$

$A \rightarrow aB$

$B \rightarrow Sb$

OR

(b) (i) What is the purpose of normalization ? Construct the CNF and GNF for the following grammar and explain the steps. **(10)**

$S \rightarrow aAa \mid bBb \mid \varepsilon$

$A \rightarrow C \mid a$

$B \rightarrow C \mid b$

$C \rightarrow CDE \mid \varepsilon$

$D \rightarrow A \mid B \mid ab$

(ii) Construct a CFG for the regular expression $(011 + 1)(01)$. **(6)**

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13. (a) (i) Construct a pushdown automaton to accept the following language L on $\Sigma = \{a, b\}$ by empty stack. $L = \{ww^R \mid w \in \Sigma^+\}$ **(10)**

(ii) What is an Instantaneous description of a PDA ? How will you represent it ? Also give the three important principles of ID and their transactions. **(6)**

OR

(b) (i) Explain acceptance by final state and acceptance by empty stack of a pushdown automata. **(8)**

(ii) State pumping Lemma for CFL. Use pumping lemma to show that the language $L = \{a^i b^j c^k / I < j < k\}$ is not a CFL. **(8)**

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14. (a) (i) Construct a Turing machine to accept palindromes in an alphabet set $\Sigma = \{a, b\}$. Trace the strings "abab" and "baab". **(8)**

(ii) Explain the variations of Turing machines. **(8)**

OR

(b) (i) Explain Halting problem. Is it solvable or unsolvable problem ? Discuss. **(8)**

(ii) Describe Chomsky hierarchy of languages with example. What are the devices that accept these languages ? **(8)**

15. (a) What is a Universal Turing machine ? Bring out its significance. Also construct a Turing machine to add two numbers and encode it. **(16)**

OR

(b) What is a post correspondence problem (PCP) ? Explain with the help of an example. **(16)**

2/5/16
AN

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