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Question Paper Code : 90417

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Fifth Semester

Computer Science and Engineering

CS 8501 — THEORY OF COMPUTATION

(Common to : Computer Science and Business Systems)

(Regulations 2017)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Prove: $1+2+...+n=n(n+1)/2$ using mathematical induction.

2. Define: ε-closure of a state.

3. State: Pumping lemma for regular languages.

4. Consider the following languages. $L1=\{ab, abb, abbb, ...\}$ and $L2=\Phi$ (empty language). Identify the list of strings that are part of the language created by $L1.L2\ U\ L2^*$

5. When do you say that given grammar G is ambiguous?

6. Draw a PDA to accept strings of the language, $L=\{a^n cb^n \mid n>=0\}$

7. What is the necessity of forming normal forms of an CFG?

8. List the properties of CFL that are closed.

9. Define "Non-Recursive" languages.

10. Write the significance of NP problems.

PART B — (5 × 13= 65 marks)

11. (a) Draw a Deterministic Finite Automata recognizing the language containing string that are multiples of 4 when represented in binary. Test your DFA using any two strings of the language.

Or

(b) Draw a Deterministic Finite Automata recognizing the language corresponding to the regular expression $(a + bca^*)^*$. Test your DFA using any two strings of the language.

12. (a) Prove the following statement with justification.

"The language L = $\{a^i b^j c^i \mid i, j > 0\}$ is not regular".

Or

(b) Minimize the given automata, G. [Refer Figure. 12(b)]

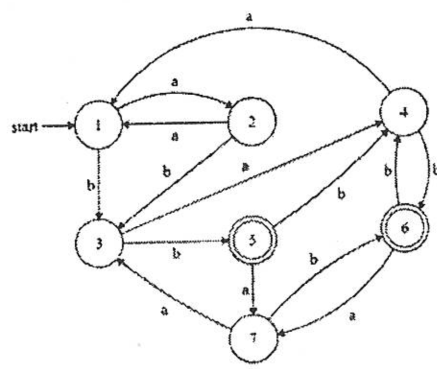

Figure. 12(b)

13. (a) Examine whether the language, $L = \{a^n b^p c^n d^{2p} \mid n > 0\}$ can be designed using Pushdown automation. Justify your answer.

Or

(b) Examine whether the language, $L = \{a^{2n} b^p c^{2n} \mid n > 0\}$ can be designed using Pushdown automation. Justify your answer.

14. (a) Convert the following grammar to be in Chomsky Normal Form.

$S \to AaA$

$A \to aaBa \mid CDA \mid CD$

$B \to bB$

$C \to Ca \mid D$

$D \to bD \mid \in$

Or

(b) Design a Turing machine to perform the following function, $f(x) = 2x + 2, x > 0$.

15. (a) State and prove the halting problem.

Or

(b) State whether the instances of the Post Correspondence Problem (PCP) have a solution. The following are the instances with $\Sigma = \{0,1\}$.

Index	List A	List B
1	10	01
2	110	011
3	110	01
4	000	00
5	10	010

In case the PCP has a solution, describe the post-correspondence solution with justification.

PART C — (1 × 15 = 15 marks)

16. (a) Identify the type of grammar as per Chomsky's hierarchy and design an appropriate automation model.

$S \to aSBC$ $S \to aBC$

$CB \to BC$ $aB \to ab$

$bB \to bb$ $bC \to bc$

$cC \to dd$

Or

(b) Identify the type of grammar as per Chomsky's hierarchy and design an appropriate automation model.

$S \to aSBC$ $S \to aBC$

$CB \to BC$ $aB \to ab$

$bB \to bb$ $bC \to bcc$

$cC \to cccc$