M 2452

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Fifth Semester

Computer Science and Engineering

CS 332 — THEORY OF COMPUTATION

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the regular expression for set of all binary strings ending in 00.

2. Distinguish between NFA and DFA.

3. Specify the language generated by the grammar $S \to aSb|\, ab$.

4. What is chomsky normal form?

5. Define pushdown automata.

6. Is it possible to construct PDA for all regular sets? Justify your answer.

7. What is partial recursive function?

8. Is turing machine more powerful than PDA? Justify your answer.

9. Distinguish between recursive and recursively enumerable languages.

10. Mention any two undecidable problems.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Prove that if L is accepted by a DFA then L is denoted by a regular expression. (8)

(ii) Construct NFA and DFA for the regular expression $(b|a)^* bba$. (8)

Or

(b) (i) Construct the DFA to accept set of all binary strings such that the 3rd symbol from the right end is 1. (8)

(ii) Which of the following languages are regular? Justify your answer.

(1) $L = \{a^n b^n \mid n \geq 1\}$

(2) $L = \{0^{2n} \mid n \geq 1\}$. (4 + 4)

12. (a) (i) Is the grammar $E \rightarrow E + E \mid E * E \mid (E) \mid id$ ambiguous? If so, construct an equivalent unambiguous grammar. (8)

(ii) Obtain the CFG with no useless symbols equivalent to

$S \rightarrow AB \mid CA$

$B \rightarrow BC \mid AB$

$A \rightarrow a$

$C \rightarrow aB \mid b$. (8)

Or

(b) (i) Construct the GNF grammar equivalent to the CFG.

$S \rightarrow AA \mid \bot$

$A \rightarrow SS \mid o$. (8)

(ii) Consider the CFG

$E \rightarrow E + E \mid E * E \mid id$. (8)

13. (a) (i) Construct the PDA for the language $L = \{wcw^R \mid w \in (a|b)^*\}$ and find the instantaneous description for abbcbba. (8)

(ii) Is the language $L = \{a^n b^n c^n \mid n \geq 1\}$ context free? Justify your answer. (8)

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| | (b) | (i) | State and prove pumping lemma for CFL. | (8) |

(ii) Construct a PDA equivalent to the grammar

$$S \rightarrow aAA$$

$$A \rightarrow aS \mid bS \mid a .$$ (8)

14. (a) (i) Construct a TM to recognize the language

$$l = \left\{ \bot^n\, 0^n\, \bot^n \mid n \geq \bot \right\}.$$ (8)

(ii) What is multitape TM? Explain. (8)

Or

(b) (i) Construct a TM to compute n^2. (8)

(ii) What is two-way infinite tape TM? Explain. (8)

15. (a) (i) Prove that the union of two recursive languages is recursive. (8)

(ii) What is universal TM? Explain. (8)

Or

(b) (i) State and prove Rice's theorem. (8)

(ii) Explain the properties of recursively enumerable languages. (8)

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