8503

BT-5/DX

AUTOMATA THEORY

Paper : CSE-305

Time : Three Hours] [Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least *one* question from each unit. Each question carries 20 marks.

UNIT–I

1. (a) Let X = {$} and Y = {a, b, 0, 1} are the language of Σ, where X and Y are the subsets of Σ. Write the string of the following language :
   (i) XY
   (ii) YX
   (iii) XYX.

   (b) Let X = {a} and Y = {b}. Write X^nY, XY^n, and $(XY)^n$.

2. (a) Write at least 2 (two) strings of each of the following regular expressions :
   (i) $(a + b)^*$
   (ii) $(a + b)^*ba$
   (iii) a^*ba^*ba
   (iv) $(ba)^*$.

   (b) Explain the concept of DFA minimization. Give a suitable example.

UNIT–II

3. (a) State and prove pumping lemma for regular language.
   (b) Construct a Mealy machine with input over {a, b} and output over {0, 1} that prints a 0 for each b consumed and a 1 for every other a, starting with the first (otherwise a 0 is printed), e.g. the output for the string "*abbaabaa*" is "10001001".

4. (a) Design a modulo-4 up-down counter.
   (b) Design a two-input, two-output sequence detector which produces an output 1 every time the sequence 0101 is detected, and output 0 at all other times, e.g., when the input sequence is 010101 the corresponding output sequence is 000101.

UNIT–III

5. (a) Prove that NPDA is more powerful than DPDA.
   (b) Prove that $L(G_{pal})$ is the set of palindromes over {0,1} if G_{pal} is given as follow :
   $P \rightarrow \epsilon \,|0|1|0P0|1P1$.

6. (a) Convert the following grammar into Griebach Normal Form (GNF) :
   $S \rightarrow a S a \,|\, b S b \,|\, a \,|\, b \,|\, aa \,|\, bb$.

   (b) Write three different derivation of string "*ababaa*" using the following grammar. Also give the derivation tree.
   $S \rightarrow AA$
   $A \rightarrow AAA \,|\, bA \,|\, Ab \,|\, a$.

UNIT–IV

7. (a) Show that if L is a recursive language, so is $\bar{L}$.
   (b) Write a note on PCP problem.

8. (a) Write a note on unrestricted grammar.
   (b) The characteristic function of a finite subset of N is primitive recursive.

2