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# D-180597

## B. Tech. EXAMINATION, 2018

Semester IV (CBS)

THEORY OF COMPUTATION

CS-404

*Time : 3 Hours* *Maximum Marks : 60*

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Section E is compulsory.

### Section A

1. Define Finite Automata. Give clear cut distinction between following machines : **10**
   (i) Deterministic Finite Automat
   (ii) Non-deterministic Finite Automata
   (iii) Mealy Machine
   (iv) Moore Machine.





2. Design a DFA M that accepts the language consisting of all strings over $\{a, b\}$ that contain an even number of $a$'s and an odd number of $b$'s. Also modify M to $M^1$ which accepts all strings over $\{a, b\}$ that do not contain an even number of $a$'s and an odd number of $b$'s. **10**

### Section B

3. Define Pumping Lemma. If $M = (Q, \Sigma, \delta, q_0, F)$ be a finite automata with $n$ states and L be the regular set accepted by M. Let $w \in L$ & $|w| >= M$. If $m>=n$, then there exists $x, y, z$ such that $w = xyz$, $y = \Lambda$, and $xy'z \in L$ for each $i >=0$. **10**

4. Construct the minimum state automata equivalent to a given automata M whose transition table is given below, where S2 is the final state. **10**

| Present State | Next State | |
|---|---|---|
| | Input(a) | Input(b) |
| $\rightarrow S_0$ | $S_1$ | $S_5$ |
| $S_1$ | $S_6$ | $S_2$ |
| $S_2$ | $S_0$ | $S_2$ |
| $S_3$ | $S_2$ | $S_6$ |

| | | |
|---|---|---|
| $S_4$ | $S_1$ | $S_6$ |
| $S_5$ | $S_2$ | $S_6$ |
| $S_6$ | $S_6$ | $S_4$ |
| $S_7$ | $S_6$ | $S_2$ |

## Section C

5. (a) Design CFG for the language consisting of all strings of even length over $\{a, b\}$.

   (b) Define Pushdown automata. Differentiate PDA by empty stack and final state by giving their definitions. **10**

6. (a) Define Context Free Grammar. Determine how a sentence can be formed from the rules of grammar. Your sentence is : "Itchy the apple eats a jumpy jumpy jumpy dog." **5**

   (b) If G is $S \rightarrow aS \mid bS \mid a \mid b$, find L(G). **5**

## Section D

7. Define Turing Machine. Design a Turning Machine over $\{1, b\}$ which can compute concatenation function over $\Sigma = \{1\}$. If a pair of words $(w_1, w_2)$ is the input the output has to be $w_1w_2$. **10**





8. (a) Given an instance of PCP with a pairs $(x_1, y_1)$, $(x_2, y_2)$,.....$(x_n, y_n)$ and character set of PCP containing only one alphabet, can you write an algorithm to find the solution of PCP, if it exists. **5**

   (b) The lists A and B given in the following are an instance of PCP. Find the solution for given PCP : **5**

| | A | B |
|---|---|---|
| 1 | 0 | 01 |
| 2 | 0101 | 1 |
| 3 | 100 | 0010 |

## Section E

9. Answer the following questions : **10×2=20**

   (a) What is the purpose of Theory of Computation ?

   (b) State two differences between DFA and NFA.

   (c) Define CNF.

   (d) Draw Chomsky hierarchy of languages.

   (e) What is multi-head Turning Machine ?

   (f) Write regular expression for set of all strings such that number of 0's is odd.

(g) Describe the instantaneous description of a PDA.

(h) Design of DFA to accept the binary number divisible by 3.

(i) State Church's Thesis.

(j) State differences between CNF and GNF.