AUTUMN END SEMESTER EXAMINATION-2014

5th Semester B.Tech / B.Tech Dual Degree

THEORY OF COMPUTATION CS-504

(Regular-2012 & Back of Previous Admitted Batches)

Full Marks: 60 **Time: 3 Hours**

Answer any SIX questions including Question No.1 which is compulsory.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. Answer all the following questions. [2 × 10

a) Define Pushdown Automata. How Pushdown Automata are different from Finite Automata?

b) What do you mean by inherently ambiguous Context Free Language? Give proper example to explain your answer.

c) What language the following Context Free Grammar will generate?

$S \rightarrow pFq$

$F \rightarrow pF \mid Fq \mid \lambda$

d) Let L and M be two CFLs. The $L \cap M$ is also a Context Free Language. (True / False). Give proper example to support your answer.

e) Construct a DFA that accepts all palindromes of length 3 over the alphabet $\Sigma = \{m, n\}$.

f) What do you mean by Chomsky Hierarchy? Give a Chomsky classification of languages accepted by different automata.

g) Consider the following grammar.

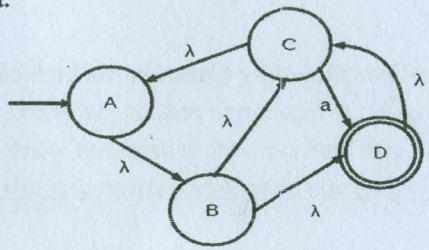
$S \rightarrow aT \mid bV$

$V \rightarrow bS \mid aVV \mid b$

$T \rightarrow bTT \mid aS \mid a$

Obtain a Leftmost and Rightmost derivation for the string **"aabbabab".**

h) Find δ^* (q, λ) for each state q in the following Finite Automata.



i) State True or False with proper justification. The language of a DFA (over Σ) in which every state except the start state is a final state is Σ^+.

j) State pumping lemma for Context Free Languages.

2. a) Let L be the language of the regular expression $a^*b^* + b^*a^*$. [4

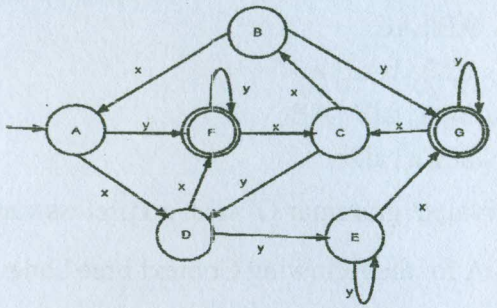
(i) Give an example of a string $\{a, b\}^*$ not in L.

(ii) Design a DFA with six states to accept L.

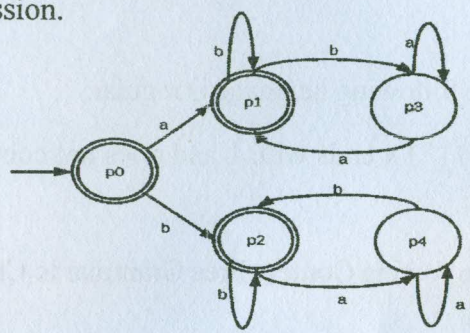
b) Convert the following NFA to DFA. Assume Q0 as initial and Q2 as final state. [4

δ	A	B
Q0	{Q1,Q2,Q3}	{Q2,Q3}
Q1	{Q1,Q2}	{Q2,Q3}
Q2	ϕ	{Q2,Q3,Q4}
Q3	{Q4}	{Q2,Q3,Q4}
Q4	ϕ	ϕ

3. a) Find the minimized DFA for the following finite automata. [4



b) Convert the following automaton to its corresponding regular expression. [4



4. a) Let $L = \{\alpha \in \{1, 2\}^* \mid \alpha = \alpha^R\}$. Show that the language L is not regular using pumping lemma for regular languages. [5

b) Prove or disprove the language $L = \{w \in \{0, 1\}^* \mid$ w has different number of 0's and 1's$\}$ is not regular. [3

5. a) Give Context Free Grammars for the following languages [4

(i) $L = \{p^m q^n r^{m+n} \mid m, n \geq 0\}$

(ii) $L = \{x^m y^n \mid n \leq m+3\}$

b. Consider the following grammar [4

$A \rightarrow AA \mid a \mid b$

(i) Show that the above grammar is ambiguous.

(ii) Write an equivalent unambiguous grammar for the above ambiguous grammar.

6. a) Consider the following Context Free Grammar G. [3

$S \rightarrow AB \mid AC$

$A \rightarrow aAb \mid bAa \mid a$

$B \rightarrow bbA \mid aaB \mid AB$

$C \rightarrow abCa \mid aDb$

Find an equivalent grammar G' with no useless variable.

b) Design a PDA for the following Context Free Language [5

$L = \{xcx^R \mid x \in \{p,q\}^*\}$

7. a) Show that the following language is regular. [3

$L = \{w \in \{0,1\}^* \mid x$ ends with 1 and does not contain the substring 00$\}$

b) Convert the following Context Free Grammar to Chomsky Normal Form. [5

$S \rightarrow AACD$

$A \rightarrow aAb \mid \lambda$

$C \rightarrow aC \mid a$

$D \rightarrow aDa \mid bDb \mid \lambda$

8. a) Design a Turing Machine that accepts the following language. [6

$L = \{ 0^k 1^k : k \geq 1 \}$

b) Show that the languages accepted by Finite Automata are closed under Intersection. [2

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