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10CS56

Fifth Semester B.E. Degree Examination, June/July 2017
Formal Languages and Automata Theory

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Give Formal definition of DFA. And also Design a DFA to read a string made up of letters "computer" and recognize the strings that contains the word "cut" as a substring. **(10 Marks)**

b. Design a DFA to accept strings of a's and b's not ending with abb. **(05 Marks)**

c. Covert the following NFA to DFA **(05 Marks)**

δ	0	1
$\rightarrow q_0$	$\{q_0\}$	$\{q_0, q_1\}$
q_1	q_2	q_2
$*q_2$	ϕ	ϕ

2 a. Consider the following $\in$ – NFA

δ	$\in$	a	b
$\rightarrow$ P	{r}	{q}	{p, r}
q	Φ	{p}	Φ
*r	{p, q}	{r}	{p}

i) Compute the $\in$-closure of each state
ii) Give the set of all strings of length 3 or less accepted by the automation
iii) Convert the automation to DFA. **(08 Marks)**

b. Describe regular expression recursively. Write the regular expression for the following:
i) Strings of a's and b's that do not end with ab over $\{a, b\}^*$
ii) String of 0^s and 1^s such that starts and ends with the same symbol. **(06 Marks)**

c. Obtain regular expression from the following DFA using state elimination method. **(06 Marks)**

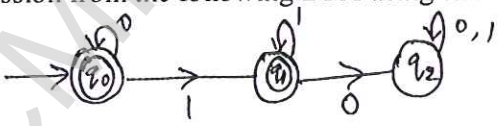

Fig Q2(c)

3 a. State and prove pumping lemma for regular languages. **(05 Marks)**

b. Prove that if L is a regular language so L^R. **(05 Marks)**

c. Minimize the following DFA using table filling Algorithm. **(10 Marks)**

δ	0	1
$\rightarrow$ A	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

4 a. Define context free grammar. Write a CFG for palindromes over $\{0, 1\}^*$. **(05 Marks)**

b. What is ambiguous grammar? Show that following grammar is ambiguous for the string "abababa". $S \rightarrow Sbs|a$ **(05 Marks)**

c. What is inherent ambiguity? Explain with an example. **(05 Marks)**

d. Explain the application of CFG with respect to parsers. **(05 Marks)**

PART – B

5 a. Explain the working of PDA with a diagram. **(05 Marks)**

b. Design a PDA for accepting the language $L = \{0^{2n}1^n | n \geq 1\}$. Draw the transition diagram for PDA obtained. Show the instantaneous description of the PDA for the string "000011". **(10 Marks)**

c. Convert the following grammar to PDA **(05 Marks)**

$I \rightarrow a|b|I_a|I_b|I_0|I_1$

$E \rightarrow I|E*E|E+E|(E)$.

6 a. Consider the following grammar

$S \rightarrow ASA|aB$

$A \rightarrow B|S$

$B \rightarrow b|E$

i) Eliminate E - production

ii) Eliminate any unit productions in the resulting grammar

iii) Eliminate any useless symbols in the resulting grammar

iv) Put the resulting grammar in to CNF. **(10 Marks)**

b. Show that $L = \{ 0^n1^n2^n \mid n \geq 1 \}$ is not context free. **(06 Marks)**

c. Prove that CFL are closed under union operation. **(04 Marks)**

7 a. Design a Turing machine to accept the Language $L = \{ a^n b^n c^n \mid n \geq 1\}$. Give the graphical representation for the Turing machine obtained. **(12 Marks)**

b. Define a Turing machine. Show that a multitape Turing machine is equivalent to a basic Turing machine. **(08 Marks)**

8 Write short notes on :

a. Recursively Enumerable Language

b. Post correspondence problem

c. Languages of PDA

d. Applications of regular expression. **(20 Marks)**

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