LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **MATHEMATICS**

SECONDSEMESTER – APRIL 2018

17PMT2ES01- FORMAL LANGUAGES AND AUTOMATA THEORY

Date: 25-04-2018 Dept. No. Max. : 100 Marks

Time: 01:00-04:00

ANSWER ALL QUESTIONS

I a) Design a DFA which accepts all positive even integers.

[OR]

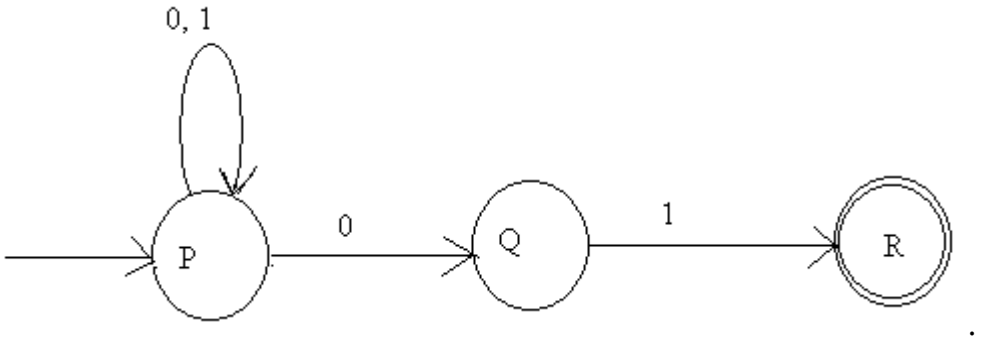
b) Construct a finite automation to accept all strings over $\{0,1\}$ containing exactly four zeros. (5)

c) i) Let r be a regular expression. Then prove that there exists an NFA with $\in$- moves that accepts L(r).

ii) Define regular expressions. Write the language of the regular expression **((01 + 001)* 0*)***. (10+5)

[OR]

d) i) Construct an equivalent DFA with minimum number of nodes for the following NFA.



ii) Write a regular expression to denote a language L which accepts all strings which begin or end with either 00 or 11. (10+5)

II a) Prove that $L = \{0^p / p \text{ is a prime number}\}$ is not regular.

[OR]

b) State and prove pumping lemma. (5).

c)i) Let L_1 = **(0 + 1)*101** and L_2 = **(0 + 1)*010.** Construct an NFA to accept $L_1 \cup L_2$.

ii) State and prove any four closure properties of regular sets. (5 + 10)

[OR]

d) Minimize the following automation.

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

(15)

III a) Construct a grammar to generate four digit odd integers.

[OR]

b) Define leftmost and rightmost derivations and give examples. (5)

c i) The CFG is given by G $G=(V,T,P,E)$ where

$V=\{E\}, T=\{id\}, P=\{E\rightarrow E+E, E\rightarrow E*E, E\rightarrow id\}$. Prove that this grammar is ambiguous.

ii) Write about Chomsky's hierarchy of languages. (7+8)

[OR]

d i) Optimize the CFG given below. S is the starting symbol.

$S\rightarrow A/0C1, A\rightarrow B/01/10, C\rightarrow \varepsilon/CD$.

ii) Write a context free grammar to generate the set of all palindromes over {a, b, c}. Hence construct an equivalent CNF to generate the same. (7+8)

IV a) Define a PDA and explain instantaneous descriptions.

[OR]

b) Eliminate ε production from the CFG with production rules $S\rightarrow XYX, X\rightarrow 0X/\varepsilon, Y\rightarrow 1Y/\varepsilon$. (5)

c) If a language L is accepted by a PDA A by empty stack then prove that there exist a PDA B accepts the same language L by final state. (15)

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[OR]

d) Design a PDA to accept $L=\{wcw^R / w\in(0,1)^*\}$ by

(1) Empty stack.

(2) Final state.

(9 + 6)

V a) Define a Turing Machine and discuss about moves of the Turing Machine.

[OR]

b) Write a short note on multiple tracks Turing Machines . (5)

c) Design a TM to accept the language $L=\{a^n b^n c^n / n\geq 1\}$. (15)

[OR]

d) Design a Turing Machine

(i) to compute $f(n)=n+2,\ n\in N$.

(ii) to compute . $f(n)=2n+1,\ n\in N$.

(ii) to add two positive integers. (5+5+5)

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