LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **APRIL 2016**

MT 3964 - FORMAL LANGUAGES AND AUTOMATA

Date: 03-05-2016 Dept. No. Max. : 100 Marks
Time: 09:00-12:00

ANSWER ALL QUESTIONS

I a) Design a DFA which can accept a positive number divisible by 3.

[OR]

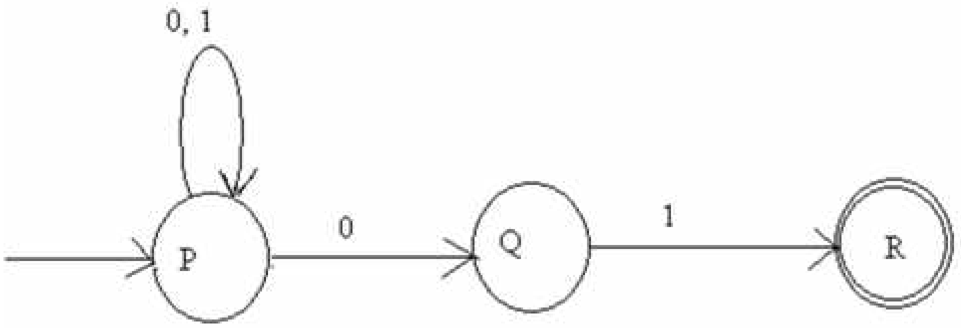
b) Construct a finite automaton to accept L over $\{0,1\}$ in which every string starts with 0 and ends with 1 **(5)**

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 an NFA with $\in$- moves to accept **(10 + 01)* + (10 +(0 + 1)*)***. **(8+7)**

[OR]

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



ii) Construct DFA equivalent to the following NFA.

	0	1
$\rightarrow$p	{q, s}	{q}
*q	{r}	{q,r}
r	{s}	{p}
s	-	{p}

(8+7)

IIa) Prove that $L = \left\{a^p \,/\, p \text{ is a prime}\right\}$ is not regular.

[OR]

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

c)i) Let L_1 = **(0 + 1)*011** and L_2 = **(0 + 1)*110.** Construct an NFA to accept $L_1 \cup L_2$.

ii) Let L_1 be the set of all strings over alphabet {0, 1} ending in 01 . Let L_2 be the set of all strings over alphabet {0, 1} having even number of 1's. Construct a DFA for $L_1 \cap L_2$ and $L_1 \cup L_2$. **(5 + 10)**

[OR]

d) Minimize the following automaton.

	0	1
→A	B	F
B	G	C
* C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

(15)

III a) Construct a grammar to generate roll numbers of all students of your class .

[OR]

b) Construct a regular grammar to generate all binary numbers . **(5)**

c i) Discuss about Chomskey's hierarchy.

ii) Write a grammar to generate $L = \{a^n b^n c^n / n \geq 1\}$. **(7+8)**

[OR]

d i) Show that the grammar $E \to E + E / E * E /(E) / a / b$ is ambiguous. Also remove ambiguity

ii) Let G be a grammar with production rules S→abSb/ a / aAb, A→bS/ aAAb. Construct a CNF to generate G. **(7+8)**

IV a) Define a PDA and explain instantaneous descriptions.

[OR]

b) Define derivation trees and give an example. **(5)**

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

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[OR]

d) Design a PDA for accepting the set of all strings over $L = \{wcw^R / w \in (a,b)^*\}$

The string should be accepted both by

(1) Empty stack.

(2) Final state. **(7 + 8)**

V a) Discuss about an ID and moves between the ID's of a Turing Machine.

[OR]

b) Write about any two properties of a TM . **(5)**

c) Design a TM to perform proper subtraction. **(15)**

[OR]

d) Design a Turing Machine to compute

(i) $f(n) = n + 4,\ n \in N.$

(ii) $f(n) = 3n,\ n \in N.$ **(7 + 8)**

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