LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2016**

MT 3964 – FORMAL LANGUAGES AND AUTOMATA

Date: 09-11-2016   Dept. No.   Max. : 100 Marks
Time: 09:00-12:00

ANSWER ALL QUESTIONS

I. a) Construct a DFA to accept all strings over {0, 1} having 00 as a substring.
                    [OR]
  b) Construct a finite automaton accepting $L = \{0^n 1^n / n \geq 1\}$.   (5)

  c) i) Let L be the language accepted by a NFA .Prove that there exist a DFA accepts L.

    ii) Let L be the set of all positive integers divisible by 4. Design a NFA to accept L.   (7+8)
                    [OR]
  d) i) Let r be a regular expression. Then prove that there exists an NFA with
       $\in$ - moves that accepts L(r).
    ii) Enumerate the difference between DFA and NFA.   (12+3)

II. a) Prove that union of two regular set is a regular set.
                    [OR]
  b) Write the language of the regular expression **11(0 + 1)*00**. Also write any four
     strings of this language.   (5)

  c) i) Construct an NFA with $\in$ - moves for the regular expression
     (0 + 1)*11 + (01)*0.
    ii) Construct an equivalent DFA to the following NFA.

	0	1
→ q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	$\{q_2\}$	$\{q_3\}$
* q_2	ϕ	$\{q_1\}$
* q_3	ϕ	ϕ

(7+8)

                    [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 all four digit positive even integers.

[OR]

b) Eliminate useless symbols in the following grammar.

$S \rightarrow aA / a / Bb / cC, A \rightarrow aB, B \rightarrow a / Aa, C \rightarrow cCD, D \rightarrow ddd$ (5)

c i) Discuss Chomsky's hierarchy.

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

[OR]

d i) Discuss Chomsky's normal form.

  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 instantaneous description of a PDA.

[OR]

b) Define ambiguous grammar and give an example.   (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) Let L be the set of all strings over {a, b} containing equal number of a's and b's.
Construct a PDA to accept L by
 (i) Empty stack.
 (ii) Final state.   (7 + 8)

V a) Define a Turing Machine.Also write about the moves of a Turing Machine.

[OR]

b) Differentiate multi tape and multi track Turing Machines .   (5)

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

[OR]

d) Design a Turing Machine to perform proper subtraction.   (15)

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