



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 110410

Roll No.

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B. Tech.

(SEM. IV) THEORY EXAMINATION, 2014-15
THEORY OF AUTOMATA AND FORMAL LANGUAGE

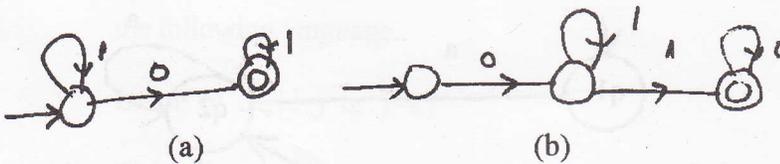
Time : 3 Hours]

[Total Marks : 100

Notes : Attempt all questions.

1 Attempt any four parts of the following. **5x4=20**

- (a) Explain the condition in which two machines M1 and M2 are said to be equivalent. Show that the following automatas are not equivalent.

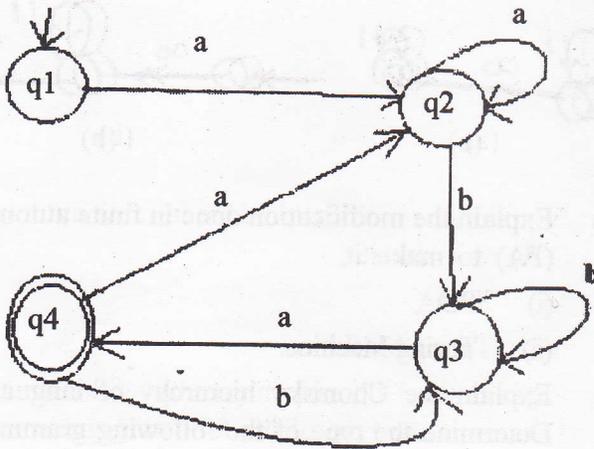


- (b) Explain the modification done in finite automata (FA) to make it.
- (i) PDA
 - (ii) Turing Machine.
- (c) Explain the Chomsky hierarchy of languages. Determine the type of the following grammar.
 $S \rightarrow aAb/\epsilon$, $A \rightarrow aA/Ab/a/b$

- (d) Find the language generated by the following grammar :
 $S \rightarrow aAb/ab, A \rightarrow bAa, A \rightarrow \epsilon$
- (e) Discuss the halting problem of a Turing machine.

2 Attempt any four parts of the following. $5 \times 4 = 20$

- (a) Design a FA which accepts set of strings containing exactly four 1's in every string over $\Sigma = \{0, 1\}$.
- (b) Design the Turing machine that accepts the language of even integers written in binary.
- (c) Convert the CFG into GNF.
 $S \rightarrow aSbA$
 $A \rightarrow Sa/a$
- (d) Define context free grammar. Find a context free grammar for the following language.
 $L = \{a^n b^{2n} c^m \mid n, m \geq 0\}$
- (e) Find the regular expression using Arden's theorem of FA given below.



3 Attempt any four parts of the following. **5x4=20**

- (a) Prove that the language $L = \{ 0^n \mid n \text{ is perfect cube} \}$ is not regular.
- (b) Find the CFG for the language $L = \{ a^n b^n \mid n+m \text{ is even} \}$.
- (c) Convert the following CFG into PDA
 $S \rightarrow aSa/aA/Bb, A \rightarrow aA/a, B \rightarrow Bb/A$
- (d) Design PDA for palindrome strips.
- (e) Discuss tractable and non tractable problems.

4 Attempt any two parts of the following. **10x2=20**

- (a) Define push down automata. Design a PDA for the following language
 $L = \{ a^i b^j c^k \mid i=j \text{ or } j=k \}$
- (b) Write the regular expression for the language containing the strings over $\{0,1\}$ in which there are at least two occurrences of 1's between any two occurrences of 0's.
- (c) Construct a CFG for the following language s.t.
 $L = \{ a^m b^n \mid m \neq n \}$.

5 Attempt any two parts of the following. 10x2=20

(a) Write short notes on the following.

(1) Universal Turing machine

(2) Post correspondence problem.

(b) Does the PCP with two lists $X=(10, 011, 101)$,
 $Y = (101, 11, 011)$ have a solution?

(c) Design Turing machine for the language

$L=\{a^{n+2} b^n \mid n > 0\}$.