

B. C. A. (Third Semester) EXAMINATION, 2011-12

Paper Third

THEORY OF COMPUTATION

Time : Three Hours ]

[ Maximum Marks : 70

Note : Attempt any five questions. All questions carry equal marks.

1. (a) What is FA ? Draw and explain the transition diagram for a non-deterministic finite automation.
- (b) Draw finite automation machine for the following regular expression :

$$R = 1(0+1)^*0$$

$$R = (a|b)^*abb$$

2. (a) Explain Noam Chomsky's classification of grammars.

- (b) Which class does the following grammar belong to :

$$(i) S \rightarrow aB$$

$$B \rightarrow Bc$$

$$B \rightarrow b, b$$

$$C \rightarrow c$$

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(ii)  $S \rightarrow Aa$

$A \rightarrow Ba$

$B \rightarrow abc$

(iii)  $S \rightarrow a \alpha b | b \alpha c | aB$

$S \rightarrow aS | b$

$S \rightarrow \alpha bb | ab$

$b \alpha \rightarrow bd b | b$

3. Explain the concept of Push down Automata. When does the push down machine behave like a Turing machine ?
4. What is a Turing Machine ? Construct a Turing machine that will compute  $f(x, y)$  where  $f$  is a multiplication operation.
5. Write regular expression for the following language. Justify your answer with proper explanation :
  - (a) Strings with a's and b's with no consecutive a's.
  - (b) Strings with a's and b's containing consecutive a's.
  - (c) Set of all strings not containing ab as a substring.
6. (a) What is Church-Turing Thesis ? Explain its concept.  
(b) Explain about universal Turing machine.
7. (a) Define Pumping Lemma for content free language. What are the applications of pumping lemma ?  
(b) Show that the set  $L = \{0^{i^2} : i \geq 1\}$  is not regular. That is, the set L which consists of all strings of 0's whose length is a perfect square is not regular.

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8. Write short notes on any *three* of the following :

- (a) Arden's theorem
- (b) Undecidability
- (c) Solvability
- (d) Regular Grammars
- (e) Chomsky Hierarchy