

**B5.2-R4 : AUTOMATA THEORY AND COMPILER DESIGN****NOTE :**

1. Answer question 1 and any FOUR from questions 2 to 7.
2. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours

Total Marks: 100

1. (a) Write down definition of "Deterministic Finite Automata". Consider the Finite Automata M given below & state T/F for the following statements with reasons :



- (i) M accepts a Null String
  - (ii) M accepts all strings over {a, b}
  - (iii) M is a deterministic FA
  - (iv) M is an NFA
- (b) Write down major differences between Moore Machine & Mealy Machine with examples.
- (c) What are basically two main issues involved in the design of lexical analyzer ?
- (d) When a grammar is said to be an ambiguous grammar ? Show that the grammar  $S \rightarrow AB|aaB$ ,  $A \rightarrow a|Aa$ ,  $B \rightarrow b$  is ambiguous.
- (e) Differentiate between DFA & NFA.
- (f) What are the limitations of using static memory allocation ?
- (g) What are the uses of Activation Records ? (7x4)
2. (a) Using principle of mathematical induction, prove that for every  $n \geq 1$ ,  $7 + 13 + 19 + \dots + (6n + 1) = n(3n + 4)$
- (b) Write down regular expression corresponding to the following languages over {0, 1}.  
"The language of all strings in which every 0 is followed immediately by 11"
- (c) Write an algorithm for removing left recursion. Remove left recursion from the following grammar :  
 $E \rightarrow E + T \mid T$      $T \rightarrow T * F \mid F$      $F \rightarrow (E) \mid id$  (6+6+6)

3. (a) Check the following grammar is LL (1) or not.  
 $S \rightarrow AaAb \mid BbBa$   
 $A \rightarrow \wedge$   
 $B \rightarrow \wedge$
- (b) Find a regular expression for the set of all strings over  $\{a, b\}$ .  
 (i) The language of all strings containing at least two a's  
 (ii) The language of all strings containing at most two b's
- (c) Consider the following grammar and obtain an equivalent grammar containing no useless grammar symbol.  
 $A \rightarrow xyz \mid Xyzz \quad X \rightarrow Xz \mid xYz \quad Y \rightarrow yYy \mid Xz \quad Z \rightarrow Zy \mid z$  (6+6+6)
4. (a) Find FIRST for S, A, B, C, D and FOLLOW for the S, A, B and C in following given grammar.  
 $S \rightarrow xABC$   
 $A \rightarrow a \mid bbD$   
 $B \rightarrow a \mid \wedge$   
 $C \rightarrow b \mid \wedge$   
 $D \rightarrow c \mid \wedge$
- (b) Explain various collision resolving methods in symbol tables. (10+8)
5. (a) Using the subset construction, draw an FA accepting the same language as the following NFA. Label the final picture so as to make it clear how it was obtained from the subset construction.
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- (b) Change the following grammar into Chomsky Normal Form :  
 $S \rightarrow ASA \mid aB \quad A \rightarrow B \mid S$   
 $B \rightarrow b \mid \wedge$  (10+8)
6. (a) What are the different storage allocation strategies? Explain in detail.  
 (b) Construct a Turing Machine that computes the function  $f(x)=x \bmod 3$  for all positive integers x. (9+9)
7. (a) What are the criteria that need to be considered while applying the code optimization? Give the criteria for achieving machine dependent and machine independent optimization.  
 (b) Discuss the design issues of code generation. (9+9)

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