JJ342

M. Sc. EXAMINATION, 2020

(5 Year Integrated)

(Tenth Semester)

(B Scheme)

(Main & Re-appear)

MATHEMATICS

MAT614H

Theory of Automata

B. Sc (Hons.) M. Sc. (Mathematics)

*Time : 3 Hours*]   [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. All questions carry equal marks.
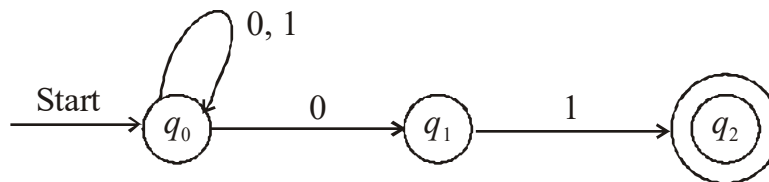
Unit I

1. (a) Design a deterministic finite state automaton over the alphabet $\{a, b\}$ that accepts only those words which do not end with *ba*.

    (b) Design a NDFA for the language L = {ab u aba}* over alphabet {a, b}. Whether this NDSA is unique ? Comment.

2. (a) Minimize the following DFSA :
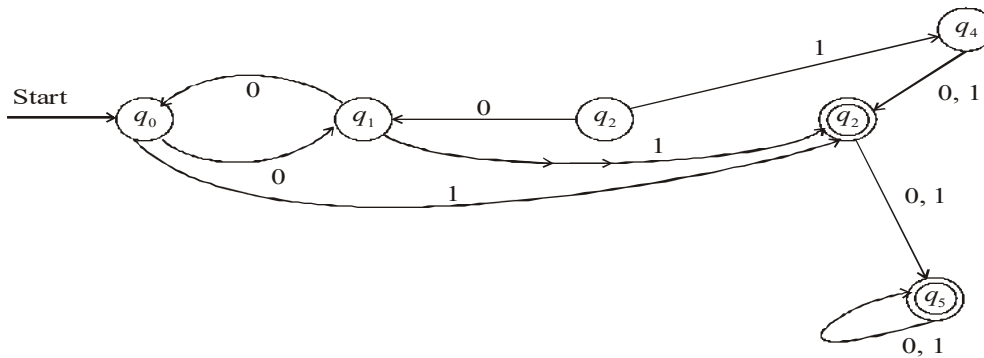
(b) In the following NDFA, describe the processing of string 00101 by it :

Unit II

3. (a) Write regular expression for each language over $\{0, 1\}$ given below :
   (i) All strings not ending in 01
   (ii) All strings containing an even number of 0's.

(b) Design a Moore machine which counts the occurrence of substring *aab* in input string.

4. (a) State and prove Pumping Lemma.

(b) State Ardens's Theorem and using this construct a regular expression corresponding to the state diagram given below :
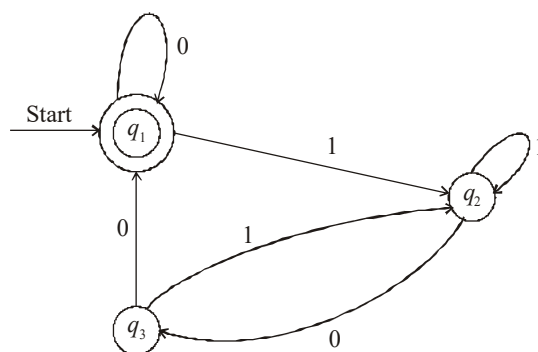
Unit III

5. (a) Find context free grammars that generate the following regular language over {*a*, *b*} :

   (i) All the strings without the substring aaa.

   (ii) All strings that end in b and have an even number of b's in total.

   (b) Discuss ambiguity in grammas by taking a suitable example.

6. (a) Consider the following CFG :

   S → XX

   X → XXX|bX|Xb|a

   Find the parse tree for the string bbaaaab.

   (b) Change the following grammar into CNF :

   S → abSb|a|aAb

   A → bS|aAAb

Unit IV

7. (a) Prove that the family of context free language is not closed under inter-section and complementation.

   (b) Prove that the language $L = \{a^n b^n c^n \mid n \geq 0\}$ is not context-free language.

8. (a) Discuss the simplifcation of context free grammars by taking examples.

   (b) What do you mean by emptiness and finiteness in languages ? Whether the language generated by the following grammar is finite or infinite :

   S → XS/b

   X → YZ

   Z → XY

   Y → ab