Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Automata Theory and Computability

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

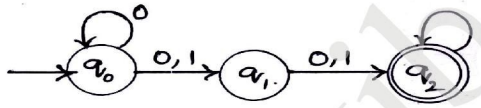
Module-1

1 a. Define the following with example :
i) String ii) Language iii) Alphabet iv) DFSM. **(08 Marks)**

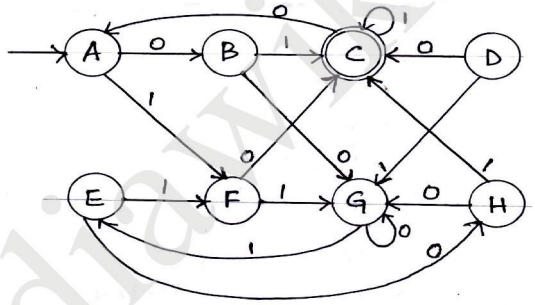
b. Design a DFSM to accept each of the following languages :
i) $L = \{W \in \{0, 1\}^* : W \text{ has 001 as a substring}\}$
ii) $L = \{W \in \{a, b\}^* : W \text{ has even number of a's and even number of b's}\}$. **(08 Marks)**

OR

2 a. Define NDFSM. Convert the following NDFSM to its equivalent DFSM. **(08 Marks)**



b. Minimize the following DFSM. **(08 Marks)**



Module-2

3 a. Define Regular expression and write Regular expression for the following language.
i) $L = \{a^{2n} b^{2m} \mid n \geq 0 , m \geq 0 \}$ **(08 Marks)**
ii) $L = \{a^n b^m \mid m \geq 1 , n \geq 1 , nm \geq 3\}$.

b. Obtain the Regular expression for the following FSM. **(08 Marks)**

OR

4 a. Define a Regular grammar. Design regular grammars for the following languages.
i) Strings of a's and b's with at least one a.
ii) Strings of a's and b's having strings without ending with ab.
iii) Strings of 0's and 1's with three consecutive 0's. **(08 Marks)**

b. State and prove pumping theorem for regular languages. **(08 Marks)**

Module-3

5 a. Define context free grammar. Design a context free grammar for the languages. **(08 Marks)**
i) $L = \{0^m 1^m 2^n \mid m \geq 0 \ , \ n \geq 0\}$ ii) $L = \{a^i b^j \mid i \neq j \ , \ i \geq 0 \ , \ j \geq 0\}$
iii) $L = \{a^n b^{n-3} \mid n \geq 3\}$.

b. Consider the grammar G with production.
$S \rightarrow AbB$
$A \rightarrow aA \mid \in$ **(08 Marks)**
$B \rightarrow aB \mid bB \mid \in$
Obtain leftmost derivation , rightmost derivation and parse tree for the string aaabab.

OR

6 a. Define a PDA. Obtain a PDA to accept
$L = \{a^n b^n \mid W \in \{a, b\}^*\}$. Draw the transition diagram. **(08 Marks)**

b. Convert the following grammar into equivalent PDA.
$S \rightarrow aABC$
$A \rightarrow aB \mid a$ **(08 Marks)**
$B \rightarrow bA \mid b$
$C \rightarrow a$.

Module-4

7 a. State and prove pumping lemma for context free languages. Show that **(10 Marks)**
$L = \{a^n b^n c^n \mid n \geq 0\}$ is not context free.

b. Explain Turing machine model. **(06 Marks)**

OR

8 a. Design a Turing machine to accept the language $L = \{0^n 1^n 2^n \mid n \geq 1\}$. **(08 Marks)**

b. Design a Turing machine to accept strings of a's and b's ending with ab or ba. **(08 Marks)**

Module-5

9 a. Explain the following :
i) Non deterministic Turing machine ii) Multi – tape Turing machine. **(06 Marks)**

b. Define the following :
i) Recursively enumerable language ii) Decidable language. **(06 Marks)**

c. What is Post correspondence problem? **(04 Marks)**

OR

10 a. What is Halting problem of Turing machine? **(06 Marks)**

b. Define the following : i) Quantum computer ii) Class NP. **(06 Marks)**

c. Explain Church Turing Thesis. **(04 Marks)**