Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Briefly describe the applications of Theory of computation. **(04 Marks)**

b. Define DFSM. Build DFSM for the following languages.

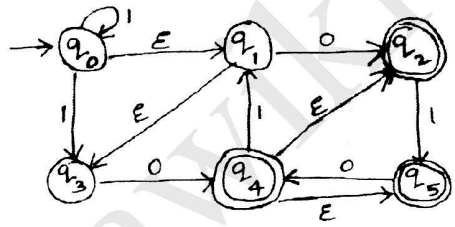
i) $L = \{w \in \{a, b\}^* : \text{every a in w is immediately followed by b}\}$

ii) $L = \{w \in \{a, b\}^* : w \text{ does not contain substring aab}\}$. **(08 Marks)**

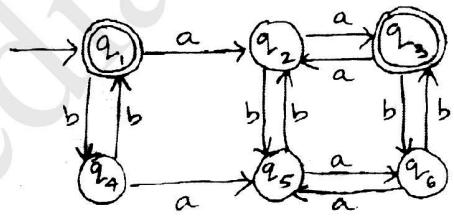
c. Describe Machine based hierarchy of language classes. **(04 Marks)**

OR

2 a. For the following NDFSM, use ndfsmtodfsm to construct an equivalent DFSM. Begin by showing the value of eps (q) for each state q : **(08 Marks)**



b. Let M be the following DFSM. Use minDFSM to minimize M. **(08 Marks)**



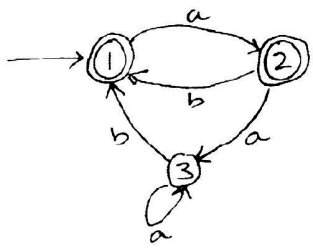
Module-2

3 a. Define Regular Expression. Write regular expression for the following :

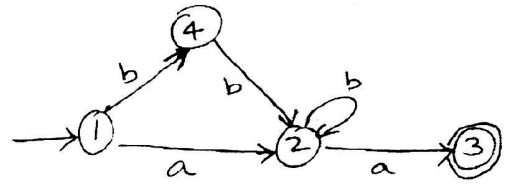
i) $L = \{w \in \{a, b\}^* : w \text{ does not end in ba}\}$

ii) $L = \{w \in \{0 - 9\}^* : w \text{ corresponds to the decimal encoding, without leading 0's , of an odd natural number}\}$. **(06 Marks)**

b. Consider the FSM M. Use the fsmtoregexheuristic algorithm to construct a regular expression that describes L(M). **(05 Marks)**



c. Consider the FSM M. Use fsmtoregex algorithm to construct a regular expression that describes L(M). **(05 Marks)**



OR

4 a. Show that regular languages are closed under complement and set difference. **(06 Marks)**

b. State and prove pumping lemma theorem for regular languages. And show that the language $L = \{a^n b^n : n \geq 0\}$ is not regular. **(10 Marks)**

Module-3

5 a. Define CFG. Design CFG for the languages.

i) $L = \{a^i b^j | 2i = 3j + 1\}$ ii) $L = \{0^{n+2} 1^n | n \geq 1\}$. **(08 Marks)**

b. Define Chomskey Normal form. Convert the following CFG to CNF.

$S \rightarrow a\ ACa$

$A \rightarrow a \mid B$

$B \rightarrow C \mid c$

$C \rightarrow cC \mid E.$ **(08 Marks)**

OR

6 a. Define Ambiguity. Consider the grammar $E \rightarrow + EE \mid * EE \mid - EE \mid x \mid y$. Find the leftmost, rightmost derivations and parse trees for the string " + * - xyxy". **(07 Marks)**

b. Define PDA. Design a PDA to accept the following language.

$L = \{ww^R : w \in \{a, b\}^*\}$. Draw the transition diagram for the constructed PDA. **(09 Marks)**

Module-4

7 a. Design a TM to accept the language $L = \{a^n b^n \mid n \geq 1\}$. Obtain the transition table and transition diagram. Also show the instantaneous description for the string "aabb". **(11 Marks)**

b. Explain the working principle of TM with diagram. **(05 Marks)**

OR

8 a. State and prove pumping theorem for CFL's shown that the language $L = \{a^n b^n c^n : n \geq 0\}$ is not context free. **(10 Marks)**

b. Explain the hierarchy within the class of CFL's (hierarchy of languages). **(03 Marks)**

c. Show that CFL's are closed under reverse. **(03 Marks)**

Module-5

9 a. Explain Multitape TM, with diagram. **(05 Marks)**

b. Prove that every language accepted by a multitape TM is acceptable by some standard TM. **(06 Marks)**

c. Explain the model of Linear Bounded Automata. **(05 Marks)**

OR

10 Write short notes on :

a. Undecidable languages.

b. Halting problem of TM.

c. Post correspondence problem.

d. Church – Turing Thesis. **(16 Marks)**