17CS54

Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Automata Theory and Computability

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain with example,
(i) Strings (ii) Language (iii) Function on string **(06 Marks)**

b. Discuss standard operations on Languages with example. **(04 Marks)**

c. Construct DFSM for the following languages :
(i) $L = \{\omega \in \{a, b\}^* \mid \omega$ contains no more than one b$\}$
(ii) $L = \{\omega \in \{a, b\}^* \mid \omega$ contains Even number of a's and odd number of b's$\}$
Give the transition Table and show that aabaa is accepted. **(10 Marks)**

OR

2 a. Convert the following $\in$-NFSM to DFSM by eliminating $\in$-transition.

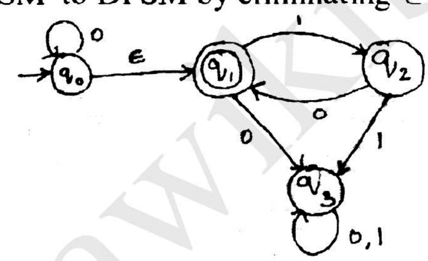

Fig. Q2 (a) **(10 Marks)**

b. Define distinguishable and indistinguishable states. Minimize the number of states in DFSM.

δ	0	1
→A	B	F
B	G	C
C	A	G
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

(10 Marks)

Module-2

3 a. Define Regular expression. Write RE for the following :
(i) Language of all strings of 0's and 1's that have odd number of 1's.
(ii) Language of all strings of 0's and 1's that has at least one pair of consecutive 0's.
(iii) The Language of all strings of 0's and 1's that have no pair's of consecutive 0's. **(10 Marks)**

b. Prove with an example that the class of language can be defined with regular Grammar is exactly the regular language. **(10 Marks)**

OR

4 a. Using Kleen's theorem, prove that any language that can be defined with a Regular expression can be accepted by some FSM. **(10 Marks)**

b. State and prove pumping lemma for regular language and show that the language $L = \{a^P \mid P \text{ is a prime number}\}$ is not regular. **(10 Marks)**

Module-3

5 a. Define context Free Grammar. Construct CFG for the following languages:

(i) Balanced parantheses.

(ii) $L = \{\omega \in \{a,b\}^* \mid \omega \text{ contains substring ab}\}$ and derive two strings for each language along with parse tree. **(10 Marks)**

b. Explain deterministic PDA and construct DPDA for language given and give the trace for the string abbaab and aababb.

$L = \{a^n b^m a^m b^n \mid m.n > 0 \text{ and } n \neq m\}$. **(10 Marks)**

OR

6 a. Discuss Chomsky normal form and Greibach normal form. Convert the following Grammar to Chomsky Normal form,

$S \to aACa$

$A \to B \mid a$

$B \to C$

$C \to cC \mid \in$

(10 Marks)

b. Explain Non deterministic PDA and construct an NPDA for the language.

$L = \{\omega\omega^R \mid \omega \in \{a,b\}^*\}$

Give the transition diagram and show the trace for a string abaaba. **(10 Marks)**

Module-4

7 a. State pumping Lemma for context free language. **(10 Marks)**

b. Define Turing Machine. Design TM to accept the language $L = \{a^n b^n c^n \mid n \geq 1\}$. Draw the transition diagram and show the moves made by TM for the string aabbcc. **(10 Marks)**

OR

8 a. Explain with a neat diagram the working of TM and design a TM to accept all set of palidrom over $\{0,1\}^*$. Also show the transition diagram and instantaneous description on string "10101". **(14 Marks)**

b. Discuss the relationship between the deterministic context free language and the languages that are not inherently ambigus. **(06 Marks)**

Module-5

9 a. With a neat diagram, explain variants of Turing Machines. **(10 Marks)**

b. Explain with example,

(i) Decidability (ii) Decidable languages (iii) Undecidable language. **(10 Marks)**

OR

10 a. Discuss Halting problem and post correspondence problem with respect to TM. **(10 Marks)**

b. Define non-deterministic TM and prove that there in a deterministic TM 'M' such that, $T(M) = T(M_1)$. **(10 Marks)**