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

OR

- 2 a. Convert the following ϵ -NFSM to DFSM by eliminating ϵ -transition.

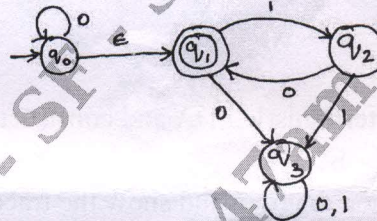


Fig. Q2 (a)

- b. Define distinguishable and indistinguishable states. Minimize the number of states in DFSM. (10 Marks)

δ	0	1
$\rightarrow A$	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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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,
 $S \rightarrow aACa$
 $A \rightarrow B \mid a$
 $B \rightarrow C$
 $C \rightarrow cC \mid \epsilon$ (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)
