

CBCS SCHEME

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15CS54

Fifth Semester B.E. Degree Examination, Feb./Mar. 2022

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) Alphabet (ii) String (iii) Language (06 Marks)
- b. Draw a DFA to accept string of a's and b's ending with ab or ba. (04 Marks)
- c. Draw a DFA to accept strings of a's and b's such that:
 - (i) Language has even number of a's and odd number of b's. (06 Marks)
 - (ii) Language has not more than three a's. (06 Marks)

OR

- 2 a. Define different types of finite state machines. (04 Marks)
- b. Minimize the following Finite state machine.

δ	0	1
$\rightarrow A$	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

- c. Convert the following ϵ -NFA to its equivalent DFA. (06 Marks)

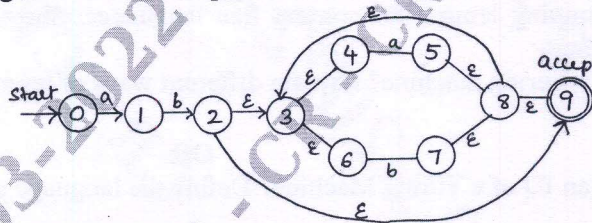


Fig.Q2(c)

(06 Marks)

Module-2

- 3 a. Define Regular expression and write R.E for the following language:
 - i) $L = \{a^{2n} b^{2m} \mid n \geq 0, m \geq 0\}$ (04 Marks)
 - ii) $L = \{a^n b^m \mid m \geq 1, n \geq 1, nm \geq 3\}$ (06 Marks)
- b. Explain different types of grammars. (06 Marks)
- c. Obtain a FSM from the following grammar:

$S \rightarrow aT$
 $T \rightarrow bT$
 $T \rightarrow aW$
 $W \rightarrow \epsilon$
 $W \rightarrow aT$

 and obtain the equivalent regular expression. (06 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. Define a Regular grammar. Design regular grammars for the following languages:
 (i) Strings of a's and b's ending with ab. (06 Marks)
 (ii) Strings of a's and b's having a substring aab. (06 Marks)
- b. State and prove pumping lemma for regular languages. (06 Marks)
- c. Show that $L = \{WW^R \mid W \in (0+1)^*\}$ is not regular using pumping lemma. (04 Marks)

Module-3

- 5 a. Define context free grammar. Write a context free grammar for the language
 $L = \{a^{n+2} b^m \mid n \geq 0 \text{ and } m > n\}$ (06 Marks)
- b. Define ambiguity of a grammar. Check whether the following grammar is ambiguous or not.
 $S \rightarrow aS \mid X$
 $X \rightarrow aX \mid a$ (04 Marks)
- c. Simplify the following grammar:
 $S \rightarrow aA \mid aB \mid cC$
 $A \rightarrow aB$
 $B \rightarrow a \mid Aa$
 $C \rightarrow cCD$
 $D \rightarrow ddd$ (06 Marks)

OR

- 6 a. Define PDA. Obtain a PDA to accept $L = \{WW^R \mid W \in \{a, b\}^*\}$. Write the transition diagram. (08 Marks)
- b. Convert the following grammar into equivalent PDA.
 $E \rightarrow E + T$
 $E \rightarrow T$
 $T \rightarrow T * F$
 $T \rightarrow F$
 $F \rightarrow (E)$
 $F \rightarrow id$ (08 Marks)

Module-4

- 7 a. State pumping lemma for context free languages. Show that $L = \{a^n b^n c^n \mid n \geq 0\}$ is not context free. (08 Marks)
- b. What is a Turing machine? Explain different ways of representing Turing machines. (08 Marks)

OR

- 8 a. What is an ID of a Turing Machine? Define the language accepted by a Turing Machine. (04 Marks)
- b. Design a TM to accept the language $L = \{a^n b^n \mid n \geq 1\}$ (06 Marks)
- c. Explain Turing Machine Model. (06 Marks)

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Module-5

- 9 a. What are the various techniques for TM construction? (06 Marks)
- b. Derive the following: (i) Recursively enumerable language, (ii) Decidable language. (04 Marks)
- c. What is post correspondence problem? (06 Marks)

OR

- 10 a. What is halting problem? Explain. (04 Marks)
- b. Define the following: (i) Quantum computer (ii) Class NP (04 Marks)
- c. Explain Church Turing Hypothesis. (08 Marks)
