CBCS SCHEME

USN | | | | | | | | | | |

17CS54

Fifth Semester B.E. Degree Examination, Aug./Sept. 2020

Automata Theory & Computability

Time: 3 hrs. Max. Marks: 100

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

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.

Module-1

1 a. Define DFA. What are the differences between DFA and NFA? **(06 Marks)**

b. Construct the DFA for the following languages over $\sum = \{a, b\}$:

(i) Set of all strings ending with a and b.

(ii) Set of all strings not containing the substring "aab".

(iii) Set of all strings with exactly three consecutive a's. **(09 Marks)**

c. Construct the NDFA model for the following language:

$L = \{\omega \in \{a, b\}^* : \omega = aba \text{ or } |\omega| \text{ is even}\}$

$L = \{\omega : \text{there is a symbol } a_i \in \sum \text{ not appearing in } \omega\}$ where $\sum = \{a, b, c, d\}$ **(05 Marks)**

OR

2 a. Convert the following $\in$ –NFA to DFA. (Ref. Fig. Q2 (a)). **(08 Marks)**

Fig. Q2 (a)

b. Minimize the following automata: (Ref. Fig. Q2 (b)) **(08 Marks)**

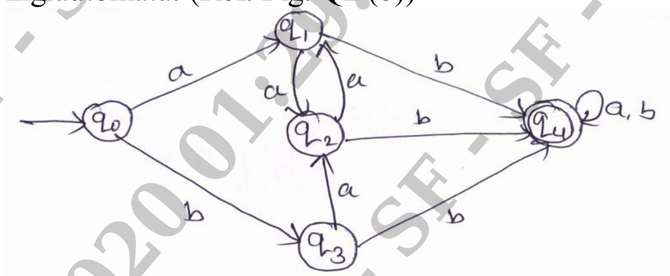

Fig. Q2 (b)

c. Different between Mealy machine and Moore machine with example. **(04 Marks)**

Module-2

3 a. Define Regular expression. Convert the following automation to a regular expression. **(08 Marks)**

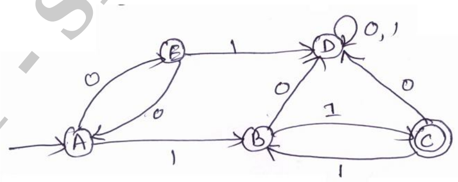

Fig. Q3 (a)

b. Construct the NFA for the following regular expression $\frac{(0+1)^*}{(0+1)}$ **(04 Marks)**

c. State and prove the pumping lemma for regular languages. **(08 Marks)**

OR

4 a. Show that $L = \{O^n \mid n \text{ is prime}\}$ is not regular? **(06 Marks)**

b. State and prove that regular languages are closed under complement, intersection difference, reverse and letter substitution. **(08 Marks)**

c. Write the regular expression for the following languages:

$L = \{a^n b^m \mid m + n \text{ is even}\}$

$L = \{a^n b^m \mid m > 1, n \geq 1\ nm \geq 3\}$ **(06 Marks)**

Module-3

5 a. Define Regular Grammar? Write CFG for the following languages:

$L = \{0^n 1^n \mid n \geq 1\}$

L = { strings of a's and b's with equal no. of a's and b's} **(05 Marks)**

b. Define ambiguous grammar and show that following expression grammar is ambiguous over the string $id + id * id$. Write equivalent unambiguous grammar for the same?

Grammar

$E \to E + E$
$E \to E - E$
$E \to E * E$
$E \to E / E$
$E \to id$ **(05 Marks)**

c. Define PDA. Obtain a PDA to accept the following language:

$L = \{n_a(\omega) = n_b(\omega) \text{ where } n \geq 1\}$

Draw the transition diagram for PDA. Also show the moves made by the PDA for the string "aabbab". **(10 Marks)**

OR

6 a. Obtain the following grammar in CNF

$S \to ABC$
$A \to aC / D$
$B \to bB / E / A$
$C \to Ac / E / Cc$
$D \to aa$ **(10 Marks)**

b. Define inherently ambiguous language with example. **(04 Marks)**

c. Let G be the grammar.

$S \to aB / bA$
$A \to a / aS / bAA$
$B \to b / bS / aBB$

For the string aaabbabbba find

(i) Left most derivation.
(ii) Right most derivation.
(iii) Parse tree. **(06 Marks)**

Module-4

7 a. State and prove the pumping theorem for Context Free Languages.

Show that $L = \{a^n b^n c^n \mid n \geq 0\}$ is not content free. **(12 Marks)**

b. Define Turing machine and explain with neat diagram, the working of a basic turing machine. **(08 Marks)**

OR

8 a. Design a TM to accept $\{0^n 1^n 2^n \mid n \geq 1\}$ and show the moves made by the machine for the string 000111222? **(10 Marks)**

b. Describe in detail decidable languages. **(05 Marks)**

c. Briefly explain the technique for Turing machine construction? **(05 Marks)**

Module-5

9 a. Explain the following:

(i) Non deterministic Turing Machine.

(ii) Multitape Turing Machine. **(10 Marks)**

b. Discuss the following:

(i) Recersively enumerable language.

(ii) Post correspondence problem. **(10 Marks)**

OR

10 Write short note on the following:

a. Quantum computer.

b. Class NP.

c. Church Turing Thesis.

d. Model of linear bounded automation.

e. Halting problem of Turing Machine. **(20 Marks)**

* * * * *