Sardar Patel Institute of Technology

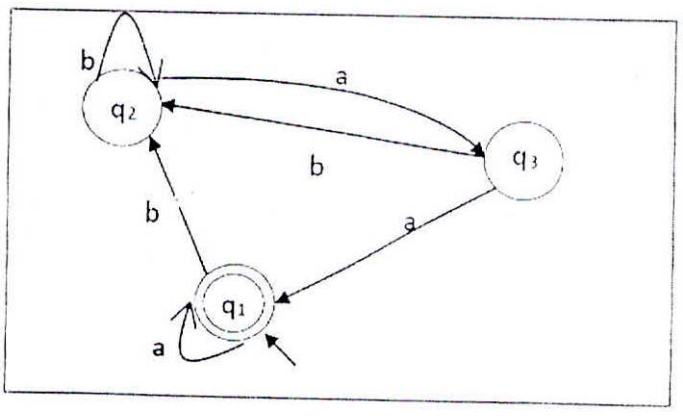
Bhavan's Campus, Munshi Nagar, Andheri (W), Mumbai: 400058, India
(Autonomous College of Affiliated to University of Mumbai)

End Semester Examination
December 2022

Maxi Marks: 100
Class: T.E
Course code: CS301/IT301
Name of the course: Theory of Computation

Duration: 3 hours
Semester: V
Branch: COMP/IT

Instructions:
(1) All questions are compulsory
(2) Draw neat diagrams
(3) Assume suitable data if necessary

Q No		Max Marks	CO	BL
Q1 a	Differentiate between Mealy machine and Moore machine	5	1	4
Q1 b	When we say a problem is decidable? Give an example of an undecidable problem?	5	4	4
Q1 c	Write a Context Free Grammar for generating a set of palindromes	5	3	3
Q1 d	Show that CFG with productions $S \rightarrow aS \mid aSabS \mid \varepsilon$ is ambiguous. Show in particular with the string 'aabb'	5	3	3
Q2 a	Design a Mealy machine to determine the residue mod 5 of a binary number	10	1	3
Q2 b	Define Arden's theorem and construct the regular expression corresponding to automata given below 	10	1	3
Q3 a	Using Pumping Lemma Prove that Language L= $\{a^{i^{*i}} \mid i \geq 1\}$ is not regular.	5	2	3

Q3 b	Develop ε-NFA for the following regular expressions RE = (a*+ b*)* (b) RE = (01*0 + 10*1)*	5	1	3
Q3 c	Describe recursive and recursively enumerable languages with example. Also compare recursive with recursively enumerable languages.	10	2	3
Q4 a	Describe different types of grammar with example.	10	3	3
Q4 b	Reduce the following production of grammar to Greibach Normal Form $S \rightarrow AA \mid a$ $A \rightarrow BS \mid b$ $B \rightarrow SA \mid a$	10	3	3
Q5 a	Design a Turing machine to copy the given number 'n' on the tape such that, Input: $\mathbf{0^n}$ Output: $\mathbf{0^n\ 1\ 0^n}$ **OR** Design a Turing machine to multiply the given number 'm' and 'n' such that, Input: $\mathbf{B0^m\ 10^n\ 1B}$ Output: $\mathbf{B0^{mn}B}$	10	4	3
Q5 b	Design a Push Down Automata for the language $\{(ab)^n c^n \mid n \geq 1\}$ OR Design a Push Down Automata for the language $\{w\ w^R \mid w\ \varepsilon\ (0+1)^*$ and w^R reverse of $w\}$	10	4	3