Sardar Patel Institute of Technology

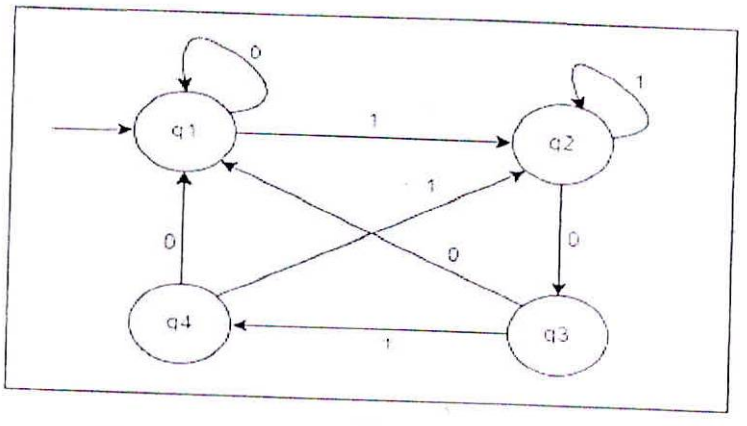
Bhavan's Campus, Munshi Nagar, Andheri (W), Mumbai: 400058, India
(Autonomous College of Affiliated to University of Mumbai)

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 Nondeterministic finite automata and deterministic finite automata	5	1	4
Q1 b	Illustrate the formal definition of a Turing machine with the help of a diagram to answer the following questions and explain your reasoning. (a) Can a Turing machine ever write the blank symbol on its tape? (b) Can the tape alphabet Γ be the same as the input alphabet Σ? (c) Can a Turing machine contain just a single state?	5	4	4
Q1 c	Define the Context free grammar and context free language. Consider the following production: $S \rightarrow ASB \mid \varepsilon$ $A \rightarrow aAS \mid a$ $B \rightarrow SbS \mid A \mid bb$ a) Are there any useless symbols? Eliminate them if so. b) Eliminate ε-productions. c) Eliminate unit productions.	10	3	4
Q2 a	Design a Mealy machine to accept all strings ending with 00 or 11 and then convert it into Moore machine.	10	1	3
Q2 b	Define Arden's theorem Construct the regular expression corresponding to automata given below 	10	1	3

Q3 a	Using Pumping Lemma Prove that Language L= $\{a^n b^{n/2} \mid n$ is even number$\}$ is not regular.	5	2	3
Q3 b	Develop ε-NFA for the following regular expressions RE = (a/b)*abb (b) RE = a(a/b)*b / b(a/b)*a	5	1	3
Q3 c	Describe the Context sensitive Language. Consider the following Production of Context sensitive grammar: S-> aBC S->SABC CA->AC BA->AB CB->BC aA->aa aB->ab bB->bb bC->bc cC->cc Derive the string "aabbcc" from the start symbol S.	10	2	3
Q4 a	Reduce the following production of grammar to Greibach Normal Form $S \rightarrow ABC$ $A \rightarrow a \mid b$ $B \rightarrow Bb \mid aa$ $C \rightarrow aC \mid CC \mid ba$ **OR** Reduce the following production of grammar to Greibach Normal Form $S \rightarrow AB$ $A \rightarrow BSB \mid BB \mid b$ $B \rightarrow aAb \mid a$	10	3	3
Q4 b	Explain Chomsky Hierarchy and differentiate the recursive Languages and Recursive enumerable languages.	10	3	3
Q5 a	Design a Turing machine to compare two numbers m and n such that, input: $0^m 1\ 0^n$ output: X if m > n Y if m = n Z if m < n **OR** Design a Turing machine to perform following operation such that, Input: $0^m 1\ 0^n$ Output: P = m – n if m > n Q = 0 if m ≤ n	10	4	3
Q5 b	Design a Push Down Automata for the language $\{w\ c\ w^R \mid w\ \varepsilon\ (0+1)^*$ and w^R reverse of w$\}$	10	4	3