K. J. Somaiya College of Engineering, Mumbai-77
(Autonomous College Affiliated to University of Mumbai)

End Semester Exam
MAY-JUNE 2021

Max. Marks: 50
Duration: 1 Hr. 45 Min.
Class: SY B.Tech Semester: IV
Name of the Course: Theory of Automata with Compiler Design Branch: Computer
Course Code: 2UCC404

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

Question No.		Max Marks
Q1 (A)	1. (P + Q)* = i) (P Q*)* ii) P* + Q* iii) (P* Q*)* iv) None 2. Which of the following sets are regular? i) { a^i | i = n2, n >=1 } ii) { a^p | p is prime } iii) { ww | w ∈ {a, b}+ } iv) { a^{2n} | n >=1 } 3. Consider the CFG as defined: X -> XY X -> aX / bX / a Y -> Ya / Yb / b Any string of terminals, which can be generated by the CFG i) Has at least one b ii) Ends with a iii) Has no consecutive a's and b's iv) Has at least 2 a's. 4. A Mealy machine accepts a string of length k; the output string length is i) k ii) 2k iii) k + 1 iv) k - 1	10 (1Mark each)

5. Which of the following production rule is in CNF?

i) S ->aA
ii) SA ->AS
iii) S ->AB
iv) All of these

6. Consider the grammar: S -> aSAb | ε; A -> bA | ε;
The grammar generates strings in the form aibi for some i, j >=0. What are the conditions for i & j?

i) i = j
ii) j <= 2i
iii) j >= 2i
iv) i <= j

7. The string 1101 does not belong to the set represented by

i) 110*(0+1)
ii) 1(0+1)*101
iii) (10)*(01)*(00+11)*
iv) (00+(11)*01)*

8. Let L be the language represented by the Regular Expression Σ*0011Σ* where Σ = {0, 1}. What is the minimum number of states in a DFA that recognizes ~L (complement of L)?

i) 4
ii) 5
iii) 6
iv) 8

9. Let X1, X2, X3 be strings with the alphabet Σ ∈ {0, 1}*. They are related as follows:

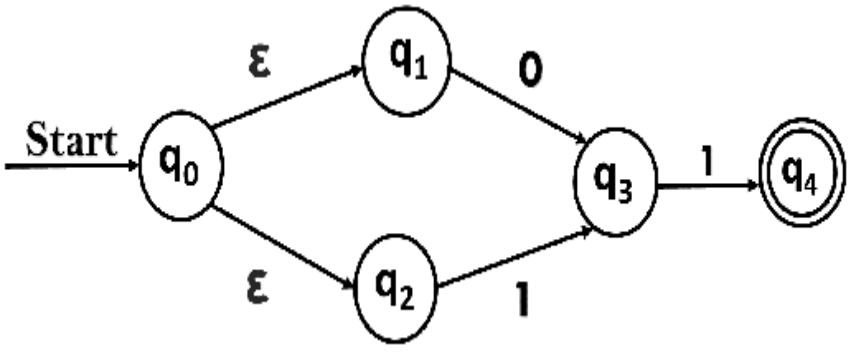
X1 = 1X2
X2 = 0X2 + 1X3
X3 = 0X2 + ε

Which of the following choices precisely represent the string in X1?

i) 10(0* + (10)*)1
ii) 10(0* + (10)*)*1
iii) 1(0 + 10)*1
iv) 10(0* + (10)*)*1 + 110(0 + 10)*1

10. Which is true for the transition statement: δ(q, ab)

i) δ(q, a) ∪ δ(q, b)
ii) δ(δ(q, a), b)
iii) δ(δ(q, b), a)
iv) δ(q, a) ∩ δ(q, b)

Q1 (B)	Attempt any FIVE questions out of the following (any 5 out of 7) a. Prove that the following grammar is not regular. $L=\{0^n1^{2n} \mid n>=0\}$ b. State closure properties of context free grammar. c. Construct Finite Automata for even length string on {0,1} not having any two same consecutive symbols. d. Compare FA with PDA on the basis of their formal definition, transition function and memory unit. e. What is undecidability? f. Show that recursive language is closed under union. g. Explain derivation tree with example.	10 (2 Marks each)
Q. 2	Attempt any two: a. Convert the given grammar into GNF E -> E + T / T T -> T * F / F F -> (E) / a b. Find the equivalent grammar after the elimination of null production for the given grammar. S -> AB / aSa A -> aAA / ε B-> bBB / ε c. Convert the given NFA with epsilon move into DFA  	10 (5 Marks each)
Q. 3	Construct PDA for accepting all strings over {0, 1}, with equal number of 0s and 1s. Show the working of Automata by considering any input string. OR Obtain a CFG, equivalent to given below PDA: $M=(\{q0, q1,q2\},\{0,1\},\{Z0,A), \delta , q0, Z0, \Phi)$	10

	Where δ is given as : (q0,0,Z0)=(q1,AZ0) (q1,0,A)=(q1,AA) (q1,1,A)=(q2, A) (q2,1,A)=(q2, ε) (q2, ε , Z0)=(q2, ε)	
Q. 4	Explain the following: a. Multitape Turing Machine b. Turing Machine as a computer of Integer Function with example.	10