SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE

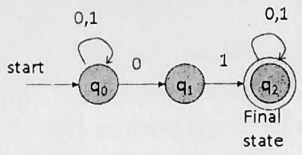
Shri Vaishnav Institute of Information Technology

Department of Computer Science and Engineering

MST I

Subject Code: BTCS501 Subject Name: Theory of Computation **Semester: VI**
Time: 1 Hour **Total Marks**: 20

Note: All questions are compulsory. Assume suitable missing data

Question No.	Question	Marks	Related CO
1.	a) Define DFA with suitable example.	3	CO1
	b) Describe Language of finite automata with example.	3	CO1
	c) Construct a finite automaton which accepts all combination of 0 & 1 such that each string should have '01' as substring.	4	CO2
	OR		
	d) What is regular expression, explain with example.		CO2
2.	a) Convert following NFA into its equivalent DFA. 	3	CO1
	b) Differentiate between NFA & NFA with ε-move.	3	CO1
	c) Construct finite automata for following language $L = \{x \in \{0,1\}^* \mid x \text{ has an even no. of 1's}\}$	4	CO2
	OR		
	d) Explain Arden's Theorem with suitable example.		CO2

CO1	Ability to relate practical problems to languages, automata, and computability.
CO2	Ability to demonstrate an increased level of mathematical sophistication.
CO3	Ability to apply mathematical and formal techniques for solving problems

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SHRI VAISHNAV VIDYAPEETH VISHWAVIDYALAYA, INDORE

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MST II

Subject Code: BTCS501 **Subject Name:** Theory of Computation **Semester: IV**

Time: 1 Hour **Total Marks:** 20

Note: All questions are compulsory. Assume suitable missing data.

Question No.	Question	Marks	Related CO
Q.1	(a) Design Moore Machine that takes Binary Number as an input and produces Residue Modulo 4 as an Output.	3	CO2
	(b) Explain the Closure properties of CFLs.	3	CO1
	(c) Prove that following language is not CFL: $\{a^n b^m c^n d^m \mid m,n>=0\}$	4	CO2
	or		
	Construct CFG for $L = \{a^{n+2}b^{m+1} \mid n=m >=0\}$ and check whether w = aaaaabbbb is generated by the grammar or not?		
Q.2	(a) Convert CFG into GNF $S \rightarrow AA \mid q$ $A \rightarrow SS \mid b$	3	CO2
	(b) Illustrate the Ambiguity in Grammar with suitable example, also explain Inherent ambiguity.	3	CO2
	(c) Give a Deterministic PDA for $\{a^m b^n c^n \mid m, n >=0\}$ over the alphabet $\sum = \{a,b,c\}$	4	CO2
	or		
	Construct PDA for $L = \{ WW^R \mid w \in (0+1)^* \ \& \ W^R$ is reverse of W$\}$		

CO1	Ability to relate practical problems to languages, automata, and computability
CO2	Ability to demonstrate an increased level of mathematical sophistication.
CO3	Ability to apply mathematical and formal techniques for solving problems.

Total No. of Questions: 05

Total No. of Printed Pages: 02

Roll No. 20100BTBDA107223

BTCS501

VI Semester Examination, June - 2023

B.Tech./B.Tech. + M.B.A. / B.Tech. + M.Tech. (CSE, CSE-CC, CSE-CF, CSE-BDA, CSE-MA, BDCE- IMPETUS, CSE-CMCI, CSE-BDAI, CSE-ICS, CSE-AII, CSE-ES, CSE-FSDI, CSE-DSI,IT)

Theory of Computation

Choice Based Credit System (CBCS)

Time: 3 Hrs. **Maximum Marks: 60**

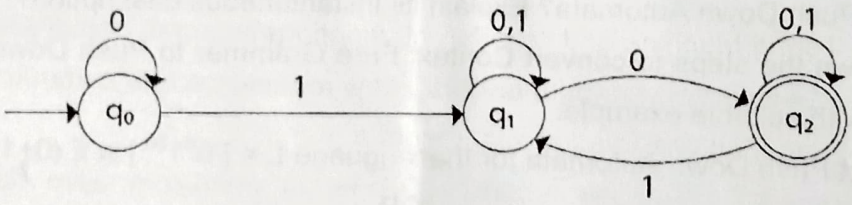
Minimum Pass Marks: 24

Note: *All questions carry equal marks, out of which part'A' and 'B' carry 3 marks and part 'C' carries 6 marks. From each question, part 'A' and 'B' are compulsory and part 'C' has internal choice. Draw neat diagram, wherever necessary. Assume suitable data wherever necessary.*

Q.1(A) Explain the following terms: Finite Automata, Language & Grammars with the help of suitable examples? **03**

(B) Design Finite Automata with $\sum = \{0, 1\}$ that accepts even no. of 0's and even no. of 1's. **03**

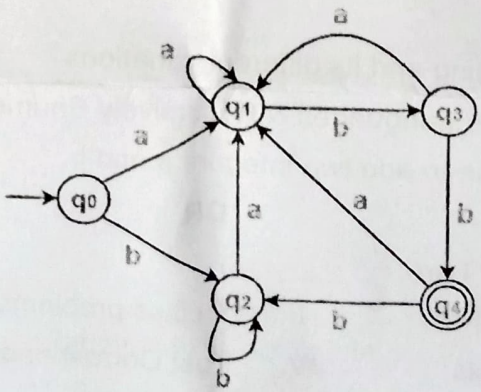
(C) Convert the given Nondeterministic Finite Automata to Deterministic Finite Automata:



06

OR

Minimize the given Deterministic Finite Automata using Myhill - Nerode Theorem:



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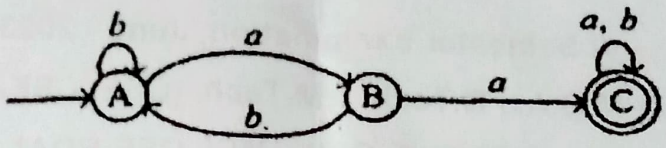
Q.2(A) Compute the Regular Expression for the given Deterministic Finite Automata:



03

(B) Explain the Closure Properties of regular sets? 03

(C) Prove that following language is not regular: $\{a^n b^{2n} \mid n>=0\}$. 06

OR

Design Moore Machine that takes any binary number as an input and produces residue modulo 5 as an output.

Q.3(A) Write Context Free Grammar for 1*0* and create derivation tree for w="1110000". 03

(B) Explain Inherently Ambiguous Grammar with suitable example? 03

(C) Construct Context Free Grammar for $L = \{a^n b^m c^m d^n \mid n, m >=0\}$ and also check whether w = "aabbbcccdd" is generated by the grammar or not? 06

OR

Convert Context Free Grammar into Greibach Normal Form:

$S \rightarrow AA \mid q$

$A \rightarrow SS \mid b$

Q.4(A) What is Push Down Automata? Explain its instantaneous description? 03

(B) Write down the steps to convert Context Free Grammar to Push Down Automata, explain with suitable example. 03

(C) Construct Push Down Automata for the language $L = \{ 0^n 1^{3n} \mid w \in (0+1)^*\}$. 06

OR

Construct Push Down Automata for the language $L = \{ WCW^R \mid w \in (0+1)^*$, C is constant & W^R is reverse of W$\}$.

Q.5(A) Describe Turing Machine and its different variations? 03

(B) Differentiate Recursive Languages & Recursively Enumerable Languages? 03

(C) Design Turing Machine to add two integers a and b. 06

OR

Write short note (Any Two):

I. Undecidability II. P class problems & NP class problems

III. Church's Thesis IV. Post Correspondence Problem (PCP)

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