R20 | SET-I | 7 R

CMR TECHNICAL CAMPUS

UGC AUTONOMOUS

B.Tech - III Semester, Regular End Examinations, Feb-2022

Theory of Computation[20CS304PC]

(Common to CSE,CSM,CSD & IT)

Time: 3 Hours **Max. Marks: 70**

Answer Any Five Questions
All Questions Carry Equal Marks

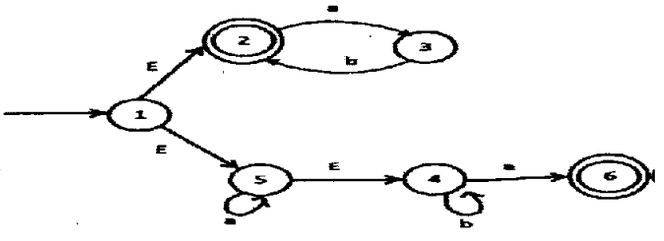
5 X 14 = 70 Marks

1. a. Convert the given NFA into DFA and check the string acceptance for the input sequence"000111010" by resultant DFA. [7M]

b. Find Deterministic Finite Automata for the following languages on Σ={a,b} ,L ={w : $n_a(w)$ mod 5>0} and show that string "aaaa" is accepted by the resultant automata. [7M]

2. a. Define Non-deterministic finite automata? Design NFA to accept the set of strings contains "010" as substring over the alphabet {0,1}. Construct transition table and show that the string "001011" is accepted by resultant NFA. [7M]

b. Convert the given ε – NFA to DFA and check for the string acceptance by resultant DFA for the string:**"aabba"** **[7M]**



3. Minimize the given finite automata [14M]

δ	0	1
→A	B	E
B	C	F
*C	D	H
D	E	H
E	F	I
*F	G	B
G	H	B
H	I	C
*I	A	E

4. a. Construct Finite Automata for the given Regular Expression (a+b)*aa(b+a)* [7M]

b. State pumping lemma? Prove the given language L= $\{a^n b a^m b a^{n+m} \mid n,m>=1\}$ is non-regular language? [7M]

5. a. Construct PDA for the language L=$\{WW^R \mid W \in (0+1)^*\}$.Check whether it is deterministic or not. [7M]

b. Show that the following grammar is ambiguous with respect to the string **aaabbabbba**.

S→ aB | bA

A→ aS| bAA| a

B→ bS | aBB | b [7M]

6. a. Write the procedure to convert CFG to PDA and also convert the following CFG to PDA. [7M]

S→ aABB | aAA

A→ aBB | a

B→ bBB | A

C→ a

b. Consider the following grammar [7M]

E→E+T | T
T→T*F | F
F→(E) | a | b | c

and consider the following string (a+b+c*a) and constuct

i. Left most derivation
ii. Right Most Derivation

7. a. Design a Turing Machine to accept the following language L= $\{ 0^n 1^n \mid n >=1\}$ [7M]

b. List and explain Decision properties of Context free languages. [7M]

8. a. State whether the following instances of PCP has a solution. It is presented as two lists A and B, and the *i*th strings on the two lists correspond for each I = 1, 2, ….. A = (001, 01, 110); B = (110, 010, 00). [7M]

b. Explain briefly about P,NP,NP-Hard and NP-Complete problems with examples. [7M]

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Subject Code: 20CS304PC	SET-II	HT NO:			7	R					

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B. Tech. III Semester Regular/Supply End Examinations, Feb-2023

Theory of Computation

Common to CSE, IT, CSM, CSD, CSG, AIML

Time: 3 Hours **Max. Marks: 70**

Note

i. This Question paper contains Part- A and Part- B.
ii. All the Questions in Part A are to be answered compulsorily.
iii. All Questions from Part B are to be answered with internal choice among them.

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PART-A

10 X 02 = 20 Marks

			Marks	CO	BL
1.	a	Draw the transition diagram for the DFA accepting all strings with a substring 01.	2	CO1	L 3
	b	Formally define NFA.	2	CO1	L 1
	c	Write a regular expression for even number of a's and even number of b's of a string w = {a, b}*.	2	CO2	L 3
	d	State pumping lemma for regular languages.	2	CO2	L 1
	e	Convert the following CFG to push down automaton: S → aS | bS |a | b	2	CO3	L 3
	f	Give the formal definition of PDA.	2	CO3	L 1
	g	What are the required fields of an instantaneous description of a Turing machine?	2	CO4	L 2
	h	Differentiate multihead and multitape Turing machine	2	CO4	L 2
	i	When is a language L recursively enumerable?	2	CO5	L 2
	j	Define NP hard and NP completeness problem.	2	CO5	L 1

PART- B

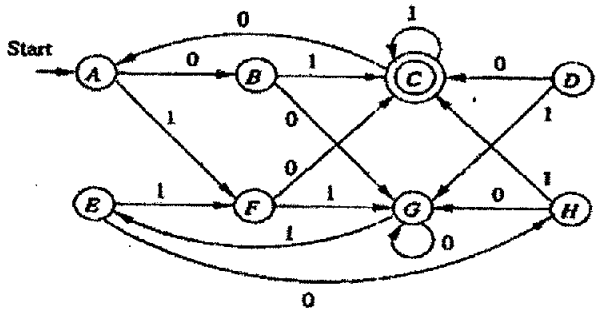
5 X 10 = 50 Marks

		Marks	CO	BL
2.	Prove that, if L is accepted by an NFA with ε-transitions, then L is accepted by an NFA without ε-transitions.	10	CO1	L 2
	OR			
3	Consider the following ε-NFA	10	CO1	L 3

	ε	a	b	c
→ p	{q, r}	∅	{q}	{r}
q	∅	{p}	{r}	{p, q}
*r	∅	∅	∅	∅

a) Compute the ε-closure of each state
b) Convert the automaton to DFA.

4	a	Discuss the basic approach to convert from NFA to regular expression. Illustrate with an example.	5	CO2	L 2
	b	Show whether the following language is regular or not. $L = \{a^n b^n a^n \mid n > 0\}$	5	CO2	L 3
		OR			
5		Minimize the following automaton:	10	CO2	L 3



6	$S \rightarrow A1B$ $A \rightarrow 0A \mid \varepsilon$ $B \rightarrow 0B \mid 1B \mid \varepsilon$ a) Show that the grammar is unambiguous b) Find a grammar for the same language that is ambiguous, and demonstrate its ambiguity.	10	CO3	L 3
	OR			
7	Design a PDA to accept the set of all strings of 0's and 1's with an equal number of 0's and 1's.	10	CO3	L 3
8	Consider the following CFG where S is the start variable: $S \rightarrow aAa \mid bBb \mid \varepsilon$ $A \rightarrow C \mid a$ $B \rightarrow C \mid b$ $C \rightarrow CDE \mid \varepsilon$ $D \rightarrow A \mid B \mid ab$ a) Eliminate ε productions b) Eliminate any unit productions in the resulting grammar. c) Eliminate any useless symbols in the resulting grammar. d) Put the resulting grammar into Chomsky normal form.	10	CO4	L 3
	OR			
9	Design a Turing machine to compute addition of two positive integers.	10	CO4	L 3
10	Prove that Universal language is recursively enumerable but not recursive	10	CO5	L 2
	OR			
11	Define PCP and prove that Post's Correspondence Problem is undecidable with one example.	10	CO5	L 2

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Theory of Computation [20CS304PC]
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Time: 3 Hours **Max. Marks: 70**

Answer Any Five Questions
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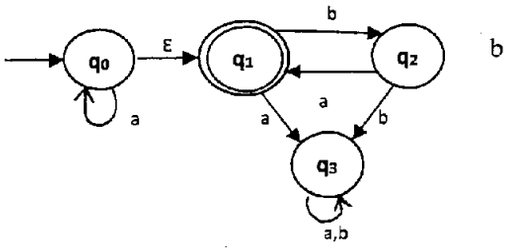
1. a. Consider the following Transition system and test the acceptance of strings given below
   i. 110001 **[7M]**
   ii. 110101

Σ / State	Input 0	Input 1
→ q_0	q_2	q_1
q_1	q_3	q_0
q_2	q_0	q_3
q_3	q_1	q_2

b. Construct a DFA equivalent to M = ({q_0, q_1, q_2, q_3, q_4}, {0, 1, 2}, δ, q_0, {q_3}), where δ is given in the following Transition table. **[7M]**

Σ / State	Input 0	Input 1	Input 2
→ q_0	{ q_1, q_4}	q_4	{ q_2, q_3}
q_1	-	q_4	-
q_2	-	-	{ q_2, q_3}
(q_3)	-	q_4	-
q_4	-	-	-

2. Convert the following NFA with ε-moves into an equivalent DFA. **[14M]**



3. a. State and prove Arden's theorem. **[7M]**
   b. Construct a Finite Automata for the Regular Expression given below
   (0+1)*(00+11)(0+1)* **[7M]**