Code: 20A05503

R20

B.Tech III Year I Semester (R20) Regular & Supplementary Examinations January 2024

FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to Information Technology and Computer Science & Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Write applications of finite automata. 2M

(b) Compare DFA and NFA. 2M

(c) Simplify regular expression: a(ab + ab)* + b(ab + ab)*. 2M

(d) Write short notes on “Homomorphism” closure property of regular language. 2M

(e) Define Left recursion with an example. 2M

(f) Construct a Context Free Grammar (CFG) for a language contains even length palindrome over Σ={0, 1} 2M

(g) What is mean by Instantaneous Description of pushdown Automata? 2M

(h) Mention merits of two stacks PDA over single stack PDA. 2M

(i) Define undecidable problem. 2M

(j) Compare recursive and recursively enumerable languages. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 (a) Design a DFA for accepting of language not contains substring as aba over alphabet Σ = {a, b}. 5M

(b) Construct equivalent DFA for the following NFA. 5M

δ	0	1
q_0	(q_0, q_1)	q_1
q_1	Φ	(q_0, q_1)

OR

3 (a) Design a Moore Machine to count number of substrings 101 in a given string over alphabet Σ = {0, 1}. 5M

(b) Let L be a set accepted by a NFA, show that there exists a DFA that accepts L. 5M

4 (a) Discuss the identity rules of Regular Expressions. 5M

(b) Apply pumping lemma for the language L= { a^n | n is prime} and prove that it is not regular. 5M

OR

5 Find regular expression for the following automata. 10M

δ	0	1
$\rightarrow q_1$	q_2	q_3
q_2	q_1	q_3
q_3	q_2	q_2

q_1 & q_3 are final states.

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6 (a) Define Chomsky Normal Form (CNF)? Write procedure to construct equivalent CNF from grammar. 5M

(b) Convert the following grammar to Chomsky Normal Form (CNF). 5M

$S \rightarrow ABA$

$A \rightarrow aA \mid \epsilon$

$B \rightarrow bB \mid \epsilon$.

OR

7 (a) Define ambiguous grammar? Show that the following grammar is ambiguous? 5M

$S \rightarrow aSbS \mid a \mid bSaS \mid b \mid \epsilon$

(b) Write the closure properties of context free languages with an example. 5M

8 (a) Design a PDA to recognize the language $L = \{WW^R \mid W \text{ in } (0+1)^*\}$. 5M

(b) Compare Deterministic PDA and NPDA. 5M

OR

9 Construct equivalent PDA for the following grammar. 10M

$S \rightarrow aAB \mid a$

$A \rightarrow aA \mid bB \mid bA \mid aB \mid \epsilon$

$B \rightarrow bA \mid aB \mid \epsilon$

10 Design a TM for the language $L = \{ a^n b^m c^n \mid m, n, >= 1\}$. Write the acceptance for the input string aaabbbbbccc. 10M

OR

11 (a) Discuss in brief about types of Turing Machines (TM). 5M

(b) Illustrate post correspondence problem with an example. 5M

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R20

B.Tech III Year I Semester (R20) Supplementary Examinations August 2023

FORMAL LANGUAGES AND AUTOMATA THEORY

(Common to IT & CSE)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define NDFA with Null moves. 2M

(b) Design a DFA to accept 0's and 1's such that string having a substring 01. 2M

(c) Define Pumping Lemma. 2M

(d) Give an English description of the following regular expression r = a(a+b)*ab. 2M

(e) State pumping lemma theorem for Context-Free Languages. 2M

(f) Under, what circumstances you can say that the grammar symbol is useless. 2M

(g) The acceptance of a string using Push-Down Automata (PDA) can be described through the instantaneous description. Define it. 2M

(h) Define Deterministic PDA. 2M

(i) The set of languages that one can recognize on Turing machines is much bigger than that of PDA and FA. Justify with an example. 2M

(j) Define Recursively Enumerable language. 2M

PART – B

(Answer all the questions: 05 X 10 = 50 Marks)

2 (a) Explain the procedure for conversion of NFA to DFA. 4M

(b) Prove That for every NFA there exists an equivalent DFA which accepts the same language. 6M

OR

3 (a) Construct NFA without ε for a given NFA with ε where q0 and q2 are the initial and final states respectively. 5M

	a	b	c	ε
q0	q0	Φ	Φ	q1
q1	Φ	q1	Φ	q2
q2	Φ	Φ	q2	Φ

(b) Construct a Moore machine to determine the residue modulo 3 of the input treated as a binary number. 5M

4 (a) Convert ((01)+. (0 + 1*))* into Finite Automata. 5M

(b) State and Prove Ardens Theorem. 5M

OR

5 (a) State and Prove Pumping Lemma for Regular Sets. 5M

(b) Obtain a CFG to obtain the balanced set of parentheses (i.e. every left parenthesis should match with the corresponding right parentheses) using the symbols '('and ')'. 5M

6 (a) Define Chomosky's classification of grammar. 5M

(b) Explain Normal Forms and convert the following grammar into GNF S→(S)/SↃS/~S/p/q. 5M

OR

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7	(a)	Define CNF and convert the following Grammar into CNF S →aAB / Aba A →aA /a/Ba B → ab /bc.	6M
	(b)	Write the procedure for conversion of CNF to GNF.	4M
8		Find the corresponding PDAs for the following CFGs:	
	(a)	S → 0 S 0 | 1 S 1 | A A→ 2 B 3 B → 2 3 | 3 1.	5M
	(b)	S → b X | a Y X → b X X | a S | a Y→ a Y Y | b S | b.	5M
		OR	
9	(a)	Design a PDA to accept odd no of 0's and even no of 1's.	5M
	(b)	Explain procedure for conversion of grammar to PDA.	5M
10	(a)	Design a Turing Machine for (m* n).	6M
	(b)	Explain about Halting problem.	4M
		OR	
11	(a)	Explain about Post Correspondence Problem.	5M
	(b)	Define Halting Problem.	5M

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