939

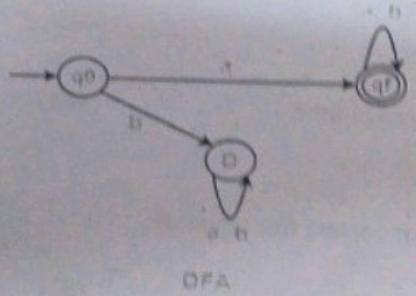
JUNE-JULY 2022 EXAMINATION
M.Sc. II Semester (Applied Mathematics)
MA94205: Mathematical Theory of Computation

Time: 3 Hrs.] [Max. Marks: 70

TOTAL NO. OF QUESTIONS IN THIS PAPER:5

Note: Attempt all questions. All questions carry equal marks. Each question carries five subparts a, b, c, d and e. Parts a, b and c are compulsory and attempt any one from d and e.

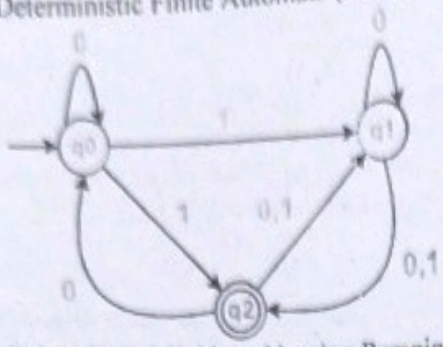
S. No.		Questions	Marks	CO	BL
Q.1	(a)	Explain all grammars in detail with the help of example.	(02)	CO1	1
	(b)	Which of the following propositions are tautologies? Why? (i) P (ii) P ⇒ P (iii) (P ⇒ P) ⇒ P (iv) P ⇒ (P ⇒ P)	(02)	CO1	1,2
	(c)	Use known logical equivalences to do each of the following - (i) Show $p \rightarrow (q \vee r) \Leftrightarrow (p \wedge \neg q) \rightarrow r$. (ii) Show $\neg (p \vee q) \vee (\neg p \wedge q) \vee \neg (\neg p \vee \neg q) \Leftrightarrow \neg (p \wedge \neg q)$.)	(03)	CO1	2
	(d)	(i) A sample graph G has 24 edges and degree of each vertex is 4.Find the number of vertices. (ii) Explain different types of graph with the help of example.	(4+3)	CO1	2
		OR			
	(e)	(i) In a survey of 60 people, it was found that 25 people read newspaper H, 26 read Newspaper T, 26 read Newspaper I, 9 read both H and I, 11 read both H and T, 8 read both T and I, 3 read all three Newspapers. Find a) The number of people who read at least one of the Newspapers. b) The number of people who read exactly one Newspaper. (ii) Which of the following relation is not an equivalence relation on set of real number- a) R1={ (a , b)/ a-b is a integer } b) R2={ (a , b) / a-b is a divisible by 3} c) R3={ (a , b)/ a-b is an odd number } d) R4={ (a , b)/ a-b is an even number	(4+3)	CO1	3
Q.2	(a)	From given (FA) finite automata write regular expression over input alphabets $\sum = \{a, b\}$	(02)	CO2	2



DFA

	(b)	Construct a finite automata for the given grammar - (b|ab*ab*)*.	(02)	CO2	2

Q.2 (c) Convert the following Non-Deterministic Finite Automata (NFA) to Deterministic Finite Automata (DFA) (03) CO2 2



(d) (i) L = { a^k b^k | k >=1} using Pumping lemma of regular languages show whether it is Regular or not? (3+4) CO2 3

(ii) The regular expression for the language having input alphabets a and b, in which two a's do not come together, which option is correct and explain why?

(a) (b + ab)* + (b +ab)*a

(b) a(b + ba)* + (b + ba)*

(c) both options (A) and (B)

(d) none of the above

OR

(e) (i) Remove Left recursion from given grammar- (3+4) CO2 3

A->AB/aA/bB, A->Ba/b, B->Aa/a

(ii) Draw Finite automata for given grammar -

a) (b|ab*ab*)* b) (a|b)*ab(a|b)*

Q.3 (a) From given Regular expression a(bc)^* design Finite automata (FA). (02) CO3 2

(b) Remove useless symbol from the given grammar - (02) CO3 1

S-> a/bXY, A -> Bad /bSX/a, B -> aSb/bBX, X -> SBD/ABX/ad

Y -> SBa/XYb

(c) Write pumping Lemma for Context free language. (03) CO3 2

(d) (i) Convert given Context free grammar (CFG) into Chomasky Normal Form (CNF): p : s-> asa/Ab, A->B/S, B->b/ (ε): Note ε - Epsilon (3+4) CO3 3

(ii) Check whether the given grammar is ambiguous or not -

$S \rightarrow SS, S \rightarrow a, S \rightarrow b$

OR

(e) (i) Concert given Context free grammar into Grebeich normal form - (3+4) CO3 3

S -> CA/BB, B->b/SB, C->b, a->a

(ii) With the help of example explain pumping lemma for context free language.

Q.4 (a) Explain Non Deterministic push down automata. (02) CO4 1

(b) Explain context free languages. (02) CO4 1

Q.4	(c)	Design push down automata for the language $a^n b^n c^n$.	(03)	CO4	2,3
	(d)	(i) Design deterministic push down automata pda for wcw' where w belongs to {a,b} of any string.	(3+4)	CO4	3
		(ii) Design push down automata for the language $a^n b^n c^n d^n$ . . .			
		OR			
	(e)	(i) Design push down automata for $a^n b^n c^n$.	(3+4)	CO4	2
		(ii) Write a short note on push down automata.			
Q.5	(a)	Define P and NP problem with the help of example.	(02)	CO5	1
	(b)	Explain Turing machine in detail with the help of example.	(02)	CO5	2
	(c)	Why do we call as Turing machine a Language acceptor?	(03)	CO5	2
	(d)	Design Linear bounded automata for $a^n b^n$.	(07)	CO5	3
		OR			
	(e)	(i) Check whether given grammar is ambiguous or not - $S \rightarrow SS,\ S \rightarrow a,\ S \rightarrow b$	(3+4)	CO5	2
		(ii) Write down properties of Context free language with help of example.			

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