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CA 132103

Roll No. of candidate

21/31

2021

M.C.A. 3rd Semester End-Term Examination

THEORY OF COMPUTER SCIENCE

(New Regulation)

Full Marks – 70 | Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answers : (10 × 1 = 10)

(i) Which of the following phrase is appropriate for an universal quantifier?

(a) "for each" (b) "for some"

(c) "for all" (d) "for few"

(ii) A statement that is always true is known as,

(a) Tautology (b) Contingency

(c) Contradiction (d) None of the above

(iii) If $\Sigma=\{0,1\}$, then the number of possible different strings with length exactly n are,

(a) 2^{n-1} (b) 2^n

(c) 2^n-1 (d) None of the above

(iv) Regular set corresponding to the regular expression $a(cc)^*b$ is,

(a) {ab,accb,accccb,......} (b) {abc,abcc,abccc,......}

(c) {acb,accb,acccb,......} (d) None of the above

[Turn over

(v) $\sim q$

$$\frac{p \Rightarrow q}{\therefore \sim p}$$

The name of the inference rule is

(a) Conjunction (b) Addition

(c) Simplification (d) Modus tollens

(vi) If R_1 and R_2 are two regular expressions, then which of the following is not true?

(a) $R_1 + R_2$ is a regular expression

(b) R_1 cannot be o

(c) $R_1 R_2$ is a regular expression

(d) $(R_1 + R_2)^*$ is a regular expression

(vii) A string w is accepted by an NFA if,

(a) all states should be the final state in the NFA

(b) atleast two paths among all possible paths lead to the final state

(c) atleast one path among all possible paths leads to the final state

(d) initial state always should be the final state in the automation

(viii) The output of a Moore machine depends on,

(a) the present state

(b) the present state and the input symbol

(c) the input symbol only

(d) none of the above

(ix) A regular language is also called

(a) Type-0 language (b) Type-1 language

(c) Type-2 language (d) Type-3 language

(x) A regular expression corresponding to the regular set {ε,a,b} is,

(a) a+b (b) ab

(c) a^*b^* (d) ε+a+b

Answer any *four* questions from the following,

2. (a) Draw the truth table of the proposition: $(\sim p \vee q) \wedge (\sim q \vee \sim p)$. (6)

(b) Obtain the principal disjunctive normal for of $q \vee (p \vee \sim q)$. (5)

(c) What is a predicate and propositional function? Give an example. What are the two type of quantifier used in predicate calculus? (4)

3. (a) Prove that $(p \wedge (p \Leftrightarrow q)) \Rightarrow q$ is a tautology. (6)

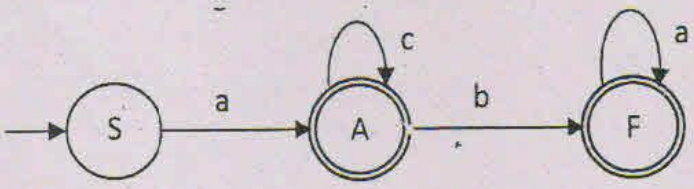
(b) Consider the propositional functions K(x): x is man, L(x): x is mortal, M(x): x is integer, N(x): x is either positive or negative. Express the following using quantifiers

(i) All man are mortal

(ii) Any integer is either positive or negative. (4)

(c) Show that t is a valid conclusion from the premises $p \Rightarrow q$, $q \Rightarrow r$, $r \Rightarrow s$ and $p \vee t$. (5)

4. (a) Define regular expression. Using Arden's theorem find the regular expression corresponding to the finite automation given below, (6)



(b) What is a reflexive, symmetric and transitive relation? (6)

(c) For the following productions of a regular grammar construct the corresponding finite automation, (3)

$S \rightarrow aA, A \rightarrow bB, B \rightarrow bS \mid b$

5. (a) Define a phrase structure grammar. What are the different type of grammars? (5)

(b) Construct finite automata corresponding to the regular expression, **(aba+b(aa)*a).** (5)

(c) Does the string ***aaababaa*** accepted by the grammar whose productions are as follows: (5)

S→aA

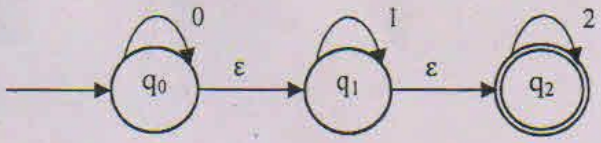
A→aA | aB | a

B→bA

6. (a) What is the difference between a DFA and NFA? Find a deterministic finite automation equivalent to M=({q_0, q_1, q_2, q_3},{0,1},δ, q_0,{ q_3}) where δ is given by, (9)

State	0	1
→ q_0	q_0,q_1	q_0
q_1	q_2	q_1
q_2	q_3	q_3
(q_3)		q_2

(b) Remove the ε-productions from the following finite automata, (6)



7. (a) Show that regular sets are closed over union operation. (4)

(b) Identify the type of the grammar whose productions are: (2)

ABC→aBc, C→ac, B→a

(c) Write 4 strings generated by the regular expression: **a*b*c*** (4)

(d) What is ambiguity in a CFG? Explain. (5)