Total No. of printed pages = 4

BCA 171403

1) 8pm

Roll No. of candidate

2022

B.C.A. 4th 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 answer : $(10 \times 1 = 10)$

   (i) Finite automata does not contain,

      (a) Set of input symbols, Σ

      (b) Set of states, Q

      (c) Set of operators, J.

      (d) Transition function, δ

   (ii) Kleene Star operation is represented by,

      (a) $\cup$ (b) *

      (c) #   (d) $\cap$

   (iii) The strings of the language associated with the grammar,

      $$S \rightarrow aB, B \rightarrow bB \mid c$$

      (a) starts with b   (b) ends with a

      (c) starts with c   (d) starts with a

   (iv) Regular language 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

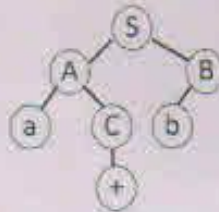(v) P, Q, R be regular expression over Σ, P is not ε, then R=Q + RP has a unique solution,

(a) Q*P   (b) QP*

(c) Q*P*   (d) (P*Q*)*

(vi) The yield of the following derivation tree is,

(a) aC+b   (b) a+bB

(c) aCb   (d) a+b

(vii) Transition function of a DFA is,

(a) Q×Σ→Q   (b) Q×Σ→2Q

(c) Q×Σ→2n   (d) Q×Σ→Qn

(viii) The regular expression (0*1*)* is same as,

(a) (0+1)*   (b) (01)*

(c) (10)*   (d) None of the above

(ix) A context free language is also called

(a) Type-0 language

(b) Type-1 language

(c) Type-2 language

(d) Type-3 language

(x) Which production among the following is the useless production in the grammar?

S→A, A→aB, C→d, B→b

(a) S→A   (b) C→d

(c) B→b   (d) A→aB

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2. (a) What is a finite automata? Mention one application of automata. (4)

    (b) Design a grammar corresponding to the language, L(G) = {a, aba, aabaa,......} (4)

    (c) Convert the following NFA to DFA. (7)
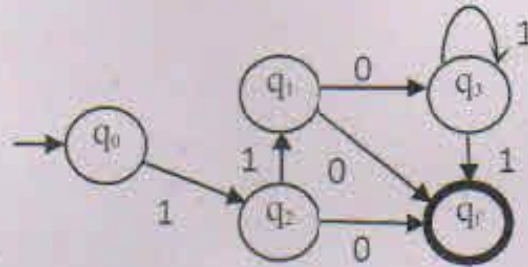
3. (a) When two states of an automation are said to be equivalent? (3)

    (b) If G = ({S}, {0,1}, {S→0A11, A→1A | ε}, S), find L(G). (4)

    (c) Minimize the following automation: (8)

State	Input	
	0	1
→q_0	q_1	q_5
q_1	q_0	q_2
((q_2))	q_0	q_3
q_3	q_2	q_6
q_4	q_7	q_5
q_5	q_2	q_6
q_6	q_6	q_4
q_7	q_6	q_2

4. (a) What is a regular set? Give example. (3)

    (b) Using Arden's theorem find the regular expression corresponding to the following finite automation, (7)

    (c) Draw the automation corresponding to the following regular expression. (5)

(abc)*ba*

5. (a) Identify the type of the following grammars, (6)

    (i) Sa→cB, B→aA, A→ab

    (ii) S→AaB, Aa→b, B→a

(b) What do you mean by derivation? Does the string *"aaababaa"* accepted by the grammar whose productions are, (5)
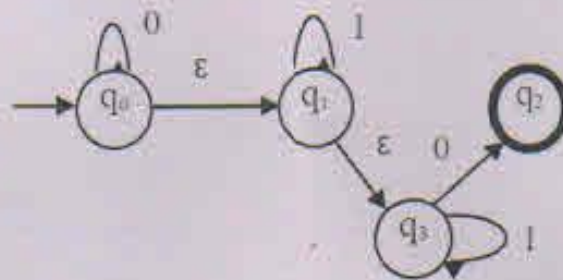
$$S \to aA$$
$$A \to aA \mid aB \mid a$$
$$B \to bA$$

(c) Write the regular set for the following regular expressions: (4)

    (i) (a+b)*bc*

    (ii) (0*+1*)(0+1)

6. (a) Define phrase structure grammar. What are the different types of productions? Give examples. (6)

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

(c) Define the terms alphabet, string and language used in formal grammar. (3)

7. (a) Show that regular sets are closed over union operation. (3)

(b) Given a grammar G whose productions are (4)

$$S \to A, A \to aBb, B \to cc$$

Show the derivation tree for the string "accb".

(c) What is ambiguity in a CFG? (2)

(d) Find a reduced grammar equivalent to the grammar G whose starting symbol is S and the productions are, (6)

$$S \to aAa$$
$$A \to Sb \mid bBB$$
$$B \to abb \mid aC$$
$$C \to aCA$$