FACULTY OF INFORMATICS

BCA I Semester (CBCS) (MAIN & BACKLOG) (NEW) Examination, March 2022

Subject: Mathematical Foundation of Computer Science

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

(Missing data, if any, may be suitably assumed)

Note: Answer all questions from Part-A, any five questions from Part-B.

PART – A (10 x 2 = 20 Marks)

(a) Define the following terms with truth table
   a. Conjunction
   b. Disjunction

(b) Define the following terms with examples.
   a Inverse
   b. Converse
   c. Contra-Positive

(c) In how many ways can 5 children arrange themselves in a ring?

(d) The no of arrangements of letters in the word TALLAHASSEE.

(e) Determine the probability p, at least one tail appears in the toss of three fair coins.

(f) Let a card be selected at random from an ordinary deck of 52 cards. Let A = {the card is a spade} and B = {the card is a face card, i.e. a jack, queen or king} then find P(A∩B).

(g) Draw all distinct binary trees with 4 vertices.

(h) Define the complete graph with example.

(i) Prove that identity element is unique in any group.

(j) Define homomorphism.

PART – B (5 x 10 = 50 Marks)

2. (a) Construct the truth table for (p∧q)∨ (~p∧r)∨(q∧r).
   (b) Verify whether the following statement formulae is tautology or not ~ (p ∨ q)∨ (~p∧q)∨p.

3. (a) What is logical equivalence? Write the logical equivalence statements for the laws used in mathematical logic.
   (b) Define Quantifiers and explain about two types of quantifiers with examples.

4. (a) How many 3-digit numbers can be formed using the digits {1,3,4,5,6,8,9}.
   (b) There are 21 consonants and 5 vowels in the English alphabet. Consider only 8-letter words with 3different vowels and 5different consonants.

5. (a) In how many ways can 7womens and 3men be arranged in a row if the 3men must always stand next to each other.
   (b) In how many ways can a hand of 5 cards be selected from a deck of 52 cards.

6. (a) If A and B are any two events, then prove that P(A∪B) = P(A)+ P(B)-P(A∩B).
   (b) Three light bulbs are chosen at random from 15 bulbs of which 5 are defective. Find the probability p that (i) none is defective, (ii) exactly one is defective.

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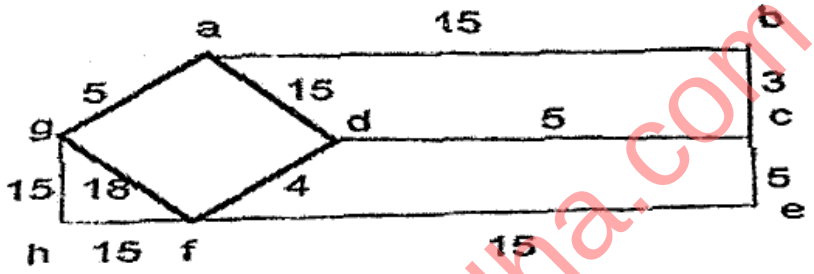
7. (a) Let S = $\{a_1, a_2, a_3, a_4\}$, and let P be a probability function on S
   (i) Find P(a_1) if P(a_2)=1/3, P(a_3) =1/6, P(a_4)= 1/9.
   (b) Let A and B be events with P(A)= 3/8, P(B)= 1/2 and P(A∩B) = 1/4 then Find P((A^c)and P((B^c).

8. (a) Define the following terms with diagram
   i) Direct graph
   ii) self-loop
   iii) parallel edges
   iv) Adjacent edges.
   (b) Write a brief note about the basic rules for constructing Hamiltonian cycles.

9. (a) Determine a railway network of minimal cost for the cities in the given figure.



   (b) What is Hamiltonian graph? Explain briefly with an example.

10. (a) Define the following with examples
   i) Group
   ii) Abelian Group
   iii) Order of a Group
   (b) Prove that the set $G = \{1, -1, i, -i\}$ is a group with respect to usual multiplication.

11. (a) If (G, *) is a group and a, b ∈ G then show that $(a * b)^{-1} = b^{-1} * a^{-1}$.
   (b) Show that $\varphi: R \to R^+$ defined by $\varphi(x) = e^x$ for $x \epsilon R$ is one-one homomorphism

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