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MCS-013

MCA (Revised) / BCA (Revised)

Term-End Examination

June, 2021

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours *Maximum Marks : 50*

Note : *Question no. **1** is **compulsory**. Attempt any **three** questions from the rest.*

1. (a) Write the truth value of the conjunction of : "The earth is round" and "3 > 4". *2*

(b) Use Mathematical Induction to prove that :

$$1 + \frac{1}{4} + \frac{1}{9} + \ldots \frac{1}{n^2} \leq 2 - \frac{1}{n} \quad \forall\, n \in N. \qquad 4$$

(c) If $f : R \to R$ is a function such that $f(x) = 3x - 2$, prove that f is injective. Also find the inverse of f. *5*

(d) Show that $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent. *3*

(e) A and B are two mutually exclusive events such that P(A) = 0 ·4 and P(B) = 0 ·2. What is the probability that :

(i) A does not occur ?

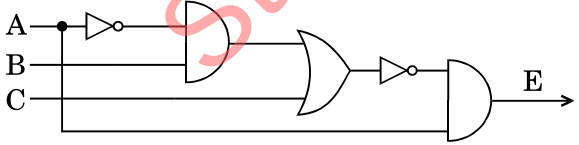
(ii) A or B does not occur ?

(iii) Either A or B does not occur ? 3

(f) Find the number of ways of placing n people in n – 1 rooms, no room being empty. 3

2. (a) What is integer partition ? Write down all the partitions of 8. Also find P_8^4 and P_8^7. 4

(b) Find Boolean Expression for the following logical circuit : 4



(c) Let two functions be such that $f(x) = x^2 + 2$ and $g(x) = 2x$. Define fog and gof. 2

3. (a) Reduce the following Boolean Expression to simpler form : 4

$E(X_1, X_2, X_3) = (X_1 \wedge X_2 \wedge X_3) \vee (X_1 \wedge X_2) \vee (X_2 \wedge X_3)$

(b) Show that $\sim(p \rightarrow q) \rightarrow p$ is a tautology. 2

(c) Prove that $\sqrt{2}$ is irrational. 4

4. (a) What is Relation ? How is relation different from function ? Explain any two properties of relations with an example. *5*

(b) A company has the following professionals : Project Leaders – 5, Team Leaders – 6, System Architects – 3.

Find how many different committees can be formed of 10 professionals, each containing at least 2 Project Leaders, at least 3 Team Leaders and at least 1 System Architect. *3*

(c) Find the dual of $A \Rightarrow B \Leftrightarrow C$. *2*

5. (a) Explain the Identity Laws of Boolean Algebra. *2*

(b) State and prove the Addition Theorem of Probability. *4*

(c) Verify that $p \wedge q \wedge \sim p$ is a contradiction. *2*

(d) What is Exclusive Disjunction ? Write truth table for $p \oplus q$. *2*