MCA (Revised)

Term-End Examination

June, 2009

03200

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours *Maximum Marks : 50*

Note : *Question number **1** is **compulsory**. Attempt **any three** questions from the rest.*

1. (a) A coin is tossed n times. What is the probability of getting exactly r heads ? **3**

(b) Construct the logic circuit for the expression $(x_1' \wedge x_2) \vee (x_1 \vee x_3)$ **3**

(c) Let the function $f : R \to R$ be defined by **3**

$$f(x) = \begin{cases} 3x-12 & \text{for } x > 3 \\ 2x^2+3 & \text{for } -2 < x \leq 3 \\ 3x^2-7 & \text{for } x \leq -2 \end{cases}$$

Find out $f^{-1}(5)$.

(d) Universal Set $U = \{1, 2, \ldots\ldots 9\}$ and given the sets $A = \{1,2,3,4,5\}$, $B = \{4,5,6,7\}$. **4**

Find (i) $A \setminus B$

(ii) $A \oplus B$

(e) Consider a set $A = \{a,b,c\}$ and the relation R on A defined by $R = \{ (a,a),(a,b),(b,c),(a,c) \}$. Find whether R is : 3

(i) reflexive

(ii) symmetric

(iii) transitive

Justify your answers with reason.

(f) A survey among 1000 people, 595 are democrats, 595 wear glasses and 550 like ice-creams. 395 of them are democrats who wear glasses, 350 of them are democrats who like ice-cream. 400 of them wear glasses and like ice cream and 250 have all the three properties. 4

(i) How many of them are not democrats do not wear glasses and do not like ice creams ?

(ii) How many of them are democrats who do not wear glasses and do not like ice cream ?

2. (a) Show that $(P \wedge (P \rightarrow q)) \rightarrow q$ is tautology. 3

(b) Find DNF form of $7(P \vee Q) \leftrightarrow P \wedge Q$ 4

(c) Prove that for every positive integer n, $n^3 + n$ is even. 3

3. (a) By the principal of mathematical induction, prove that : 4

$3^{2n+1} + (-1)^n 2$ is divisible by 5.

(b) Define the De-Morgan's Laws for complementation. Further illustrate with suitable examples. 3

(c) Find the coefficient of x^2y^4 in $(x+y)^6$. 3

4. (a) Write down all the partitions of 7. Also find P_7^4 and P_7^5. 4

(b) By contrapositive method of proof, prove that x^2 is divisible by 4, then x is even. 3

(c) Establish the equivalence 3

$(P \rightarrow Q) \rightarrow (P \wedge Q) \equiv (7P \rightarrow Q) \wedge (Q \rightarrow P)$

5. (a) If set X has 10 members, how many members do P(X) has ? How many members of P(X) are proper subset of X ? 3

(b) Prove that $A - (A - B) = A \cap B$ 3

(c) Let $f : R \rightarrow R$ is defined by $f(x) = ax + b$ where $a, b, x \in R$, and $a \neq 0$. Show that f is invertible and find the inverse of f. 4

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