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MCS-013

MCA (Revised) / BCA (Revised)

Term-End Examination

03701

June, 2017

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) Negate the following : 4

(i) $(\forall x\, \exists y)\, (P(x) \vee Q(y))$

(ii) $(\forall x\, \forall y)\, (P(x) \wedge Q(y))$

(b) Write the contrapositive, converse and inverse of the conditional statement "The home team wins whenever it is raining." 2

(c) Prove that if $x^2 - 4 = 0$, then $x \neq 0$ by contradiction method. 3

(d) Draw Venn Diagram to show the following set operations : 3

(i) $\overline{A \cup B}$

(ii) $A \subset B$

(iii) $(A \cup B) \cap C$

(e) A box contains 10 chocolates. Find the number of n ordered samples of

(i) size 3 with replacement, and

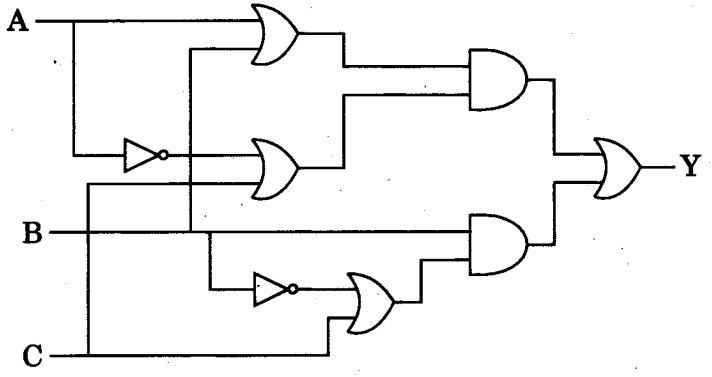
(ii) size 3 without replacement. *4*

(f) How many solutions does $x_1 + x_2 + x_3 = 11$ have where x_1, x_2 and x_3 are non-negative integers with $x_1 \leq 3$, $x_2 \leq 4$, $x_3 \leq 6$? *4*

2. (a) Two dice, one red and one white are rolled. What is the probability that the white dice turns up a smaller number than the red dice ? *3*

(b) Four boys picked up 30 mangoes. In how many ways can they divide them if all the mangoes be identical ? 2

(c) Find the Boolean expression for the following circuit : *3*



(d) How many words of three distinct letters can be formed from the letters of the word LAND ? *2*

3. (a) Find the composition of the following two permutations and show that it is not commutative : 2

$$f = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 1 & 4 & 3 \end{pmatrix} \quad g = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 3 & 2 & 1 & 4 \end{pmatrix}$$

(b) Given S = {1, 2, ..., 10} and a relation R on S where

$$R = \{(x, y) \mid x + y = 10\}.$$

Find whether R has the following properties or not ? 3

(i) Reflexive

(ii) Transitive

(iii) Symmetric

(c) Show that the functions $f(x) = x^3$ and $g(x) = x^{1/3}$ for all $x \in R$ are inverse of each other. 3

(d) Under what conditions on sets A and B is

$$A \times B = B \times A ?$$ 2

4. (a) Find DNF of $\sim (p \vee q) \leftrightarrow (p \vee q)$. 4

(b) How many five-digit numbers are even ? How many five-digit numbers are composed of only odd digits ? 3

(c) Draw the circuit for the following Boolean expression : $Y = AB'C + AC' + B'C$, using logic gates. 3

5. (a) Construct truth table to check whether the following is a tautology or a contingency or a contradiction : *4*

(i) $(p \wedge q) \rightarrow (p \vee q)$

(ii) $((\sim q \wedge p) \wedge q)$

(b) If the temperature is $-6°$, then it is cold. Write the

(i) converse, and

(ii) contrapositive. *2*

(c) Show that

$$\frac{1}{1.2} + \frac{1}{2.3} + \ldots + \frac{1}{n.(n+1)} = \frac{n}{n+1}$$

by mathematical induction. *4*