

No. of Printed Pages : 3

MCS-013

04039

MCA (Revised)
Term-End Examination
June, 2011

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) It is required to sit 5 men and 4 women in a row so that the women occupy the even places. How many such arrangements are possible ? 3
- (b) A question paper of discrete mathematics has two sections of five questions each. In how many ways can an examinee answer six questions taking at least two questions from each group ? 4
- (c) If A and B are sets, prove that. 3

$$A \cup B = (A - B) \cup B$$
- (d) Find $f^{-1}(x)$ where $f(x) = \frac{x+4}{x-3}$ 3
- (e) Show that; $\sim (P \vee (\sim P \wedge Q)) \equiv \sim P \wedge \sim Q$ 3
 using logical equivalent formulas.

- (f) What is pigeon hole principle ? Using this principle show that in any group of 36 people, we can always find 6 people who were born on the same day of week. 4
2. (a) Express the Boolean expression in three variables $(x + y + z) (xy + x'z)'$ in DNF 4
- (b) Use mathematical induction method, prove that : 3
- $$1 + 2 + 3 + \dots + n = \frac{n(n + 1)}{2}$$
- (c) Prove that a relation R in the set Z of integers defined by ' $aRb \Leftrightarrow a - b$ is even' is an equivalence relation. 3
3. (a) Prove that $(P \Rightarrow q) \vee r \equiv (P \vee r) \Rightarrow (q \vee r)$ 3
- (b) If $f : R \rightarrow R$ is a function such that $f(x) = 3x + 5$ 4
- prove that f is one - one onto. Also find the inverse of f .
- (c) Determine the number of integer solutions to the equation $x_1 + x_2 + x_3 + x_4 = 7$ where $x_i \geq 0 \forall i = 1, 2, 3, 4$ 3
4. (a) Two dice, one red and one white are rolled. 4
- What is the probability that the white die turns up a smaller number than the red die ?

- (b) What is duality principle ? Find dual of $(A \cup B) \wedge C$ 3
- (c) Verify that $p \wedge q \wedge \sim p$ is a contradiction and $p \rightarrow q \Leftrightarrow \sim p \vee q$ is a tautology. 3
5. (a) Show that $\sqrt{3}$ is irrational 4
- (b) Construct the logic circuit and obtain the logic table for the expression $x_1 \vee (x'_2 \wedge x'_3)$ 3
- (c) How many numbers are there between 100 and 1000 such that 7 is in the unit's place ? 3

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MCS-013

MCA (Revised)
Term-End Examination
December, 2011

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) If there are 12 persons in a party, and if each two of them shake hands with each other how many hand shakes happen in the party ? 3

- (b) Prove that $A - B = A \Leftrightarrow A \cap B = \emptyset$ 4

- (c) Let R be the binary relation defined as $R = \{(a, b) \in \mathbb{R}^2 \mid a - b \leq 3\}$ 4

Determine whether R is reflexive, symmetric, antisymmetric or transitive.

- (d) What is a propositional function ? Write propositional function for following statement. 3

Always there are some students in a class who are hardworking.

- (e) Represent the following argument symbolically and determine whether the argument is valid ? 3

"If today is Children's day then today is Pt.Jawaharlal Nehru's birthday". "If today is Pt.Jawaharlal Nehru's birthday then today is 14th Nov".

Hence "If today is Children's day then today is 14th Nov.

- (f) Simplify the Boolean function 3

$$B(x_1, x_2, x_3) = [(x_1 \wedge x_2) \vee ((x_1 \wedge x_2) \wedge x_3)] \vee (x_2 \wedge x_3)$$

2. (a) Using mathematical induction method, show that : 4

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left[\frac{n(n+1)}{2} \right]^2$$

- (b) Find the number of different messages that can be represented by sequences of 4 dashes and 3 dots. 2

- (c) If I be the set of integers, find whether $f: I \rightarrow I$ defined by $f(x) = x^3$ is one-one onto or both. 4

3. (a) Construct a logic circuit represented by the Boolean expression. 4

$$(x'_1 \wedge x_2) \vee (x_1 \vee x'_3) \wedge (x_2 \vee x_3)$$

where $x_i (1 \leq i \leq 3)$ are assumed to be inputs to that circuitry.

- (b) Verify that the proposition $p \vee \sim (P \wedge Q)$ is a tautology. 2
- (c) A valid Computer password consists of nine characters, the first of which is the digit 1, 5 or 7 the third character is either a # or a \$ and the remaining a english alphabet or a digit. Find how many different passwords are possible ? 4
4. (a) Let I be the set of all integers. Let R be a relation on I , defined by
 $R = \{(x, y) : x - y \text{ is divisible by } 6 \forall x, y \in I\}$
 Show that R is an equivalence relation. 3
- (b) Give the geometric representation of $\{3\} \times \mathbb{R}$. 3
- (c) There are 15 points in a plane, no three of which are collinear. Find the number of straight lines formed by joining them. 4
5. (a) If 100 bulbs are placed in 15 boxes. Show that two of the boxes must have the same number of bulbs. 3
- (b) If $f(x) = x^2$ and $g(x) = x + 1$, then find $(f \circ g)x$ and $(g \circ f)x$. 4
- (c) Explain with reason, whether or not 3
- (i) the collection of all good teachers is a set.
- (ii) the set of points on a line is finite.

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MCS-013

07117

MCA (Revised)
Term-End Examination
June, 2012

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours

Maximum Marks : 50

Note : Q. No. 1 is compulsory.

Attempt **any three** from the rest.

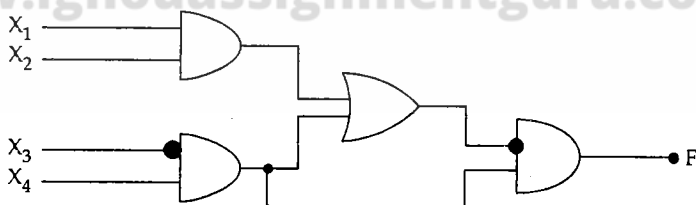
1. (a) Show that $p \vee \sim (p \wedge q)$ is a tautology. 3

(b) Prove the following equivalence 3

$$\sim \forall x P(x) \equiv \exists x \sim P(x)$$

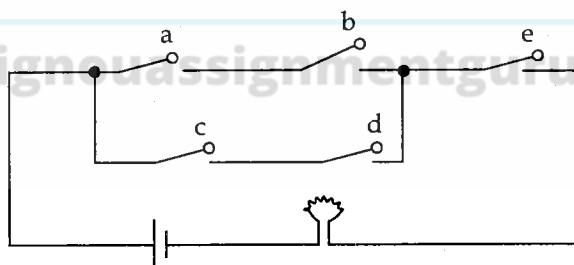
(c) Use principle of mathematical induction to 3
 prove that $n^3 - n$ is divisible by 3.

(d) Write the output of following circuit. 3



(e) Let R be a relation on the set $A = \{1, 2, 3, 4\}$ 3
 such that aRb if and only if $a + b > 5$. Check
 if R is reflexive, symmetric, transitive.

- (f) How many permutations are there for the word ASSOCIATION ? 2
- (g) Three coins are tossed and number of heads are observed. Find the probability that 3
- (i) at least one head appears
- (ii) all heads or all tails appear.
2. (a) Prove De Morgan's laws using truth table. 3
- (b) Present a Direct proof of the statement. 3
- "Square of an odd integer is odd".
- (c) Explain : 4
- (i) Proof by contrapositive
- (ii) Proof by contradiction with the help of suitable examples.
3. (a) Write boolean equation for the following circuit. 4



- (b) Reduce the following boolean equation to simplest form. 3
- $$(a \wedge b' \wedge c) \vee (a \wedge b' \wedge c') \vee (a' \wedge b \wedge c') \vee (a' \wedge b' \wedge c')$$
- (c) Write a short note on "Principal of Duality". 3

4. (a) Let A , B and C be three sets such that $A \cup B = A \cup C$. Does it imply $B = C$? Support your answer by suitable example. 2
- (b) Prove $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ 3
- (c) Let $f(x) = x^2$ and $g(x) = x + 7$ 2
Find $f \circ g(x)$ and $g \circ f(x)$.
- (d) Let A be the set of natural nos. 1, 2, 3, 4, ..., 3
Let R be a relation on A such that aRb if and only if $a \bmod 5 = b \bmod 5$. Prove that R is equivalence relation.
5. (a) In how many ways can a party of 9 people 3
arrange themselves around a circular table?
- (b) What is the sum of coefficients of all the 3
terms in the expansion of $(a + b + c)^5$?
- (c) In how many ways r distinct objects can be 4
distributed into 5 different boxes with at least one box empty?

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MCS-013

13025

MCA(Revised)
Term-End Examination
December, 2012

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours

Maximum Marks : 50

Note : Q. No. 1 is compulsory.

Attempt **any three** from the rest.

1. (a) Prove the following equivalence 3

$$\sim (\exists x \sim P(x)) \equiv \forall x P(x)$$
- (b) Use proof by contradiction to prove that 3
 $\sqrt{2}$ is irrational.
- (c) Simplify the following boolean expression 3
 $(a' \wedge b' \wedge c') \vee (a' \wedge b' \wedge c) \vee (a \wedge b' \wedge c') \vee (a' \wedge b \wedge c')$
- (d) Use Venn diagram to show the following 3
 set operation.
 (i) \overline{A} (ii) $A \cup (B \cap C)$
 (iii) $A \cap (B \cup C)$
- (e) Why is $y^2 = x$ not a function ? 2
- (f) An urn contains 15 balls, 8 of which are red 2
 and 7 are black. In how many ways 5 balls
 can be drawn such that
 (i) all 5 are red.
 (ii) 3 are red and 2 are black.

- (g) In a survey of 260 college students following data was obtained. 4

64 had taken mathematics course

94 had taken computer science.

58 had taken business studies.

28 had taken both mathematics and business studies

26 had taken both mathematics and computer science

22 had taken both computer science and business studies

14 had taken all three types of courses .

What is the probability that a student chosen at random had not taken any course ?

2. (a) Construct truth table to check whether the following is a tautology, contingency or absurdity. 3

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

- (b) If $p \rightarrow q$ is false, what is the truth value of 2

$(\sim(p \wedge q)) \rightarrow q$? Explain.

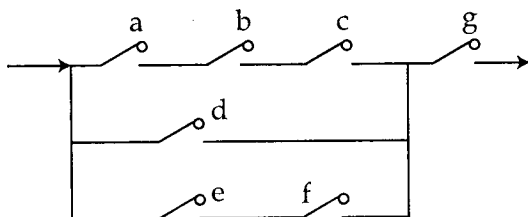
- (c) Write the contrapositive & converse of the statement : 2

If it rains then I will get wet.

- (d) Prove by mathematical induction 3

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4}$$

3. (a) For the following circuit write the boolean expression 3



- (b) Make the circuit for the following boolean expression using logic gates 3

$$((x_1 \wedge x_2)' \vee (x_3 \vee x_4)) \wedge (x_1 \wedge x_3)' \wedge (x_2 \wedge x_4')$$

- (c) For the following truth table write DNF and CNF. 4

x_1	x_2	x_3	$f(x_1, x_2, x_3)$
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

4. (a) Explain the following types of relations with the help of suitable examples. 4

- (i) Reflexive (ii) Antisymmetric
(iii) Transitive (iv) Equivalence

- (b) Let : 2

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

Find fog and gof.

- (c) In how many ways 6 men and 6 women can sit alternately in a row. 2

- (d) "If a function is not one to one then it is not invertible." Explain. 2

5. (a) Prove that ${}^{n+1}C_r = {}^nC_r + {}^nC_{r-1}$. 3

- (b) A and B are two mutually exclusive events such that $P(A) = 0.3$ and $P(B) = 0.6$. What is the probability that 2

(i) B does not occur?

(ii) A or B occurs.

- (c) If there be a set A partitioned into n number of subsets. Show that the largest subset contains at least $\frac{|A|}{n}$ number of elements. 3

- (d) How many 7 digits numbers are composed of only odd digits ? 2

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MCS-013

MCA(Revised)**Term-End Examination****June, 2013****MCS-013 : DISCRETE MATHEMATICS***Time : 2 hours**Maximum Marks : 50*

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

1. (a) A carpenter has twelve patterns of chairs and five patterns of tables. In how many ways can he make a pair of chair and table ? 3
- (b) If 30 books in a school contain a total of 61,327 pages, then show that one of the books must have at least 2045 pages. 3
- (c) Prove that $A - B = A \Rightarrow A \cap B = \emptyset$ 3
- (d) Find the domain for which the functions $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal. Also find a domain for which the functions are not equal. 4
- (e) Construct the truth table of $(7p \vee q) \wedge (7r \vee p)$. 4
- (f) Show that $a.b + a'.b' = (a' + b).(a + b')$ 3
2. (a) Use mathematical induction method to prove that $1 + 3 + 5 + \dots + (2n - 1) = n^2$. 4

(b) Prove that $n! (n+2) = n! + (n+1)!$ 3

(c) Consider the set of ordered pair of natural numbers $N \times N$ defined by : 3

$(a, b) R (c, d) \Leftrightarrow a + d = b + c$. Prove that R is an equivalence relation.

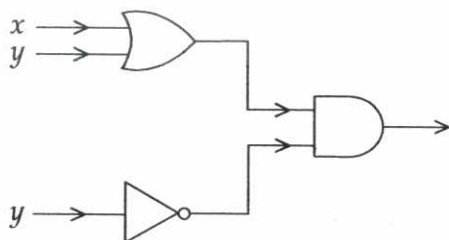
3. (a) Show that $(p \wedge q) \Rightarrow (p \vee q)$ is a tautology. 3

(b) Prove that the inverse of one-one onto mapping is unique. 4

(c) How many solutions does the equation $x_1 + x_2 + x_3 = 11$ have, where x_1, x_2 and x_3 are non negative integers ? 3

4. (a) Express the Boolean expression $xyz' + y'z + xz'$ in a sum of product form. 4

(b) Find the output of the given circuit. 3



(c) Show that : 3

$$(p \rightarrow q) \rightarrow q \Rightarrow p \vee q$$

5. (a) In how many ways a person can invite eight of his friends to a party by inviting at least one of them be a female. Considering that the person is having 15 male and 8 female friends. 4
- (b) Let A be the set { 1, 2, 3, 4 }. Which ordered pairs are in the relation $R = \{(a, b) \mid a \text{ divides } b\}$? 3
- (c) Explain duality principle with the help of example. 3



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MCS-013

04814

MCA(Revised)
Term-End Examination
December, 2013

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) In how many ways 100 voters can vote for three candidates standing for the election of the post of president of their association ? 3
- (b) How many five different letter words can be formed out of the word "LOGARITHMS" ? 3
- (c) Prove that $(A \cup B)' = A' \cap B'$. 4
- (d) Let $A = \{1, 2, 3, 4, 5\}$ and define R on A by xRy if $x + 1 = y$. Find : 3
 - (i) R (ii) R^2 (iii) R^3
- (e) Construct a truth table for the given proposition $(7p \Leftrightarrow 7q) \Leftrightarrow (q \Leftrightarrow r)$ 3
- (f) Find the dual of $(x \cdot \perp) + (x \cdot y) + (y \cdot z) + (z \cdot 0)$ 4
2. (a) Show that $((p \rightarrow q) \rightarrow q) \rightarrow (p \vee q)$ is a tautology. 3
- (b) Use mathematical induction method to prove that $n^3 + 2n$ is divisible by 3 for $n \geq 1$. 4
- (c) If $f : A \rightarrow B$ such that $f(x) = x - 1$ and $g : B \rightarrow C$ such that $g(y) = y^2$ find $f \circ g(y)$. 3

3. (a) Let R be a relation in the set of all lines in a plane defined by aRb if line 'a' is parallel to line b' . Then prove that R is an equivalence relation. 4
- (b) Find n if $p(n, 4) = 42 p(n, 2)$. 3
- (c) Express the Boolean expression in three variables $(x + y + z) (xy + x'z)'$ in DNF. 3
4. (a) Construct a logic circuit by minimizing the Boolean function 5
- $$f(x, y, z) = xyz + x\bar{y}z + \bar{x}\bar{y}z + \bar{x}y\bar{z}$$
- (b) If there are 12 persons in a party and if each two of them shake hands with each other, how many hand shakes happen in the party ? 5
5. (a) What is the minimum number of students required in a particular class to be sure that atleast six students will receive the same division if there are five possible divisions. 4
- (b) Find the dual of $(A \cap B)' \cap C$. 3
- (c) Show that $p \rightarrow q \equiv \neg q \rightarrow \neg p$. 3

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MCS-013

MCA(Revised)**Term-End Examination****June, 2014**

05648

MCS-013 : DISCRETE MATHEMATICS*Time : 2 hours**Maximum Marks : 50*

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

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1. (a) Let $f(x) = \frac{1}{x}$ and $g(x) = x^3 + 2$ where $x \in \mathbb{R}$. Find $(f+g)(x)$ and $(fg)(x)$? 3
- (b) Draw Venn diagram to represent $A \Delta B$ where A and B are two sets. 3
- (c) If A and B are two mutually exclusive events such that $P(A) = 0.3$ and $P(B) = 0.4$ What is the probability that either A or B does not occur ? 2
- (d) Prove that 3
-
- $$\frac{1}{1.2} + \frac{1}{2.3} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1} \text{ using}$$
- Mathematical Induction.
- (e) Show that $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent. 3
- (f) Prove that product of two odd integers is an odd integer ? 3
- (g) How many different strings can be made from the letters of the word "SUCCESS" using all the letters ? 3

2. (a) Let $A = R - \{3\}$ and $B = R - \{1\}$. $f : A \rightarrow B$ 5
defined by $f(x) = \frac{x-2}{x-3}$ find f^{-1} ?
- (b) Let R is the relation on the set of strings of 5
Hindi letters such that aRb iff $l(a) = l(b)$
where $l(x)$ is length of string x . Show that
 R is an equivalence relation.
3. (a) Write contrapositive, converse and the 3
inverse of the implication "The home team
does not win whenever it is raining."
- (b) Draw the logic circuit for the expression 4
 $Y = ABC + A' C' + B' C'$
- (c) Determine the number of integer solutions 3
to the equation $x_1 + x_2 + x_3 + x_4 = 7$, where
 $x_i \geq 0 \forall i = 1, 2, 3, 4$.
4. (a) Five balls are to be placed in three boxes. 5
Each box can hold all the five balls. In how
many ways can we place the balls so that
no box is empty if balls and boxes are
different ?
- (b) Show that $r \rightarrow s$ can be derived from 5
 $p \rightarrow (q \rightarrow s), \sim r \vee p$ and q .
5. (a) Show that a map $f : R \rightarrow R$ defined by 4
 $f(x) = 2x + 1$ for $x \in R$ is a objective map from
 R to R .
- (b) If $f = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 1 \end{pmatrix}$ and $g = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}$. Find $f \circ g$ 4
and $g \circ f$?
- (c) List all the permutations of $\{a, b, c\}$. 2

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MCS-013

MCA (Revised) / BCA (Revised)**Term-End Examination****December, 2014**

01204

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) Let $A = \{a, b, c, d\}$, $B = \{1, 2, 3\}$ and $R = \{(a, 2), (b, 1), (c, 2), (d, 1)\}$. Is R a function? Why? 3
- (b) Under what conditions on sets A and B , $A \times B = B \times A$? Explain. 3
- (c) How many bit strings of length 8 contain at least four 1s? 3
- (d) Show that the proposition $p \rightarrow q$ and $\sim p \vee q$ are logically equivalent? 2
- (e) Use mathematical induction to show that $n! \geq 2^{n-1}$ for $n \geq 1$. 3
- (f) A coin is tossed n times. What is the probability of getting exactly r heads? 3
- (g) Prove that if x and y are rational numbers, then $x + y$ is rational. 3

2. (a) Find f^{-1} , where f is defined by $f(x) = x^3 - 3$ where $x \in \mathbb{R}$. 5
- (b) Let the set $A = \{1, 2, 3, 4, 5, 6\}$ and R is defined as $R = \{(i, j) \mid |i - j| = 2\}$. Is ' R ' transitive ? Is ' R ' reflexive ? Is ' R ' symmetric ? 5
3. (a) What are the inverse, converse and contrapositive of the implication "If today is holiday then I will go for a movie." ? 3
- (b) Draw the logic circuit for

$$Y = AB'C + ABC' + AB'C'$$
 4
- (c) In how many ways can a prize winner choose three books from a list of 10 bestsellers, if repeats are allowed ? 3
4. (a) What is understood by the logical quantifiers ? How would you represent the following propositions and their negations using logical quantifiers : 5
- (i) There is a lawyer who never tells lies.
- (ii) All politicians are not honest.
- (b) Show that

$$(\sim p \wedge (\sim q \wedge r)) \vee (q \wedge r) \vee (p \wedge r) \Leftrightarrow r$$
 3
- (c) Define Modus Tollens. 2

5. (a) If R is the set of all real numbers, then show that a map $g : R \rightarrow R$ defined by $g(x) = x$ for $x \in R$ is a bijective map. 4

- (b) Let $A = \{1, 2, 3, 4\}$ and

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

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

Find $f \circ g$ and $g \circ f$. 4

- (c) A club has 25 members. How many ways are there to choose four members of the club to serve on an executive committee? 2

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MCS-013

MCA (Revised) / BCA (Revised)**Term-End Examination**

05293

June, 2015**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) Write down the truth table of

$$p \rightarrow q \wedge \sim r \leftrightarrow r \oplus q.$$
Also explain whether it is a tautology or not. 5
- (b) Show that $\sqrt{5}$ is irrational. 4
- (c) Give the geometric representation of $\mathbb{R} \times \{2\}$. 3
- (d) Find the f inverse of the function

$$f : f(x) = x^3 - 3.$$
3
- (e) Present a *direct proof* of the statement :
“Square of an odd integer is odd.” 3
- (f) How many permutations are there for the word “UNIVERSITY” ? 2

2. (a) (i) Check whether
 $(A \cup B) \cap C = A \cup (B \cap C)$ or not,
using Venn Diagram. 3
- (ii) Find the dual of $A \cup (B \cup C)$. 2
- (b) Prove that $C(n, r) = C(n, n - r)$, for
 $0 \leq r \leq n, n \in \mathbb{N}$. 5
3. (a) State and prove Addition Theorem of
Probability. 5
- (b) Show that in any group of 30 people, we
can always find 5 people who were born on
the same day of the week. 3
- (c) State Pigeonhole principle. Also give an
example of its application. 2
-
4. (a) What is the probability that a number
between 1 and 200 is divisible by neither
2, 3, 5 nor 7? 3
- (b) In how many ways can 20 students be
grouped into 3 groups? 3
- (c) In how many ways can r distinct objects be
distributed into 6 different boxes with at
least two boxes empty? 4

5. (a) Give an example of a compound proposition that is neither a tautology nor a contradiction. 2

(b) Show that $2^n > n^3$ for $n \geq 10$. 5

(c) Draw the logic circuit for the following boolean expression :

$$x \cdot y + x \cdot y' + x' \cdot y. \quad 3$$



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

-
-
1. (a) Write the truth value of the disjunction of
"The earth is flat" and " $3 + 5 = 2$ ". 2
- (b) If p and q are two propositions, then show
that $\sim (p \vee q) \equiv \sim p \wedge \sim q$. 4
- (c) Use Mathematical induction to prove that 4
$$1 + \frac{1}{4} + \frac{1}{9} + \dots + \frac{1}{n^2} \leq 2 - \frac{1}{n} \quad \forall n \in \mathbb{N}.$$
- (d) If $f : \mathbb{R} \rightarrow \mathbb{R}$ is a function such that
 $f(x) = 3x + 2$, prove that f is one-one onto.
Also, find the inverse of f . 4
- (e) How many integers between 100 and 999
consist of distinct even digits ? 3

- (f) Show that the number of words of length n on an alphabet of m letters is m^n . 3

2. (a) Prove that :

$$\frac{(n+1)}{(r+1)} C(n, r) = C(n+1, r+1). \quad 5$$

- (b) Express the Boolean expression in three variables $(x + y' + z')(xy + x'z)$ in DNF. 5

3. (a) Two dice, one red and one white, are rolled. What is the probability that the white die turns up a smaller number than the red die? 4

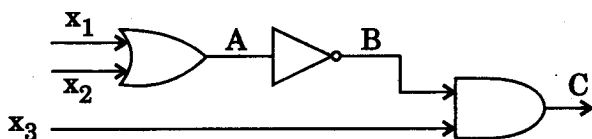
- (b) State and explain De Morgan's law for Boolean algebra. Also, explain duality principle with the help of an example. 4

- (c) In how many distinct ways is it possible to seat eight persons at a round table? 2

4. (a) Use Mathematical induction to prove that 4

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6} \quad \forall n \in \mathbb{N}.$$

- (b) Find the Boolean expression C for the following logic circuit : 4



- (c) Prove the following equivalence : 2

$$\sim \forall x P(x) \equiv \exists x \sim P(x)$$

5. (a) Verify that $p \wedge q \wedge \sim p$ is a contradiction and $p \rightarrow q \leftrightarrow \sim p \vee q$ is a tautology. 5

- (b) Show that $\sqrt{2}$ is irrational. 5

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No. of Printed Pages : 4

MCS-013**MCA (Revised) / BCA (Revised)****Term-End Examination****08018****June, 2016****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) Using the principle of mathematical induction prove that

$$5 + 10 + 15 + \dots + 5n = \frac{5n(n+1)}{2} \quad 3$$

- (b) Let A and B be the $n \times n$ matrices and I be the identity matrix of order $n \times n$.

Check the validity of the following statements and give justification : 4

- (i) $\exists B \forall A \quad A + B = I$
 (ii) $\exists B \forall A \quad A + B = A$

- (c) Let $f: \beta^2 \rightarrow \beta$ be a function defined as
 $f(0, 0) = 1, f(0, 1) = 0, f(1, 0) = 0$ and $f(1, 1) = 1$.
 Find the Boolean expression specifying the function f. 3

- (d) Let f be a permutation function defined as follows :

$$f(1) = 2, f(2) = 4, f(3) = 1, f(4) = 3$$

Find the inverse of f i.e., f^{-1} . 2

- (e) Make a table to recursively calculate P_n^k , where n is the total number, k is the number of partitions, using the following conditions :

$$7 \geq n \geq 1 \text{ and } 1 \leq k < 7.$$

- (f) An urn contains 15 balls, of which eight are red and seven are black. In how many ways can 5 balls be chosen such that two are red and three are black ? 3

- (g) In how many ways can 7 people be seated around a circular table ? 2

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

- (b) Prove : 3

$$\sim(\forall x P(x)) \equiv \exists x \sim P(x)$$

- (c) Give the direct proof of the statement "The sum of two odd integers is always even". 3

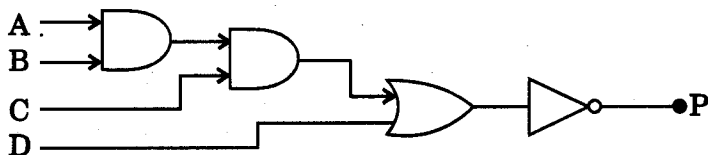
- (d) Explain the Identity Laws of Boolean algebra. 2

3. (a) Reduce the following Boolean expressions to simpler form : 5

$$(i) \quad X(x_1, x_2, x_3) = (x_1 \wedge x_2 \wedge x_3) \vee (x_1 \wedge x_2) \vee (x_2 \wedge x_3)$$

$$(ii) \quad X(x_1, x_2, x_3) = (x_1 \wedge x_3) \vee x_3 \vee x_2$$

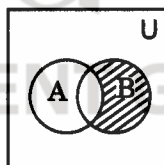
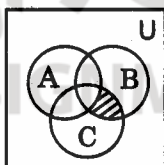
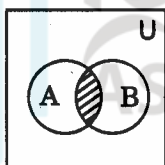
- (b) Find the Boolean expression for the following circuit : 3



- (c) Make the circuit corresponding to the following Boolean expression : 2

$$x_1' \vee (x_2 \wedge x_3)' \vee (x_2 \wedge x_3 \wedge x_1)$$

4. (a) Write the set expressions for the following Venn diagrams : 3



- (b) What is an equivalence relation? Let $A = \{1, 2, 3, 4\}$ be a set and R be an equivalence relation on A such that $A/R = \{\{1, 2\}, \{3, 4\}\}$. Write R . 3

- (c) Let f and g be the two functions such that $f(x) = x^2$ and $g(x) = 2x$. Define $f \circ f$, $f \circ g$, $g \circ f$ and $g \circ g$. 2

- (d) Find the number of distinguishable words that can be framed from the letters of 'MISSISSIPPI'. 2

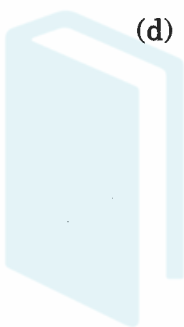
5. (a) Prove : 3

$${}^{n+1}C_r = {}^nC_{r-1} + {}^nC_r$$

(b) Use pigeonhole principle to show that if 7 colours are used to paint 50 bicycles, then at least 8 bicycles will have the same colour. 2

(c) In how many ways can 10 students be grouped into 2 groups ? 3

(d) Obtain the truth value of the disjunction of 'Sun moves around the Earth' and ' $2 > 3$ '. 2



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No. of Printed Pages : 4

MCS-013**MCA (Revised) / BCA (Revised)****Term-End Examination****December, 2016**

13285

MCS-013 : DISCRETE MATHEMATICS*Time : 2 hours**Maximum Marks : 50*

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

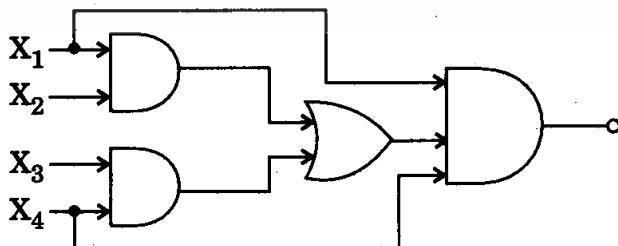
1. (a) Using the truth table, show that : 4

(i) $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$

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

(b) Prove that $\sqrt{2}$ is irrational. 3

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



- (d) Make Venn diagram for the following set of expressions : 2
- (i) \bar{A}
- (ii) $A \Delta B$ (Symmetric difference)
- (iii) $A \cap B \cap C$
- (iv) $A \cup B - C$
- (e) Let there be a relation f defined as $f = \{(a, 1), (a, 2), (d, 3), (c, 4)\}$. Is f a function? If not, why? 2
- (f) How many distinct three-letter words can be formed from the letters of the word MAST? 2
- (g) In how many ways can a student choose 8 questions out of 10 in an exam? 2
- (h) A coin is tossed n times. What is the probability of getting exactly r heads? 2

2. (a) Prove the following : 3

$$\sim (\exists x P(x)) \equiv \forall x (\sim P(x))$$

- (b) Use mathematical induction to prove that

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}.$$

- (c) Write the contrapositive and converse of the following sentence : 2

"If $2 + 2 = 5$, then I am Prime Minister of India."

- (d) Explain proof by contradiction, with the help of an example. 2

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

$$(i) \quad F(a, b, c) = (a' \wedge b' \wedge c') \vee (a' \wedge b' \wedge c) \vee (a \wedge b \wedge c')$$

$$(ii) \quad F(a, b) = (a' \wedge b') \vee (a' \wedge b) \vee (a \wedge b')$$

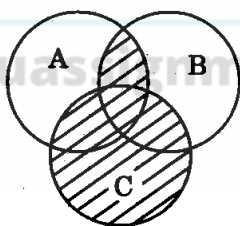
- (b) Construct logic circuits for the following Boolean expressions : 4

$$(i) \quad (a \wedge b \wedge c) \vee (b \wedge c)' \vee (a \wedge b)'$$

$$(ii) \quad (a' \wedge b') \vee (b' \wedge c) \vee d$$

- (c) What is dual of a Boolean expression ? Explain the principle of duality with the help of an example. 2

4. (a) Describe the following region using intersection and union : 2



- (b) Let $A = \{1, 2, 3, 4\}$ be a set and a relation R is defined on A such that aRb if $a \geq b$. Check if R is (i) reflexive, (ii) symmetric, (iii) transitive, and (iv) asymmetric. 4

- (c) Let there be a function $f : A \rightarrow B$, where A and B are sets defined as follows :

$$A = \{ a, b, c, d \}, B = \{ p, q, r, s \}$$

$$f = \{ (a, p), (b, q), (c, r), (d, p) \}$$

Explain if f is

(i) one to one,

(ii) onto,

(iii) bijective.

2

- (d) Prove that $A - (A - B) = A \cap B$ using Venn Diagram.

2

5. (a) Make Pascal's triangle up to $n = 6$.

3

- (b) Let A and B be two mutually exclusive events such that $p(A) = 0.6$ and $p(B) = 0.3$.

What is the probability that

(i) A does not occur ?

(ii) A and B both occur simultaneously ?

2

- (c) How many ways are there to distribute r distinct objects into 5 distinct boxes with no empty box ?

3

- (d) Disprove the following statement :

2

$$(\forall a \in \mathbf{R}) (\forall b \in \mathbf{R}) [(a^2 = b^2) \Rightarrow (a = b)]$$

No. of Printed Pages : 4

MCS-013

MCA (Revised) / BCA (Revised)

Term-End Examination

03701

June, 2017

MCS-013 : DISCRETE MATHEMATICS

Time : 2 hours

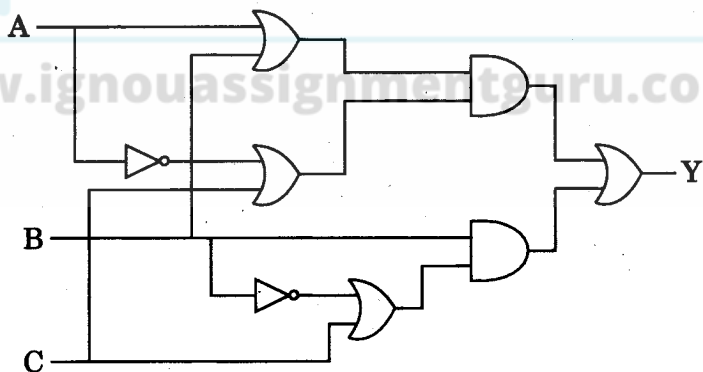
Maximum Marks : 50

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
- size 3 with replacement, and
 - 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 $S = \{1, 2, \dots, 10\}$ 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 $x \in \mathbb{R}$ are inverse of each other. 3

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

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

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

$$\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \dots + \frac{1}{n \cdot (n+1)} = \frac{n}{n+1}$$

by mathematical induction. 4

No. of Printed Pages : 3

MCS-013

MCA (Revised) / BCA (Revised)

Term-End Examination

December, 2017

00890

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) Translate the statement
"The sum of two positive integers is positive" into a logical expression. 2
- (b) Write the negation of
"If x is an integer then x is a rational number." 2
- (c) Prove that if x^2 is an even integer, then x is an even integer by contraposition method. 3
- (d) Draw a Venn Diagram to show the following set operations : 3
- (i) $A - B$
- (ii) $(A \cap B) \cup C$
- (iii) $(A \cap B) \cap C$

- (e) A box contains 5 balls. Find the number of ordered samples of size 2
- with replacement, and
 - without replacement. 4
- (f) Check whether the function $f(x) = x + 1$ is one-one or not. 2
- (g) How many numbers from 0 to 999 are not divisible by either 5 or 7 ? 4
2. (a) A and B are mutually exclusive events such that $P(A) = 0.3$ and $P(B) = 0.4$. What is the probability that either A or B does not occur ? 3
- (b) How many six-digit numbers contain exactly three different digits ? 2
- (c) In how many ways can an employer distribute 100 one-rupee notes among 6 employees so that each gets at least one note ? 3
- (d) How many words can be formed from A, B, C, using the letter A thrice, the letter B twice and the letter C once ? 2
3. (a) Explain Pascal's Triangle. 2
- (b) Given $A = \{1, 2, 3, 4\}$ and Relation R as $\{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$. Examine whether R is
- Symmetric
 - Reflexive
 - Transitive 3

- (c) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = 3x - 4$.
Find f^{-1} . 3
- (d) Let $A = \{a, b, c, d\}$, $B = \{1, 2, 3\}$,
 $R = \{(a, 2), (b, 1), (c, 2), (d, 1)\}$.
Is R a function ? Why ? 2
4. (a) Find CNF of $\sim (p \vee q) \leftrightarrow (p \wedge q)$. 4
- (b) What is a proper subset ? Write the
number of proper subsets of the set
 $\{a, b, c, d\}$. 3
- (c) Draw the circuit for the following Boolean
expression using logic gates
 $Y = A'BC + A'BC' + ABC'$. 3
5. (a) Construct a truth table to check whether
the following is a tautology or a
contingency or a contradiction : 4
- (i) $p \rightarrow (q \rightarrow p)$
- (ii) $p \wedge (q \wedge \sim p)$
- (b) 'If today is a holiday then I will go for a
movie.' Write
- (i) Inverse
- (ii) Contrapositive 2
- (c) Show that $n^2 > 2n + 1$ for $n \geq 3$ by
Mathematical Induction. 4

No. of Printed Pages : 3

MCS-013

MCA (Revised) / BCA (Revised)

Term-End Examination

June, 2018

12165

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) How many three digit numbers are there with no digit repeated ? 2
- (b) Show that $\sim (p \vee q) = \sim p \wedge \sim q$ 2
- (c) Prove that $ab + [c (a' + b')] = ab + c$ 3
- (d) Find the domain for which the function $f(x) = 3x^2 - 1$ and $g(x) = 1 - 5x$ are equal. Also find a domain for which the functions are not equal. 4

- (e) Prove that 3
 $(A - B) \cup B = A \cup B$
- (f) If there are 12 persons in a party, and if each two of them shake hands with each other, how many handshakes happen in the party? 3
- (g) Show that for integers greater than zero : 3
 $2^n > n + 1$
2. (a) Use mathematical induction method to prove that 4

$$1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$
- (b) Draw Venn diagrams to represent the following for sets A, B and C. 4
- (i) $A \Delta B$
- (ii) $A \cap B \cup C$
- (c) Find n if $2P(n, 2) + 50 = P(2n, 2)$. 2
3. (a) If $f : R \rightarrow R$ is a function such that $f(x) = 3x + 5$, prove that f is one-one onto. 4
- (b) Show that $p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$ is a tautology. 3
- (c) Find in how many ways can 25 identical books be placed in 5 identical boxes. 3

4. (a) Find the Boolean Expression for the given circuit. 3

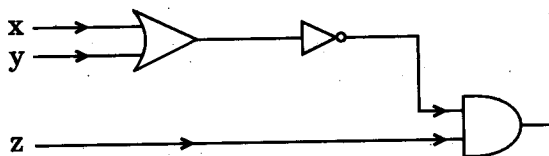


Figure 1

- (b) Show whether $\sqrt{17}$ is rational or irrational. 4
- (c) Prove that 3
- $$p \Leftrightarrow q \equiv (p \Rightarrow q) \wedge (q \Rightarrow p).$$
5. (a) Let $A = \{a, b, c, d\}$, $B = \{1, 2, 3\}$ and $R = \{(a, 2), (b, 1), (c, 2), (d, 1)\}$. Is R a function? Why? 2
- (b) How many permutations are there of the letters, taken all at a time, of the word DISTINCT? 3
- (c) Show that in any group of 30 people, we can always find 5 people who were born on the same day of the week. 3
- (d) Find how many 4 digit numbers are odd. 2

No. of Printed Pages : 3

MCS-013(S)

MCA (Revised) / BCA (Revised)

Term-End Examination

December, 2018

MCS-013(S) : DISCRETE MATHEMATICS

Time : 2 hours

Maximum Marks : 50

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

1. (a) Find the dual of
- (i) $A \cap (B \cap C) = (A \cap B) \cap C$ and
 - (ii) $(A \cup B) \cap (A \cup C)$. 4
- (b) Give the geometric representation of $R \times \{2\}$. R is the set of Real Numbers. 4
- (c) Find the number of distinct sets of 5 cards that can be dealt from a deck of 52 cards. 4
- (d) Find the number of ways of placing n people in $(n - 1)$ rooms, no room being empty. 4
- (e) Verify that $p \wedge q \wedge (\sim p)$ is a contradiction and $p \rightarrow q \leftrightarrow \sim p \vee q$ is a tautology. 4

2. (a) Prove that if $x, y \in I$ such that xy is odd, then both x and y are odd, by proving its contrapositive. I is the set of Integers. 5

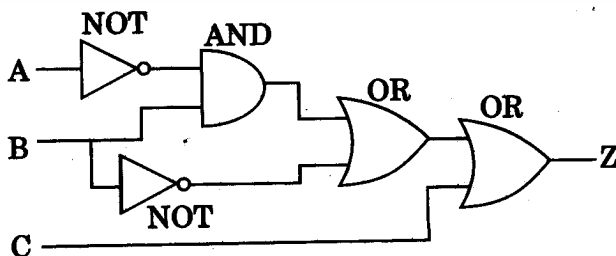
(b) Design a logic circuit to operate a light bulb by two switches x_1 and x_2 . 5

3. (a) A box contains 3 red, 3 blue and 4 white socks. In how many ways can 8 socks be pulled out of the box, one at a time, if order is important? 5

(b) Suppose 5 points are chosen at random within or on the boundary of an equilateral triangle of side 1 metre.

Show how we can find two points at a distance of at most $\frac{1}{2}$ metre. 5

4. (a) Find the boolean expression for the following circuit : 4



(b) Find the inverse of the following function : 3

$$f(x) = x^3 - 3$$

(c) State and explain Pigenhole principle. 3

5. (a) A car manufacturer has 5 service centres in a city. 10 identical cars were served in these centres for a particular mechanical defect. In how many ways could the cars have been distributed at the various centres ? 6

(b) Show that $\sqrt{5}$ is irrational. 4

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89792

No. of Printed Pages : 4

MCS-013

M. C. A. (REVISED)/B. C. A. (REVISED)

Term-End Examination

June, 2019

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) Obtain the truth value of the disjunction of
"The earth is flat" and " $3 + 5 = 2$." 4
- (b) Write down the truth table of
 $(p \rightarrow q \wedge \neg r) \leftrightarrow (r \oplus q)$. 4
- (c) Show that $2^n > n^3$ for $n \geq 10$. 4
- (d) Design a logic circuit capable of operating a
central light bulb in a hall by three
switches x_1, x_2, x_3 (say) placed at the three
entrances to that hall. 4

[2]

MCS-013

- (e) If $X = \{a, b, c\}$ and $Y = \{1, 2, 3\}$, find $X \times X$
and $X \times Y$. 4

2. (a) Suppose 10 people have exactly the same briefcase, which they leave at a counter. The briefcases are handed back to the people randomly. What is the probability that no one gets the right briefcase? 5

- (b) What is a function? Explain the following types of functions with example: 5

(i) Bijective

(ii) Surjective

3. (a) Show that: 5

$$(p \rightarrow \sim q) \wedge (p \rightarrow \sim r) \equiv \sim [p \wedge (q \vee r)].$$

- (b) Prove that $(x \vee y)' = x' \wedge y'$ and

$$(x \wedge y)' = x' \vee y'. \quad 5$$

[3]

MCS-013

4. (a) Let $f : B^2 \rightarrow B$ be a function which is defined by :

$$f(0,0) = 1, f(1,0) = 0,$$

$$f(0,1) = 1, f(1,1) = 1$$

Find the Boolean expression specifying the function f .

- (b) Give the expression

$$(x_1' \vee (x_2 \wedge x_3')) \wedge (x_2 \vee x_4'),$$

find the corresponding circuit, where

x_i ($1 \leq i \leq 4$) are assumed to be inputs to the circuitary.

5. (a) There is a village that consists of two types of people—those who always tell the truth and those who always lie. Suppose that you

[4]

MCS-013

visit the village and two villagers A and B come up to you. Further suppose :

A says, "B always tells the truth" and B says, "A and I are of opposite types." What types are A and B ?

5

(b) Draw a Venn diagram to represent the following :

5

(i) $(A \cup B) \cap (A \sim C)$

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

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577304

No. of Printed Pages : 4

MCS-013

M. C. A. (REVISED)/B. C. A. (REVISED)
(MCA/BCA)

Term-End Examination

December, 2019

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) Construct the truth table for the formula :

$$\alpha = (P \rightarrow (Q \rightarrow R)) \rightarrow ((P \rightarrow Q) \rightarrow (P \rightarrow R))$$

Check whether it is a tautology or not . 5

- (b) Show that $\sqrt{2}$ is irrational. 4

- (c) Given $A = \{1, 3, 5, 7\}$, $B = \{2, 3, 5, 8\}$.

List all the elements of $(A \cap B) \times (B - A)$. 3

- (d) Show that the function $f(x) = x^3$ and

$g(x) = x^{1/3}$ for all $x \in \mathbb{R}$ are inverse of one

another.

2

[2]

MCS-013

- (e) Give the direct proof of the statement : 3

"The product of two odd integers is odd."

- (f) How many license plate containing two letter followed by three digit can be formed ? If the letters as well as digits can be repeated. 3

2. (a) Find the power set of: 2

$$A = \{a, b, c, d\}.$$

- (b) In a group of students, 70 have a personal computer, 120 have a personal stereo and 41 have both. How many own at least one of these device ? Draw an appropriate Venn diagram. 4

- (c) $^{1000}C_{98} = ^{999}C_{97} + ^x C_{901}$. Find x . 4

3. (a) Draw logical circuit for the following logical expression : 3

$$x_1 \wedge x_2'$$

- (b) Find the probability of getting the sum 9 or 11 in a single throw of two dice. 3

[3]

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- (c) A drawer contains ten black and ten white socks. What is the least no. of socks one must pull out to be sure to get a matched pair ? 4

4. (a) A problem of discrete mathematics is given to three students whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$. What is the probability that exactly one of them solves it ? 3

- (b) A house has 4 doors and 10 windows. In how many ways can a thief rob the house by entering through a window and exiting through a door ? 3

- (c) A committee of 2 hawkers and 3 shopkeepers is to be formed from 7 hawkers and 10 shopkeepers. Find the no. of ways in which this can be done if a particular shopkeeper is included and a particular hawker is excluded. 4

[4]

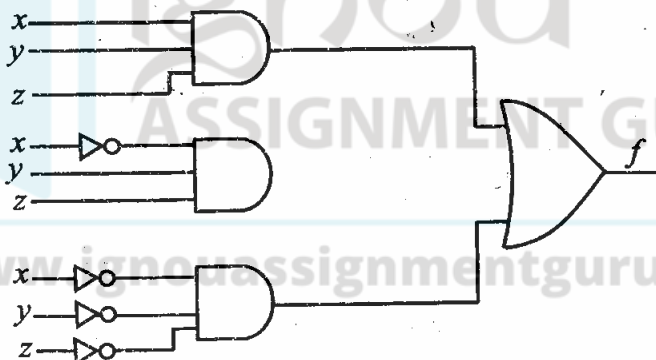
MCS-013

5. (a) Show that 5 divides $n^5 - n$, where n is a non-negative integer. 4

(b) Write the negation of the following statement : 2

"If he studies he will pass the examination."

(c) Give the output of the given circuit : 4



No. of Printed Pages : 4

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**M. C. A./B. C. A. REVISED
(MCA/BCA)**

Term-End Examination

June, 2020

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) Check whether the following formula is
tautology, contradiction or contingency : 5

$$\sim ((P \rightarrow Q) \rightarrow ((R \vee P) \rightarrow (R \vee Q)))$$

- (b) Two finite sets have x and y number of
elements. The total number of subsets of
the first set is four times the total number
of subsets of second set. Find out the value
of $x - y$. 4

P. T. O.

(c) In a group of 400 people 250 can speak in English only and 70 can speak Hindi only.3

(i) How many can speak English ?

(ii) How many can speak Hindi ?

(iii) How many can speak both English and Hindi ?

(d) If $f : A \rightarrow B$ and $g : B \rightarrow C$ are injective function, then $g \circ f : A \rightarrow C$ is an injective function. Prove or disprove. 3

(e) Use the method of proof by contradiction to show that $x \in \mathbb{R}$ if $x^3 + 4x = 0$, then $x = 0$. 3

(f) Three persons enter in a railway compartment. If there are 5 seats vacant, in how many ways they can take these seats ? 2

2. (a) Given : 5

$$A = \{1, 3, 5, 7\}$$

$$B = \{2, 3, 5, 8\}$$

(i) List the elements of $(A \times B) \times (B - A)$.

(ii) Is $(A \times B) \times (B - A)$ a subset of $A \times B$?

[3]

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(b) Prove that : 5

$${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r \quad (0 \leq r \leq n).$$

3. (a) Show that in any set of eleven integers there are two which are divisible by 10, by applying pigeonhole principle. 3

(b) How many solutions are there of: 4

$$x + y + z = 17$$

subject to the constraints :

$$x \geq 1$$

$$y \geq 2$$

$$z \geq 3.$$

(c) If: 3

$$P(A) = \frac{1}{4}$$

$$P(B) = \frac{2}{5}$$

$$\text{and } P(A \cup B) = \frac{1}{2}$$

find :

$$(i) \cdot P(A \cap B)$$

$$(ii) P(A \cap B')$$

P. T. O.

[4]

MCS-013

4. (a) Five balls are drawn from a bag containing 6 white and 4 black balls. What is the probability that 3 are white and 2 black ? 3
- (b) From the digit 1, 2, 3, 4, 5, 6, how many three digit odd numbers can be formed when
- (i) repetition of digit is allowed ? 2
- (ii) repetition of digit is not allowed ? 2
- (c) How many numbers divisible by 2 lying between 50,000 and 70,000 can be formed from the digits 3, 4, 5, 6, 7, 8, 9, no digit being repeated in any number. 3
5. (a) Show that : 4

$$1.2 + 2.3 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$$

- (b) Write the negation of the following statement : 2

If it is raining, then the game is cancelled.

- (c) Draw the circuit represented by the following Boolean function : 4

$$f : xy + \bar{x}y$$

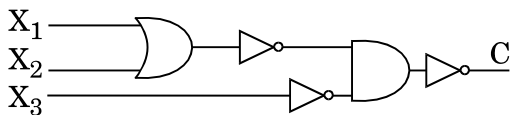
MCA (Revised) / BCA (Revised)**Term-End Examination****February, 2021****MCS-013 : DISCRETE MATHEMATICS***Time : 2 hours**Maximum Marks : 50*

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

1. (a) Show using truth table whether $(p \wedge q \wedge r)$ and $(p \vee r) \wedge (q \vee r)$ are equivalent or not. 3
- (b) Using Mathematical Induction, prove that :
$$1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2} .$$
 4
- (c) Prove that if A is a set with n elements, then $|P(A)| = 2^n$. 3
- (d) If there are 7 men and 5 women, how many circular arrangements are possible in which women do not sit adjacent to each other ? 3

- (e) Find Boolean expression for the following logic circuit :

3



- (f) If $f : \mathbb{R} \rightarrow \mathbb{R}$ be a function given by $f(x) = x^3 - 2$, find whether f^{-1} exists or not. If f^{-1} exists, find it.

4

2. (a) How many words can be formed using the letters of the word "DEPARTMENT", if each letter must be used at most once ?

4

- (b) Give geometric representation for $\{1, 3\} \times \{-2, 3\}$.

2

- (c) Show that $(p \rightarrow q) \rightarrow q = p \vee q$.

2

- (d) Find the number of ways to distribute 20 distinct objects into 10 distinct boxes with at least 4 boxes remaining empty.

2

3. (a) Draw Venn diagrams for the following expressions : 3
- (i) $A \cup B \cup C$
- (ii) $A \cap B \cup C$
- (iii) $A \cap B \cap C$
- (b) Draw logic circuit for the following Boolean expression : 2
- $$(X_1 \wedge X_2') \vee (X_1' \wedge X_2')$$
- (c) Write the following statements in the symbolic form : 2
- (i) Every thing is correct.
- (ii) All birds can not fly.
- (d) Explain Principle of Duality with the help of an example. 3
-
4. (a) Show that $\sqrt{11}$ is irrational. 4
- (b) What is an indirect proof ? Explain with the help of an example. 3
- (c) Explain De Morgan's Laws with the help of Venn diagram. 3
5. (a) In a ten-question true-false exam, a student must achieve five correct answers to pass. If he selects his answers randomly, what is the probability that he will pass ? 3

- (b) In how many ways can an employer distribute 50 twenty-rupee notes among 5 employees so that each gets at least one note ? 2
- (c) Show that in any group of 30 people, you can always find 5 people who were born on the same day of the week. 3
- (d) Draw truth table for : 2

$$(p \rightarrow q) \rightarrow p$$



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