MCS–013

BACHELOR OF COMPUTER APPLICATIONS (BCAOL)

DISCRETE MATHEMATICS

Time: Two Hours

Maximum Marks: 100

Note: 1) This question paper comprise of three sections : A, B and C.

2) Section A comprise seven questions of 4 marks each. Attempt any five.

3) Section B comprise seven questions of 10 marks each. Attempt any five.

4) Section C comprise three questions of 15 marks each. Attempt any two.

Section–A (5×4=20)

Note: Attempt any five from the following.

1. Construct the truth table for the following formula:

$(p \to q \wedge \sim r) \leftrightarrow (q \oplus r)$

2. Give a direct proof of the statement: 'The product of two odd integers is odd.'

3. Let $f:\beta^2 \to \beta$, 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 for function *f*.

4. 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.

5. 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?

6. In how many ways can an employer distribute 100 one-rupee notes among 6 employees so that each gets at least one note?

7. Use mathematical induction to prove the following:

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

Section–B (5×10=50)

Note: Attempt any five of the following.

8. For each of the following compound statements, first identify the simple propositions p, q, r etc. that are combined to make it. Then write in symbols using the connective and give its truth values:

i) If triangle ABC is equilateral, then it is isosceles

ii) If Raja has five glasses of water and Sudha has four cups of tea, then Shyam will not pass the Math examination.

9. a) Show that $\sqrt{11}$ is irrational.

b) Explain De Morgan's laws with the help of suitable Venn diagram.

10. a) Simplify the given Boolean expression:

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

b) Make the circuit corresponding to the following Boolean expression:

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

Also write the truth table for the expression.

11. a) Let A = $\{1,2,3,4\}$ be a set and relation R is defined on A such that aRb if $a \geq b$. Check if R is:

i) Transitive

ii) Asymmetric

iii) Reflective and

iv) Symmetric

b) Let $f : R \to R$ defined by $f(x) = 3x - 4,$ find f^{-1}.

12. a) Find the value of *x*, where:

$$^{1000}C_{98} = {}^{999}C_{97} + {}^{x}C_{901}$$

b) How many different 7-person committees can be formed, each consisting of 3 women and 4 men, from a set of 20 women and 30 men?

13. a) How many solutions are there of the equation $x+y+z=17$, subject to the given constraints $x\geq 1, y\geq 2, z\geq 3$?

b) If 100 balls are placed in 15 boxes, show that two of the boxes must have the same number of balls.

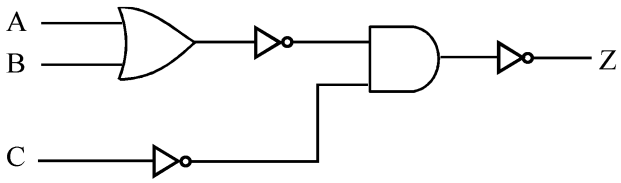
14. a) Find the number of surjective functions from an *n*-element set onto an *m*-element set.

b) Find the number of distinguishable words that can be framed from the letters of the word 'MISSISSIPPI'.

Section–C (2×15=30)

Note: Attempt any two from the following.

15. a) Find the Boolean expression for the following circuit diagram:



b) Prove that if $x,y\in I$ such that xy is odd, both x and y are odd, by proving its contrapostive. Here I is the set of integers.

c) Negate the following expressions:

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

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

16. Write short notes on the following:

i) Relation and functions

ii) Pascal’s formula

iii) Integer partitions

17. Write short notes one the following:

i) Precedence rules

ii) Principle of Induction

iii) Logic gates and circuits