CB

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MASTER OF COMPUTER APPLICATIONS

EXAMINATION : DECEMBER - 2023

SEMESTER - I

Sub: Discrete Mathematics (MCA-100-22)

Date : 27/12/2023 **Total Marks : 60** **Time: 10.00 am To 12.30 pm**

Instruction:

1. *All questions are compulsory unless and otherwise stated.*
2. *Bold figures to the right of every question are the maximum marks for that question.*
3. *Candidates are advised to attempt questions in order.*
4. *Answers written illegibly are likely to be marked zero.*
5. *Use of scientific calculators, Log tables, Mollier Charts is allowed.*
6. *Draw neat and labelled diagram wherever necessary.*

Q.1 Answer the following in 2-3 lines (Any 5) **(10)**

1. If $f(x) = \dfrac{x^2 + 5x - 1}{2x - 1}$. Check whether the function even or odd?

2. Rewrite the following statement without using If-then:
   If $b^2 - 4ac = 0$ then the roots of the quadratic equation are equal.

3. In a binomial distribution, find p if mean = 5 and variance = 5/2.

4. If $p = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 5 & 1 & 3 & 2 & 4 \end{pmatrix}$, $q = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 4 & 1 & 5 & 3 \end{pmatrix}$. Find: pq & qp.

5. Write down the negation of the following statements:
   (i) All equilateral triangles are equiangular.
   (ii) Some parallelograms are rectangles.

6. If $f(x) = 5x - 11$. Find $f^{-1}(2)$ and $f^{-1}(-3)$.

7. If X has a Poisson distribution with a parameter m = 3. Find $p(x \le 1)$.
   Given : $\left(e^{-3} = 0.0497\right)$

Q.2 Answer the following in short. (Any 4) **(20)**

1. A diet of a sick person must contain at least 400 units of vitamins, 60 units of minerals and 150 units of calories. Two foods F1 & F2 are available at cost Rs.10 anfd Rs.15 per packet. If one unit of food F1 contains 200 units of vitamins, 1 unit of minerals and 50 calories whereas 1 of food F1 contains 300 units of vitamins, 3 unit of minerals and 60 calories. Formulate the problem as L.P.P. in order to meet the requirements of the sick person at minimum cost.

2. Show that: A group G is abelian if and only if $(ab)^2 = a^2.b^2 \quad \forall a, b \in G$.

3. Identify the parameters: $f(x) = \frac{1}{\sqrt{10\pi}} e^{\left(\frac{-x^2}{10}+4x-40\right)}$, $-\infty < x < \infty$

4. Solve the system of equations by Cramer`s Rule:
$2x + 5y - 4z = 12$, $x - y + 2z = 3, -2x + 10y + z = 15$

5. Let G be the group and $a, b \in G$. Then the equations $ax = b$ and $ya = b$ have unique solutions in G.

6. Find Expected value of 'x' for the following probability distribution:

x	1	2	3	4	5
P(x)	0.12	0.27	0.21	0.31	0.09

Q.3 Answer the following in detail. (Any 3) **(30)**

1. Prove : (i) Left cancellation law in groups. (ii) Right cancellation law in group.

2. A sample of 2000 electronic parts tested to find the length of life produced the following results: Mean, $\mu = 12000$ hrs & Standard Deviation , $\sigma = 3000$ hrs. Assuming that the data are normally distributed, what percentage of electronic parts are expected to have a life (i) less than 6000 hrs. (ii) more than 15000 hrs (iii) in between 10000 to 14000 hrs.

Z	0.67	1	2
Area	0.2487	0.3413	0.4772

3. The p.m.f. of a r.v. X is given by

$$P(X = x) = \frac{\binom{5}{x}}{32} \quad , \quad x = 0,1,2,3,4,5$$
$$= 0 \quad , \quad \text{otherwise.}$$

Find : $P(x \le 2)$ and $P(x \ge 3)$
Comment on the result.

4. A firm manufactures two types of dolls A and B. To produce a single unit of doll A, 10 mins of cutting machine and 20 mins of polishing machine is required. To produce a single unit of doll B, 15 mins of cutting machine and 12 mins of polishing machine is required. Cutting machine is available for 4 hrs per day and polishing machine is available for 5 hrs per day. The profits on doll A and B are Rs.50 and Rs.60 respectively per piece. Only formulate the problem as L.P.P. in order to maximize the profit and solve it graphically.
