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MASTER OF COMPUTER APPLICATIONS (MCA)
EXAMINATION : DECEMBER - 2024
SEMESTER - I
Sub: Discrete Mathematics (MCA-100-22)

Date : 24 /12/2024

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. State whether the following statements are true or false?
 - (i) The only idempotent element in group G is the unit element.
 - (ii) A group G is cyclic then it is abelian.
2. Find the distinct arrangements of the letters of the word 'INDEPENDENCE'.
3. A coin is tossed 10 times. Find the probability of getting at the most 1 heads.
4. If $f(x) = x^2 + 2x - 3$. Find $f^{-1}(-3)$ and $f^{-1}(1)$.
5. Write down the duals of the following statements:
 - (i) $(p \vee q) \rightarrow (q \wedge p)$
 - (ii) $(p \wedge q) \vee (q \leftrightarrow p)$
6. Check whether the function $f(x) = 5x - 3$ on real numbers is one-one or not?
7. Show that the only idempotent element in group G is the unit element.

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

1. For the probability distribution given below, Find : (i) k (ii) $p(x < 2)$ (iii) $p(x \geq 2)$

X	0	1	2	3	4
P(X)	2k	3k	5k	6k	k

2. What are the conditions, which should get satisfied by any set so that it will be treated as a group?
3. If $p = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 4 & 3 & 5 & 1 \end{pmatrix}$ and $q = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 5 & 4 & 3 & 1 \end{pmatrix}$. Find $(pq)^{-1}$ & pq^{-1}
4. If $f(x) = 5x + 4$ and $g(x) = 4x - 5$. Find $f \circ g$ & $g \circ f$. Comment on the results.

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

Find : $p(x \leq 2)$.

6. State, which among the following are statements in Logic? If yes, find their truth values.
- (i) Congratulations...!!!
 - (ii) 81 is a perfect square number.
 - (iii) All whole numbers are non negative numbers.

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

(30)

1. (a) Solve the equations by Cramer's Rule:

$$x - y - z = -1, 3x + 6y - 8z = 1, x - 3y + z = -1$$

- (b) Express the permutation $k = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 2 & 5 & 8 & 6 & 1 & 3 & 7 & 4 & 9 \end{pmatrix}$ as a product of cycles.

2. Write down the negation of the following statements:

- (i) If $AB = BC = AC$ then $\triangle ABC$ is equilateral triangle.
- (ii) Some Engineers are Scholars.
- (iii) The roots of the quadratic equation are equal if and only if $b^2 - 4ac = 0$.
- (iv) All rectangles are parallelograms.
- (v) 2 is a prime number and 4 is a perfect square.

3. (i) If $f(x) = \frac{1}{5\sqrt{2\pi}} e^{\left(\frac{-x^2}{50} + 4x - 200\right)}$, $-\infty < x < \infty$

is the p.d.f. for Normal distribution. Find all the parameters.

- (ii) If X has a Poisson distribution with Parameter, $P(x = 2) = P(x = 3)$ Find $P(x \geq 2)$. (Given that: $e^{-3} = 0.0497$)

4. (i) 20 Doctors, 24 Lawyers and 36 Engineers were interviewed for a post of a chairman in a certain organization. The probability of selection of a doctor is $3/5$, that of a lawyer is $6/7$ and that of an engineer is $1/2$. If one of the three types of candidates is selected at random for a post of chairman. Find the probability that he is a doctor.
- (ii) In a Binomial distribution, mean = 5, variance = $5/2$. Find the probability of at least 1 success.
