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**MCA 182105**

Roll No. of candidate

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25/3/22

2022

DR. A. CHOWDHURY DEPT. OF MATHS  
(G.M.T. & T.P.S.)  
AZADI, Hatkrumpara,  
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**M.C.A. 1<sup>st</sup> Semester End-Term Examination**

**NUMERICAL COMPUTATION AND STATISTICAL METHODS**

**New Regulation (w.e.f. 2017-18) &**

**New Syllabus (w.e.f. 2018-19)**

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answer : (10 × 1 = 10)
- (i) An integer is chosen from 2 to 8. What is the probability that it is prime?
- (a)  $\frac{4}{7}$  (b)  $\frac{3}{7}$
- (c)  $\frac{2}{7}$  (d) None of the above
- (ii) Let  $A$  and  $B$  be two events such that  $P(A) = 1$ , then  $P\left(\frac{B}{A}\right) = \text{_____}$ .
- (a)  $P(A)$  (b)  $P(B)$
- (c)  $P(A \cap B)$  (d)  $P(A \cup B)$
- (iii) The mean of the binomial distribution is
- (a)  $np$  (b)  $npq$
- (c)  $nq$  (d) None of the above
- (iv) The value of  $\text{Var}(aX + Y)$  is
- (a)  $a\text{Var}(X + Y)$  (b)  $a^2\text{Var}(X + Y)$
- (c)  $-a\text{Var}(X + Y)$  (d) None of the above

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- (v) The rate of convergence of bisection method is
- (a) Linear (b) Quadratic  
(c) Cubic (d) None of the above
- (vi) 2% of the items produced by a firm are defective. If a box contains 100 items, then the variance is \_\_\_\_\_
- (a) 2 (b) 3  
(c) 1 (d) 4
- (vii) Newton's forward interpolation formula is generally used to find the values in near the
- (a) End of the table (b) Middle of the table  
(c) Beginning of the table (d) None of the above
- (viii) If  $\theta$  be the angle between the lines of regression of the variables  $X$  and  $Y$ , then the lines of regression are perpendicular to each other if \_\_\_\_\_
- (a)  $\tan \theta = \frac{\pi}{2}$  (b)  $\sin \theta = \frac{\pi}{2}$   
(c)  $\tan \theta = \infty$  (d)  $\sin \theta = 0$
- (ix) Gauss-seidal method is an
- (a) Direct method (b) Iterative method  
(c) Step by step method (d) Self correcting method
- (x) A sample is of size 25 is a
- (a) Large sample (b) Small sample  
(c) Exact sample (d) None of the above

2. Answer the following:

- (a) For any two events  $A$  and  $B$ , prove that  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ .  
(5)
- (b) A bag  $X$  contains 2 white and 3 red balls and a bag  $Y$  contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and is found to be red. Find the probability that it was drawn from bag  $Y$ ?  
(5)
- (c) A coin is tossed three times. Find the expectation of number of heads obtained.  
(5)

3. Answer the following:

- (a) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or six? (5)
- (b) Find the mean of the Poisson distribution. (5)
- (c) Using the least square method fit a straight line to the four points (1, 1), (2, 4), (3, 9), (4, 16). (5)

4. Answer the following:

- (a) If the curve  $y = f(x)$  takes the values  $f(0) = 3$ ,  $f(3) = 18$ ,  $f(6) = 195$  and  $f(9) = 896$ , find  $f(2)$ . (5)
- (b) In a normal distribution, 31% of the items are under 45 and 8% of the items are over 64. What is the mean and standard deviation of the distribution? (5)
- (c) A sample of 20 items has the mean 42 units and standard deviation 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units. (5)

5. Answer the following:

- (a) Find a positive real root of  $x^3 - 2x - 5 = 0$  by Newton-Raphson method correct to three decimal places. (5)
- (b) Solve the following equations by Gauss-elimination method:  
 $x + y + 2z = 4$ ,  $3x + y - 3z = -4$ ,  $2x - 3y - 5z = -5$ . (5)
- (c) The regression lines of  $X$  and  $Y$  are  $8x - 10y + 66 = 0$  and  $40x - 18y = 214$  respectively. Find the mean of  $X$  and  $Y$ . (5)

6. Answer the following:

- (a) Show that the rate of convergence of Newton-Raphson method is quadratic. (5)
- (b) Solve  $\frac{dy}{dx} = x + y^2$  given that  $y(0) = 1$  using Runge-Kutta method of 4<sup>th</sup> order to find an approximate value of  $y$  at  $x = 0.2$  in one step length. (5)
- (c) Solve  $\frac{dy}{dx} = 3x + 4y + 1$  at  $x = 0.8$  given that  $y(0) = 1$ ,  $y(0.2) = 2$ ,  $y(0.4) = 3.92$ ,  $y(0.6) = 7.496$ , using Milne's predictor corrector method. (5)

7. Answer the following:

(a) The theory predicts the proportion of beans in four groups  $G_1, G_2, G_3$  and  $G_4$  should be in the ratio 9:3:3:1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? (5)

(b) Let two dice be thrown at random. Let  $X$  be the discrete random variable that assigns to each point  $(a, b)$  the minimum of its numbers. Find probability distribution function of  $X$ . (5)

(c) Solve the following system by Gauss-seidal method upto third iteration.

$$8x - 3y + 2z = 20, 6x + 3y + 12z = 5, 4x + 11y - z = 33. \quad (5)$$

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