

This question paper contains 7 printed pages]

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S. No. of Question Paper : 7916

Unique Paper Code : 1091101

F-1

Name of the Paper : Mathematics and Statistics for Business (DC-1.1)

Name of the Course : Bachelor of Management Studies

Semester : I

Duration : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Question 1 is compulsory.

Attempt any five questions out of the remaining six questions (Q. No. 2–Q. No. 7)

Use of non-programmable calculators is allowed.

1. (a) The equilibrium conditions for three related commodities are given by :

$$11P_1 - P_2 - P_3 = 31$$

$$-P_1 + 6P_2 - 2P_3 = 26$$

$$-P_1 - 2P_2 + 7P_3 = 24$$

Using matrix inversion, find the equilibrium prices for each commodity.

P.T.O.

- (b) Approximate the function, $y = \frac{1}{\sqrt{1+x}}$, by a linear function, x is approximately equal to "0".
- (c) For a group of 200 candidates, the mean and standard deviation of scores were found to be 40 and 15 respectively. Later on it was discovered that the scores 43 and 35 was misread as 34 and 53 respectively. Find the correct mean and standard deviation corresponding to the corrected figures.
- (d) Find Karl Pearson's coefficient of correlation between capital employed and profit obtained from the following data and comment :

Capital employed	Profits obtained
(Rs. Crore)	(Rs. Crore)
10	2
20	4
30	8
40	5
50	10
60	15

70	14
80	20
90	22
100	50

- (e) A manufacturer of sports equipment has developed a new synthetic fishing line that he claims has a mean breaking strength of 8 kilograms with a standard deviation of 0.5 kilogram. Test the hypothesis that $\mu = 8$ kilograms against the alternative that $\mu \neq 8$ kilograms if a random sample of 50 lines is tested and found to have a mean breaking strength of 7.8 kilograms. Use a 0.01 level of significance. 5×5=25

2. (a) Determine the value(s) of λ so that the following system of equations is consistent using rank method :

$$3x - y + 4z = 3$$

$$x + 2y - 3z = -2$$

$$6x + 5y - \lambda z = -3$$

P.T.O.

- (b) Test the function for $y = x^4 - 6x^2 + 5x - 6$ for concavity and points of inflexion.

Or

Find the minimum value of $z = 3x + 4y$ subject to the constraint $x^2 + y^2 = 9$.

5×2=10

3. (a) If $u = \log\left(\frac{x^3 + y^3}{x + y}\right)$, then find the value of $x(\partial u / \partial x) + y(\partial u / \partial y)$.

- (b) The total cost C , of purchasing x litres of diesel is given by the Cost function :

$$C(x) = \begin{cases} 9x, & \text{when } 0 \leq x \leq 50 \\ 150 + 6x, & \text{when } 50 < x \leq 100 \\ 300 + 5x, & \text{when } x > 100 \end{cases}$$

Is the cost function continuous at $x = 50$ and $x = 100$?

5×2=10

4. (a) A manufacturing firm produces steel pipes in three plants with daily production volumes of 500, 1,000 and 2,000 units respectively. According to past experience it is known that the fractions of defective output by the three plants are respectively 0.005, 0.008 and 0.010. If a pipe is selected from a day's total production and found to be defective.

Find out what is the probability that it came from the first plant ?

(b) Let X be a random variable with probability density

$$f(x) = \begin{cases} c(4x - 2x^2) & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$

(i) What is the value of c ?

(ii) $P[(1/2) < x < (3/2)] = ?$

Or

The joint probability distribution of a pair of random variables is given by the following

table :

X→ Y↓	1	2	3
1	1/12	1/6	0
2	0	1/9	1/5
3	1/18	1/4	2/15

Evaluate :

(i) The marginal probability of X.

(ii) Conditional probability mass function of Y given $X = 2$.

5×2=10

P.T.O.

- No error*
5. (a) A prisoner is trapped in a cell containing three doors. The first door leads him to a tunnel that returns him to his cell after two days of travel. The second leads to a tunnel that returns him to his cell after three days of travel. The third door leads immediately to freedom. Assuming that the prisoner will always select doors 1, 2 and 3 with probabilities 0.5, 0.3, 0.2, what is expected number of days until he reaches freedom ?
- (b) On the average, one in 400 items is defective. If the items are packed in boxes of 100, what is the probability that any given box of items will contain :
- (i) no defectives
- (ii) less than two defectives. $5 \times 2 = 10$
6. (a) Let X be the number of times that a fair coin, flipped 40 times, lands heads. Find the probability that $X = 20$. Use the normal approximation and compare it to exact solution.
- (b) Suppose we know that the number of items produced in a factory during a week is a random variable with mean 500. If the variance of a week's production is known to equal 100, then what can be said about the probability that this week's production will be between 400 and 600 ? $5 \times 2 = 10$

7. (a) A random sample of size 16 has 53 as mean. The sum of the squares of the deviations taken from mean is 150. Can this sample be regarded as taken from the population having 56 as mean ? Use 1% level of significance.
- (b) State the Central Limit Theorem. The lifetime of a special type of battery is a random variable with mean 40 hours and standard deviation 20 hours. A battery is used until it fails, at which point it is replaced by a new one. Assuming a stockpile of 25 such batteries, the lifetimes of which are independent, approximate the probability that over 1100 hours of use can be obtained.

Or

Define the following terms :

- (i) Statistic;
- (ii) Level of significance.

5×2=10