

[This question paper contains 10 printed pages.]

1956

Your Roll No. ....

MIB / I Sem.

A

Course 512 – Business Statistics

(Admissions of 2004 and onwards)

Time : 3 hours

Maximum Marks : 70

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

Attempt all questions.

1. Answer the following questions : (2×10=20)
- (a) State Chebyshev's theorem.
  - (b) What is the essence of the statistical process control ?
  - (c) Draw two regression lines when correlation between the two variables is zero.
  - (d) What is the skewness and kurtosis of the normal distribution ?
  - (e) What is known as sampling design ?
  - (f) State Conditional theorem of probability.
  - (g) How chi -quare distribution is related to a standard normal distribution ?

P.T.O.

- (h) What is p chart ?
- (i) What is central limit theorem ? What is its significance ?
- (j) When a process is said to be out of control ?
2. (a) A factory has two machines A and B. Past records show that machine A produces 30% of the total output and machine B the remaining 70%. Machine A produces 5% defective articles and machine B 1% defective items. An item is drawn at random and found to be defective. What is the probability that it was produced by (i) machine A (ii) machine B. (3+3)
- (b) Eight coins are thrown simultaneously. Calculate the probability of obtaining at least 6 heads. (6)
- (c) What is a standard normal variable ? (1)

OR

- (a) A, B and C in order toss a coin. The first one who throws a head wins. What are their respective chances of winning ? (6)
- (b) Assume the mean height of soldiers to be 68.22 inches with variance of 10.8 inches. How many soldiers in a regiment of 1000 would you expect to be over six feet tall ? (6)

- (c) Prove that the variance of binomial distribution is less than its mean. (1)
3. (a) A random sample of 25 employees has a mean weekly wage of Rs. 130. Could this sample have been drawn from a population normally distributed about a mean of Rs. 120 with a standard deviation of Rs. 10 ? (6)
- (b) Given that the standard deviation of metropolitan rents derived from a pilot survey is Rs. 9.50, what sized sample should be taken to ascertain the mean level of metropolitan rents, so that we shall be 95% confident that the population mean rent lies within 50 paise either way of the sample mean. It is stated that the population consists of 10,000 rents. (6)

**OR**

- (a) A social-service agency in a local government is interested in estimating the mean annual income of 700 families living in a four-square-block section of a community. A simple random sample of size 50 reveals the sample mean to be Rs. 11,800 and sample standard deviation to be Rs. 950. The agency asks you to calculate a 80% and 95% confidence interval estimate of the mean income of the families in the population. (3+3)

- (b) It is intended to poll students in a certain University in order to determine what proportion of them is in favour of new grading system. Please determine a sample size that will enable the investigator to be 90% certain of estimating the true proportion of the population of students that is in favour of the new grading system within plus and minus 0.02. (6)

4. (a) A Health Care Company samples its hospital employees' attitudes towards job-performance reviews in four regions of India. Respondents are given a choice between the present method and a proposed new method.

	North	South	East	West
Number who prefer present method	68	75	57	79
Number who prefer new method	32	45	33	31

Test whether attitude about performance reviews is independent of geography. (6)

- (b) A wholesaler sells strawberries, which have very limited useful life. If not sold on the date of delivery, it is useless. One pack of strawberries costs Rs. 20 and the wholesaler receives Rs. 50

for it. The analysis of past records of sale by the wholesaler is given below.

Sales during 100 days

Daily sales *	No. of days sold
10	15
11	20
12	40
13	25

- (i) Derive the conditional profit table.
- (ii) Calculate the expected profit table.
- (iii) What is the optimal-stock option. (3×2)

**OR**

- (a) After collecting data on the amount of air pollution in a city, the concerned environmental protection agency decided to issue strict new rules to govern the amount of hydrocarbons in the air. For the next year, it took monthly measurements of this pollutant and compared them to the preceding year's measurements for the corresponding months. Based on the following data, does the agency have enough evidence to conclude with 95 percent confidence that the new rules were effective in lowering the amount of hydrocarbons

in the air ? To justify these laws for another year, it must conclude at 10 % level of significance that they are effective. Will these laws still be in effect next year ?

Months of the Year	Units of Measurement*	
	Last year	This year
Jan.	7.0	5.3
Feb.	6.0	6.1
Mar.	5.4	5.6
April	5.9	5.7
May	3.9	3.7
June	5.7	4.7
July	6.9	6.1
Aug.	7.6	7.2
Sep.	6.3	6.4
Oct.	5.8	5.7
Nov.	5.1	4.9
Dec.	5.9	5.8

\*Measured in parts per million. (6)

- (b) The manager of a food-stall has introduced a new item of food delicacy. He has calculated that the cost of manufacture is Rs. 1 per piece and it would

sell for Rs. 3 per piece. It is however perishable and: any unsold goods at the end of the day are a dead loss. He expects the demand to be variable and has drawn up the following probability distribution.

No. of piece demanded	10	11	12	13	14	15
Probability	.07	.10	.23	.38	.12	.10

How many pieces should be manufactured so that his net expected profit is maximum. (6)

5. (a) What is the major limitation of the simple regression model? (1)
- (b) The following tables reports data on three variables,  $X_1$ ,  $X_2$  and  $Y$ .

$X_1$	45	42	44	45	43	46	44	45	44	43
$X_2$	16	14	15	13	13	14	16	16	15	15
$Y$	29	24	27	25	26	28	30	28	28	27

Calculate the multiple regression equation of  $Y$  on  $X_1$  and  $X_2$ . (6)

- (c) The following table gives the inspection data on 2000 spark plugs in 20 lots of 100 each

Lot Number	Number of Defectives
1.	5
2.	10
3.	12
4.	8
5.	6
6.	5
7.	6
8.	3
9.	3
10.	5
11.	4
12.	7
13.	8
14.	2
15.	3
16.	4
17.	5
18.	8
19.	6
20.	10



- (i) Calculate the lower and upper control limits  
(ii) Construct a p-chart. (4+2)

## OR

- (a) The following constants are obtained from measurement on length in mm. ( $X_1$ ), volume in cc ( $X_2$ ), and weight in gms. ( $X_3$ ) of 300 eggs.

Mean of  $X_1 = 55.95$ , Std. Dev. of  $X_1 = 2.26$ ,  
Correlation coefficient between and  $X_1$  and  
 $X_2 = 0.578$

Mean of  $X_2 = 51.48$ , Std. Dev. of  $X_2 = 4.39$ ,  
Correlation coefficient between and  $X_1$  and  
 $X_3 = 0.581$

Mean of  $X_3 = 56.03$ , Std. Dev. of  $X_3 = 4.41$ ,  
Correlation coefficient between  $X_2$  and  $X_3 = 0.974$

Obtain the linear regression equation of egg weight  
on egg length and egg volume. (6)

- (b) Apollo Tyre Company sells tyres with a 50,000-mile tread-life warranty. Mr. X, a quality control engineer with the company, runs simulated road test to monitor the life of the life of the output. From each of the last 12 batches of 1,000 tyres, he has tested 5 tyres and recorded the following

results, with mean and range measured in thousands of miles:

Batch	1	2	3	4	5	6	7	8	9	10	11	12
Mean	50.5	49.7	50.0	50.7	50.7	50.6	49.8	51.1	50.2	50.4	50.6	50.7
Range	1.1	1.6	1.8	0.1	0.9	2.1	0.3	0.8	2.3	1.3	2.0	2.1

- (i) Use the data above to help construct a mean chart? (5)
- (ii) Is the production process in control? (1)
- (c) Is it possible for regression coefficients be of opposite sign? (1)