2008

COMMERCE

(*Statistical Analysis*)

PAPER—IV

Full Marks : 100

Time : 4 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustarete the answers wherever necessary

FIRST HALF

(*Basic Statistics*)

[*Marks* : 50]

Answer **Q.No.1** and *two* from the rest taking *one* from each Group

1. Answer any *four* of the following :   5 × 4

(*a*) Briefly explain the Relative Frequency approach of probability. What are its limitations ?

(b) A bag contains 3 red, 6 white and 7 blue balls. If two balls are drawn at random, find the probability that one is red and one is blue.

(c) In each of the following cases, indicate the correct answer :

(i) If two regression coefficients are b_2 and b_1 then the correlation coefficient r is

(A) b_1 / b_2

(B) b_2 / b_1

(C) $b_1 b_2$

(D) $\sqrt{b_1 b_2}$.

(ii) The farther the two regression lines cut each other,

(A) the greater will be the degree of correlation

(B) the lesser will be the degree of correlation

(C) does not matter.

(*iii*) If one regression coefficient is greater than unity, then the other must be

  (*A*) greater than first one

  (*B*) equal to unity

  (*C*) less than unity

  (*D*) equal to zero.

(*iv*) When the correlation coefficient $r = \pm 1$, then two regression lines

  (*A*) are perpendicular to each other

  (*B*) are parallel to each other

  (*C*) coincide

  (*D*) None of them.

(*v*) The two regression lines are given as $X + 2Y - 5 = 0$ and $2X + 3Y = 8$. The mean values of X and Y are respectively

  (*A*) 2, 1

  (*B*) 1, 2

  (*C*) 2, 5

  (*D*) 2, 3.

(d) Explain the following terms :

    (i) Spurious correlation

    (ii) Partial regression coefficient.

(e) (i) Write the special feature of seasonal variation in time series analysis.

    (ii) A Large company estimates its average monthly sales in a year to be Rs. 2,00,000. The seasonal indices of the sales data for the first three months are as follows :

Month	January	February	March
Seasonal Index	76	98	128

    Calculate the estimated monthly sales of the company for the above three months.

(f) From the following data of wholesale prices of wheat for the five years construct index numbers by Chain base method :

Year	Price of wheat (Rs. per 40 kg)
2003	50
2004	60
2005	65
2006	78
2007	88

(Continued)

(g) With a view to study whether the working condition in a factory had any influence on the frequency of accidents, a researcher collected and tabulated the accident data as follows :

Working condition	No. of accidents		
	Less	More	Total
Good	280	80	360
Bad	120	120	240
Total	400	200	600

Using Yule's method, calculate the co-efficient of association between the number of accidents and the working condition in the factory. What inference would you draw from the result ?

(h) If $\delta = (AB) - (AB)_0$, then with usual notations, prove that

$$\delta = \frac{1}{N}[(AB)(\alpha\beta) - (A\beta)(\alpha B)].$$

GROUP—A

Answer any *one* question

2. (a) If two events A and B are independent, show that events $\bar{A}$ and $\bar{B}$ are also independent.

   (b) 6 friends are going to Darjeeling for a pleasure trip by Darjeeling Mail. They have reserved six berths for their journey and at night they took their berths at random. Find the probability that

   (i) None of them is in his own berth.

   (ii) Exactly two of them are in thier own berth.

   (c) A consignment of 15 CDs contains 4 defectives. If they are examined one after one randomly (without replacement) then what is the probability that the 9th one examined is the last defective ? $4 + 5 + 6$

3. (a) Deduce Spearman's formula for rank correlation coefficient.

   (b) Show that Spearman's rank correlation coefficient (r_R) lies between - 1 and + 1 .

(Continued)

(c) Given that the means of X and Y are 65 and 67. Their standard deviations are 2·5 and 3·5 respectively and the coefficient of correlation between them is 0·8. Write down the two regression lines. $6 + 4 + 5$

GROUP—B

Answer any *one* question

4. (a) Illustrate the trend component in Time Series analysis.

   (b) The annual revenue expenditure (in Rs. crores) of Govt. of India is given below for 6 successive years :

Year	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Revenue Expenditure	220	240	265	295	400	550

   Fit a linear trend by the method of least squares and estimate the expenditure for the year 2008-09. $4 + 11$

5. (a) Show that Edgeworth-Marshall's formula lies between Laspeyres' and Paasche's formulae.

(b) Discuss the different tests of consistency in the selection of an appropriate index formula. Verify whether Fisher's ideal index formula does satisfy such tests. $5 + (5 + 5)$

SECOND HALF

(*Advanced Business Statistics*)

[*Marks*: 50]

Answer Q.No.6 and any *two* from the rest

6. Answer any *four* of the following : 5×4

(a) The mean of a Poisson distribution is 8. Find its first four central moments and comment on the skewness and Kurtosis of this distribution.

(b) In an examination, there are 20 multiple choice questions. Each question has four alternative answers, out of which one is correct. Four marks are given for every correct answer and one mark is deducted for every wrong answer. A student must secure at least 50% marks to qualify the examination. Suppose that a student has not studied at all and he decides to select the answers on a random basis. Find the probability that he will pass the examination.

(*Continued*)

(c) What do you understand by Statistical Quality Control? What are its advantages?

(d) Write down the advantages of Non-Parametric test over the Parametric test.

(e) A random sample of 9 Boys and 7 Girls are drawn from a group of students. The time taken (in minutes) to solve a statistical problem by them is recorded:

Boys: 18 20 36 50 49 36 34 49 41

Girls: 29 28 26 35 30 44 46

Assuming the distribution of time taken by Boys and Girls are normal, test the hypothesis that $\sigma_1^2 = \sigma_2^2$ against the alternative $\sigma_1^2 \neq \sigma_2^2$ at 2% LOS.

[Given: $F_{0.01;(8,6)} = 6.37$ and $F_{0.01;(6,8)} = 8.10$

(f) Write a brief note on Systematic Sampling.

(g) Distinguish between:

(i) Null hypothesis and Alternative hypothesis

(ii) Type I and Type II errors.

(*h*) Explain the general procedure to draw a control chart.

7. (*a*) Derive first four raw moments of the Binomial distribution and hence find its skewness and Kurtosis.

(*b*) Suppose that the chance of an individual coal-miner being killed in a mine accident during a year is $\frac{1}{1400}$. Use the Poisson distribution to calculate the probability that in the mine employing 350 miners, there will be at least one fatal accident in a year.

[Given $e^{-0.25} = 0.78$] 9 + 6

8. (*a*) The R.T.O. of certain district claims that on an average cars are driven 2000 km. per month. A random sample of 100 car owners are asked to keep a record of kilometers they drive their cars. On the basis of the sample record it is found that on an average cars were driven for 2200 km. per month with a S.D. of 600 kms. Do the sample data support the claim of R.T.O. ? Use $\alpha = 0.05$.

(b) Ten samples of size 5 each are drawn at regular intervals from a manufacturing process. The sample means ($\bar{x}$) and their ranges (R) are given below :

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean ($\bar{x}$)	49	45	48	53	39	47	46	39	51	45
Range (R)	7	5	7	9	5	8	8	6	7	6

Draw the control charts for Mean ($\bar{x}$) and Range (R) and comment on the state of control.

[Conversion factor for $n = 10$ are $A_2 = 0.31$, $D_3 = 0.22$, $D_4 = 1.78$ and for $n = 5$ are $A_2 = 0.58$, $D_3 = 0$, $D_4 = 2.11$].

$5 + 10$

9. (a) A marketing agency gives you the following information about the age groups of the sample informants and their liking for a particular model of bike which a company plans to introduce :

	Age Group of Informants			
	below – 25	25 – 39	40 – 55	Total
Liked	130	410	60	600
Disliked	70	230	100	400
Total	200	640	160	1000

One the basis of the above data, can it be concluded that the model appeal is independent of age group?

$$[\text{Given } \chi^2_{0.05,2} = 5.99]$$

(b) Eleven school boys were given a test in geometry. They were given a month's of tution and a second test was held at the end of it. Do the marks give evidence that the students have benefited by the extra coaching?

Boys	Marks (1st test)	Marks (2nd test)
1	23	24
2	20	19
3	19	22
4	21	18
5	18	20
6	20	22
7	18	20
8	17	20
9	23	23
10	16	20
11	19	17

$$[\text{Given } t_{0.05,10} = 1.812]$$

8 + 7

(*Continued*)

10. (a) Explain what is meant by 'sampling fluctuation' and 'sampling distribution' of a statistic.

(b) Discuss the properties of the Maximum Likelihood Estimator.

(c) Deduce the maximum likelihood estimators of the parameters of normal distribution.   4 + 4 + 7

———