

2007**COMMERCE****(Statistical Analysis)****PAPER—IV***Full Marks : 100**Time : 4 hours**The figures in the right-hand margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.**Illustrate 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) Define the axiomatic approach of probability. Show that the classical definition of probability is a special case of the axiomatic approach.
- (b) There are 4 boxes containing one dozen eggs each. They contain 2, 3, 1, 0 spoiled eggs respectively. One box is selected at random and then an egg is taken at random. What is the probability that the egg is spoiled ?

(Turn Over)

(c) The coefficient of rank correlation of the marks detained by 10 students in statistics and Accountancy was found to be 0.8. It was later discovered that the difference in rank in two subjects obtained by one of the students was wrongly taken as 7 instead of 9. Find the correct coefficient of rank correlation.

(d) Prove that the residual variance —

$$\text{Var}(e) = S_y^2 (1 - r^2)$$

(e) There were 400 students in M.Com. in Calcutta University. Their results in various terminal examinations are given below :

180 passed in first terminal

140 passed in second terminal

180 passed in third terminal

60 passed in all terminals

80 failed in all terminals

40 passed in the first and second terminals but failed in the third terminal, 70 failed in the first and second terminals but passed in the third terminal.

Find out how many students passed at least two examinations using Association of Attribute concept.

(f) (i) Convert the following into annual trend equation :

$$y = 100 + 2.5t \text{ (origin : January 2006)}$$

t unit = 1 month

y unit = monthly production
in tons)

(ii) Given the equation

$$y = 50(2.5)^t \text{ (origin : year 2006)}$$

t unit = 1 year)

Shift the origin backward by 2 years.

(g) Prove that $\frac{L(P)}{L(Q)} = \frac{P(P)}{P(Q)} = \text{Von}$

where $L(P)$ denotes Laspayers Price Index,
 $L(Q)$ denotes Laspeyers Quantity Index,
 $P(P)$ denotes Paasches Price Index,
 $P(Q)$ denoted Paasches quantity Index and
 Von denotes Value Index.

(h) 100 cricketers appeared in a trial match and 30 of them were successful, 23 cricketers received special coaching and out of them 12 cricketers were successful. Compute Yule's coefficient of colligation.

Group—A

Answer any one questions.

2. (a) State the prove Bayes' theorem of probability.
 (b) Two boxes contain respectively 4 white and 2 black, and 1 white and 3 black balls. One ball is transferred from the first box into the second, and then one ball is drawn from the latter. It turns out to be black. What is the probability that the transferred ball was white? 8+7
3. (a) "A correlation coefficient of 0.5 does not mean that 50% of the data are explained"— comment.
 (b) For calculation of correlation coefficient for 3 variables x_1 , x_2 and x_3 , the following data are obtained :
- $r_{12} = 0.6, \quad r_{23} = 0.8, \quad r_{31} = -0.5$
- Are the above date consistant ?

- (c) In a three-variate multiple correlation analysis, the following results were found :

$$\bar{x}_1 = 6.8, \bar{x}_2 = 7, \bar{x}_3 = 74,$$

$$\sigma_1 = 1, \sigma_2 = 0.8, \sigma_3 = 9,$$

$$r_{12} = 0.6, r_{13} = 0.7, r_{23} = 0.65,$$

(The symbols have their usual significance).

Obtain the multiple regression equations. Also estimate the value of x_3 when $x_1 = 4$ and $x_2 = 8$.

3+4+8

Group—B

Answer any one question.

4. (a) Which characteristic movement of a time series would you find in the following cases? Give reasons.
- increasing demand of management courses in West Bengal.
 - increasing demand of mobile phones,
 - increase in payments of life insurance premium during last quarter of financial year.
- (b) From the data given below you are required to find out the seasonal variations under
- the method of ratio to trend and
 - the method of deviation from trend.

6+9

Year Quarter	Profit (Rs.'000)		Trend Values (Rs.'000)	
	2005	2006	2005	2006
I	125	213	120	180
II	104	176	125	185
III	101	163	130	190
IV	95	151	135	195

5. (a) A Price Index number was started in 1996 as base. By 2000 it rose by 30%. The link relative for 2001 was 90. In this year a new series was started. This new series rose by 10 points by next year. But during next four years the rise was not rapid. During 2006 the price level was only 8% higher than 2004 and in 2004 they were 5% higher than 2002.

Splice the two series and calculate the index numbers for the various years by shifting the base of 2002.

- (b) Suppose $x_i =$ Price relative $= \frac{P_{1i}}{P_{0i}}$, $y_i =$ Quantity relative $= \frac{Q_{1i}}{Q_{0i}}$, $V_{01} =$ Value Index number $= \frac{\sum P_{1i} Q_{1i}}{\sum P_{0i} Q_{0i}}$ and $w_i =$ weights of x_i and $y_i = P_{0i} Q_{0i}$ [where $i = 1, 2, \dots, n$]

Show that $\frac{P_{01}^L}{P_{01}^P} = 1 - \frac{\sigma_{xy} \sigma_x \sigma_y}{V_{01}}$; where σ_{xy} is the weighted co-rrrelation co-efficient between x and y , σ_x and σ_y are the weighted. Weighted standard deviation of x and y respectively. Deduce the condition under which Laspepers Price Index (P_{01}^L) is greater than, equal to or less than Paasches price index (P_{01}^P). 7+8

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) Show that the Poisson distribution is a limiting case of Binomial distribution.

- (b) Write down the basic steps to be followed for test of significance.
- (c) Draw a random sample of size 10 (without replacement) from the following data, stating clearly the procedure followed by you :

45	24	43	17	5	28	27	21	11	46	
33	26	24	14	34	21	25	48	35	38	
26	27	35	8	30	26	30	28	21	27	
20	13	23	36	38	20	25	31	24	18	12

Use the random sampling numbers given below :

5967	8941	7989	3335	7577	9735
3042	8409	7053	5364	5872	1143

- (d) What do you mean by a 'statistic' and its 'standard error'? Give expression of the standard error of sample mean.
- (e) The probability of a bomb hitting a target is $2/5$. Four direct hits are necessary to destroy a damaged bridge completely. If six bombs are aimed at the bridge, what is the probability that the bridge will be destroyed?
- (f) A sample of 600 screws is taken from a large consignment and 75 are found to be defective. Estimate the percentage of defective screws in the whole consignment and assign limit at 95% confidence, within which the percentage lies.
- (g) Point out the main indications about lack of control of a production process, by a control chart.
- (h) Distinguish between—
- Point estimation and Interval estimation,
 - One-tailed test and two-tailed test.
7. (a) Find the Moment Generating Function of Normal distribution. Hence derive its mean, variance, skewness and kurtosis.

- (b) There are 600 Commerce students in the post graduate classes of a university, and the probability for any student to need a copy of a particular book from the university library on any day is 0.05.

How many copies of the book should be kept in the university library so that the probability may be greater than 0.90 that none of them needing a copy from the library will come back disappointed?

(use Normal approximation to the Binomial distribution) 9+6

8. (a) State the 'method of maximum likelihood' for the estimation of unknown parameters.
- (b) Estimate the Poisson parameter λ with the help of maximum likelihood estimation method.
- (c) Distinguish between 'simple random sampling' and 'stratified random sampling'. 4+6+5
9. (a) The following table gives the number of air craft accidents that occurred during the various days of the weeks. Find whether the accidents are uniformly distributed over the week.

Days	: Sun.	Mon.	Tue.	Wed.	Thus.	Fri.	Sat.
Number of Accident	: 14	16	8	12	11	9	14

$$\left[\text{Given } X_{0.05, 7}^2 = 14.07; X_{0.05, 6}^2 = 12.59 \right]$$

- (b) A television producer of a farming show believes that the show is more popular with rural viewers than with urban viewers. To test this claim a TV station showed this programme to 300 rural viewers and 100 urban viewers. It was noted that 65 of the rural viewers and 18 of the urban viewers enjoyed the programme. Test whether the producer's claim is correct at $\alpha = 0.01$

8+7

10. (a) A student with BBA degree applied to several universities for admission into MBA programme in Finance. He got chance in three universities.

Before deciding which university to join, he wants to know about the starting salary of qualified students from these three institutions. A random survey of starting salary (in Rs. '000 per month) of some qualified students of each of the three universities A, B and C was taken and the results are recorded as follows :

University-A	University-B	University-C
41	45	37
37	43	37
39	45	35
42	40	35
45	42	34
40	41	30
	43	37
		40

Is there any evidence of difference in the average starting salary of MBA qualified from these three universities? Test at 99% confidence.

[Given $F_{0.01; (2,18)} = 6.01$]

- (b) Distinguish between 'Chance cause' and 'assignable cause' of deviations in quality of manufactured product, in the context of SQC. 10+5