T 6051

M.B.A. DEGREE EXAMINATION, APRIL/MAY 2004

First Semester

BA 100 — STATISTICS FOR MANAGEMENT

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

Use of calculator and statistical tables is permitted.

PART A — (10 × 2 = 20 marks)

1. Define the following terms :

   (a) Sampling distribution   — Unit-2

   (b) Standard error.   — Unit- 2

2. In measuring reaction time, a psychologist estimates that the standard deviation is 0.05 seconds. How large a sample of measurements must be taken in order to be 95% confident that the error of his estimate will not exceed 0.01 seconds? Unit 2

3. If $x_1, x_2, \cdots, x_n$ is a random sample from a normal population $N(\mu, 1)$, then prove that $t = \dfrac{1}{n}\sum_{i=1}^{n} x_i^2$, is an unbiased estimator of $\mu^2 + 1$. — Unit 2

4. Given that $n_1 = 400; \bar{x}_1 = 250, s_1 = 40$ for one sample and $n_2 = 400, \bar{x}_2 = 220, s_2 = 55$ for another sample, find the standard error of $\bar{x}_1 - \bar{x}_2$. Unit - 3

5. What are the uses of χ^2 test? Unit-4

6. What are the assumptions on which the F–test is based? — Unit- 3

7. Write short note on "Kruskal–Wallis test". Unit- 4

8. If the equations of the regression lines are $x + 2y = 5$ and $2x + 3y = 8$, find the correlation coefficient between x and y. Unit- 5

9. Explain the following terms :

   (a) Cyclical fluctuations *Unit 5*

   (b) Seasonal variations.

10. In a regression problem with a sample size of 17, the slope was found to be 3.73 and the standard error of estimate 28.654. The quantity $\left(\Sigma X^2 - n\overline{X}^2\right) = 871.56$. Find the 98% confidence interval for the population slope.

PART B — (5 × 16 = 80 marks)

11. (i) 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. (8) *Unit 2*

    (ii) Two machines are used for filling plastic bottles with a net volume of 16.0 ounces. The fill volume can be assumed normal with standard deviation $\sigma_1 = 0.020$ and $\sigma_2 = 0.025$ ounces. A member of the quality engineering staff suspects that both machines fill to the same net volume, whether or not this volume is 16.0 ounces. A random sample of 10 bottles is taken from the output of each machine. *Unit 2*

    M/C I : 16.03 16.04 16.05 16.05 16.02 16.01 15.96 15.98 16.02 15.99

    M/C II : 16.02 15.97 15.96 16.01 15.99 16.03 16.04 16.02 16.01 16.00

    Do you think the engineer is correct? Use $\alpha = 0.05$. (8)

12. (a) Discuss in detail the chief characteristics of normal distribution and normal probability curve. (16) *Unit 1*

    Or

    (b) (i) A civil engineer is analysing the compressive strength of concrete. Compressive strength is approximately normally distributed with variance $\sigma^2 = 1000$ (psi)². A random sample of 12 specimens has a mean compressive strength of $\overline{x} = 3250$ psi. Construct a 95% two sided confidence interval on mean compressive strength. (8) *Unit 2*

(ii) The fraction of defective product produced by two production lines is being analysed. A random sample of 100 units from line 1 has 10 defectives. While a random sample of 120 units from line 2 has 25 defectives. Find a 99% confidence interval on the difference in fractions defective produced by the two lines. (8)

unit-1 probably

13. (a) (i) 4 coins were tossed 160 times and the following results were obtained :

No. of heads :	0	1	2	3	4
Observed frequencies :	17	52	54	31	6

unit-1

Under the assumption that coins are balanced, find the expected frequencies of setting 0, 1, 2, 3 and 4 heads and test the goodness of fit. (8)

(ii) Two samples are drawn from two normal populations. From the following data, test whether the two samples have the same variance at 5% level : (8)

Sample 1 : 60 65 71 74 76 82 85 87

Sample 2 : 61 66 67 85 78 63 85 86 88 91

unit-3

Or

(b) 10 varieties of wheat are grown in 3 plots each and following yields in quintals, per acre, obtained :

Plots Variety	1	2	3	4	5	6	7	8	9	10
I	7	7	14	11	9	6	9	8	12	9
II	8	9	13	10	9	7	13	13	11	11
III	7	6	16	11	12	5	12	11	11	11

unit-4

Test the significance of the differences between variety yields at 1% level. (16)

14. (a) (i) The nicotine content of two brands of cigarettes measured in Milligrams, was found to be as follows :

Brand A : 2.1 4.0 6.3 5.4 4.8 3.7 6.1 3.3

Brand B : 4.1 0.6 3.1 2.5 4.0 6.2 1.6 2.2 1.9 5.4

unit-2

Use the rank-sum test, test the hypothesis, at the 0.05 level of significance, that the average nicotine contents of the two brands are equal against the alternative that they are unequal. (8)

(ii) The following are ratings of aggressiveness (X) and amount of sales (Y) in the last year for eight salespeople. Is there a significant rank correlation between the two measures? Use the 0.10 significance level. (8)

X :	30	17	35	28	42	25	19	29
Y :	35	31	43	46	50	32	33	42

unit-5

Or

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(b) Three different brands of king–size cigarettes were tested for tar content in a pack of 10 cigarettes. The tar content in Milligram for the three brands is found as in the following table. Using Kruskal–Walli's test, verify that $\alpha = 0.05$ level of significance that there is no significant difference in the three brands of cigarettes in terms of the tar content.

	X	Y	Z
1	10	16	12
2	14	13	14
3	13	11	10
4	11	14	17
5	12	10	11

unit–4

15. (a) The following data relate to marketing expenditure (Rs. lac) and the corresponding sales (in Rs. crores) :

Marketing expenditure :	10	12	15	20	23
Sales :	14	17	23	21	35

– unit5

Estimate the marketing expenditure to obtain a sales target of Rs. 40 crores.

Or

(b) The prices of a commodity during 1993–98 are given below :

Fit a parabola $y = a + bx + cx^2$ to these data. Estimate the price of the commodity for the year 1999.

Year :	1993	94	95	96	97	98
Prices :	100	107	128	140	181	192

– unit5

Also plot the actual and trend values on the graph.

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