

**E 8040**

M.B.A. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

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. From a population of 125 items with a mean of 105 and a standard deviation of 17, 64 items were chosen. What is the  $P(107.5 < \bar{X} < 109)$ ? *unit 2*
2. Write the statistical properties of  $t$  distribution. *unit 3*
3. Define Confidence level and precision of estimation. *unit 2*
4. Distinguish between size and power of a Statistical test. *unit - 2*
5. What are the primary shortcomings of non parametric tests? *unit 4*
6. Explain briefly about the Kruskal-Wallis test. *unit 4*
7. An article in Concrete Research presented data on compressive strength  $x$  and intrinsic permeability  $y$  of various concrete mixes and cures. Summary quantities are  $n = 14$ ,  $\Sigma y_i = 572$ ,  $\Sigma y_i^2 = 23530$ ,  $\Sigma x_i = 43$ ,  $\Sigma x_i^2 = 157.42$  and  $\Sigma x_i y_i = 1697.80$ . Assume that the two variables are related according to the simple linear regression model. Calculate the least squares estimates of the slope and intercept. *unit - 3*
8. 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  $(\Sigma x^2 - n\bar{X}^2) = 871.56$ . Find the standard error of the regression slope coefficient. *unit - 3*
9. What are the principal components of a time series? *unit 5*
10. Define : Seasonal variation and cyclical variation. *unit 5*

PART B — (5 × 16 = 80 marks)

11. (i) An article in the Journal of Testing and Evaluation presents the following 20 measurements on residual flame time (in seconds) of treated specimens of children's nightwear :

9.85	9.93	9.75	9.77	9.67
9.87	9.67	9.94	9.85	9.75
9.83	9.92	9.74	9.99	9.88
9.95	9.95	9.93	9.92	9.89

Find a 95% confidence interval on the mean residual flame time. (8)

- (ii) Let  $X_1, X_2, \dots, X_7$  denote a random sample from a population having mean  $\mu$  and variance  $\sigma^2$ . Consider the following estimators of  $\mu$

$$\theta_1 = \frac{X_1 + X_2 + \dots + X_7}{7}, \quad \theta_2 = \frac{2X_1 - X_6 + X_4}{2}$$

Is either estimator unbiased? Which estimator is best? In what sense is it best? (8)

12. (a) (i) Suppose the current measurements in a strip of wire are assumed to follow a normal distribution with a mean of 10 milliamperes and a variance of 4 (milliamperes)<sup>2</sup>. What is the probability that a measurement will exceed 13 milliamperes? What is the probability that a current measurement is between 9 and 11 milliamperes? and determine the value for which the probability that a current measurement is below this value is 0.98. (8)

- (ii) A random sample of 1500 residential telephones in X city in 1990 found that 387 of the numbers were unlisted. A random sample in the same year of 1200 telephones in Y city found that 310 were unlisted. Find a 95% confidence interval on the difference in the two proportions. (8)

Or

- (b) (i) A manufacturer of video display units is testing two micro circuit designs to determine whether they produce equivalent current flow. Development engineering has obtained the following data :

$$\text{Design I : } n_1 = 15, \bar{x}_1 = 24.2, s_1^2 = 10$$

$$\text{Design II : } n_2 = 10, \bar{x}_2 = 23.9, s_2^2 = 20$$

Using 10% level of significance, to determine whether there is any difference in mean current flow between the two designs. Assume that  $\sigma_1^2 \neq \sigma_2^2$ . (8)

- (ii) The cycle time of an automatic machine has been observed and recorded :

Seconds :	2.10	2.11	2.12	2.13	2.14	2.15
Frequency :	16	28	41	74	149	256
Seconds :	2.16	2.17	2.18	2.19	2.29	
Frequency :	137	82	40	19	11	

Does the normal distribution seem to be a reasonable probability model for the cycle time? (8)

13. (a) A research company has designed three different systems to clean up oil spills. The following table contains the results, measured by how much surface area (in square meters) is cleaned in 1 Hour. The data were found by testing each method in several trials. Are the three systems equally effective? Use the 5% level of significance

System A :	55	60	63	56	59	55
B :	57	53	64	49	62	
C :	66	52	61	57		

Or

- (b) (i) A company manufactures rope whose breaking strengths have a mean of 300 lb and a standard deviation of 24 lb. It is believed that by a newly developed process the mean breaking strength can be increased. Design a decision rule for rejecting the old process at the 0.01 significance level if it is agreed to test 64 ropes. (6)

- (ii) A professor has two classes in Statistics : a morning class of 9 students and an afternoon class of 12 students. On a final examination scheduled at the same time for all students, the classes received the marks shown in Table. Can one conclude at the 5% significance level that the morning class performed worse than the afternoon class? Solve a problem using the U test. (10)

Morning class :	73	87	79	75	82	66
Afternoon class :	86	81	84	88	90	85
Morning class :	95	75	70			
Afternoon class :	84	92	83	91	53	84

14. (a) Cost Accountants estimate overhead based on the level of production. At XYZ & Co., they have collected information on overhead expenses and units produced at different plants and want to estimate a regression equation to predict future overhead.

Overhead :	191	170	272	155	280	173	234	116	153	178
Units :	40	42	53	35	56	39	48	30	37	40

- (i) Develop the regression equation for the cost accountants. (10)
- (ii) Predict overhead when 50 units are produced. (2)
- (iii) Calculate the standard error of estimate. (4)

Or

- (b) (i) Find the coefficient of linear correlation between the variables X and Y presented in table : (10)

X:	1	3	4	6	8	9	11	14
Y:	1	2	4	4	5	7	8	9

- (ii) 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  $(\sum X^2 - n\bar{X}^2) = 871.56$ . Construct a 98% confidence interval for the population slope. (6)

- 15. (a) (i) Construct a 4-yearly centered moving average from the following data :

Year :	1991	1992	1993	1994	1995	1996	1997
Sale of computers : (100 units)	129	131	106	91	95	14	93

Also determine the short term fluctuations. (6)

- (ii) Fit a second degree parabola to the following data. Estimate the value for 2000. (10)

Year :	1950	1960	1970	1980	1990
Production : (000 units)	6	8	9	10	12

Or

- (b) (i) Assuming that trend is absent, calculate the seasonal indices for various quarters in the following data : (10)

Year	I Quarter	II Quarter	III Quarter	IV Quarter
1996	37	41	33	35
1997	37	39	36	36
1998	40	41	33	31
1999	33	44	40	40

- (ii) Explain the steps involved in obtaining a seasonal index by the

- (1) Method of simple averages
- (2) Ratio-to-trend Method. (6)

