# Y 7040

M.B.A. DEGREE EXAMINATION, MAY/JUNE 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. Suppose that current measurements in a strip of wire are assumed to follow a normal distribution with a mean of 10 milliamperes and variance of 4 (milliamperes)$^2$. What is the probability that a measurement will exceed 13 milliamperes? Unit-1

2. Differentiate between the point estimate and Interval estimate. Unit-2

3. Define the following terms : Unit-3

   Power of the Hypothesis Test and Standard Error.

4. What are the uses of Chi-Square Test? Unit-4

5. Write short note on "Mann-Whitney Test". - Unit 4

6. A machinist is expected to make engine parts with axle diameter of 1.75 cm. A random sample of 10 parts shows a mean diameter of 1.85 cm with an standard deviation of 0.1 cm. On the basis of this sample, would you say that the work of the machinist is inferior? Unit-3

7. Prove that correlation coefficient is the geometric mean between the regression coefficient and it lies between –1 and +1. Unit-5

8. The lines of regression of $Y$ on $X$ and $X$ on $Y$ are respectively $Y = X + 5$ and $16X - 9Y = 94$. Find the variance of $X$ if the variance of $Y$ is 16. Also find the covariance of $X$ and $Y$. Unit-5

9. Mention the basic elements of a time series. Unit-5

10. Find the weighted moving average of order of the numbers 2, 6, 1, 5, 3, 7 and 2 if the respective weights are 1,4 and 1. - Unit-5

PART B — (5 × 16 = 80 marks)

11. (i) The weight of a sophisticated running shoe is normally distributed with a mean of 12 ounces and a standard deviation of 0.5 ounce.

(1) What is the probability that a shoe weighs more than 13 ounces?

Unit-1

(2) What must the standard deviation of weight be in order for the company to state that 99.9% of its shoes are less than 13 ounces?

(3) If the standard deviation remains at 0.5 ounce, what must the mean weight be in order for the company to state the 99.9% of its shoes are less than 13 ounces?

(ii) At the 0.10 level of significance, can we conclude that the following 400 observations follow a Poisson distribution with mean 3?

Unit-1

| Number of arrivals per hour : | 0 | 1 | 2 | 3 | 4 | 5 or more |
|---|---|---|---|---|---|---|
| Number of Hours : | 20 | 57 | 98 | 85 | 78 | 62 |

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

Unit-3

$$T_1 = \frac{X_1 + X_2 + \cdots + X_7}{7}$$

$$T_2 = \frac{2X_1 - X_6 + X_4}{2}$$

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

(ii) An article in the Journal of Testing and Evaluation (Vol. 10, No. 4, 1982, pp.133) presents the following 20 measurements on residual flame time (in seconds) of treated specimens of children's night wear :

Unit-3

| | | | | |
|---|---|---|---|---|
| 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 |

Assume that residual flame time follows a normal distribution. Find a 95% confidence interval on the mean residual flame time.

Or

(b) (i) 20% of the population of a town is supposed to be rice eaters. At 95% level of confidence, what should be the sample size, so that the sampling error is not more than 5% above or below the true proportion of rice eaters?

Unit-2

(ii) Two independent samples of observations were collected. For the first sample of 60 elements the mean was 86 and the standard deviation 6. The second sample of 75 elements had a mean of 82 and a standard deviation of 9. Using $\alpha = 0.01$, test whether the two samples can reasonably be considered to have come from populations with the same mean.

13. (a) The price of a certain commodity was as certained in each of the four towns A, B, C and D in four quarters of a year. The prices are given below. Are the variations in prices between different towns and in different seasons significant?

| | Towns | | | |
|---|---|---|---|---|
| Quarters | A | B | C | D |
| I | 60 | 50 | 60 | 50 |
| II | 50 | 40 | 65 | 50 |
| III | 45 | 35 | 45 | 50 |
| IV | 65 | 45 | 60 | 70 |

Or

(b) (i) An automotive engineer is investigating two different types of metering devices for an electronic fuel injection system to determine whether they differ in their fuel mileage performance. The system is installed on 12 different cars and a test is run with each metering device on each car. The observed fuel mileage performance data are given the following table. Use the sign test to determine whether the median fuel mileage performance is the same for both devices using 5% level of significance.

| Car : | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Metering Device I : | 17.6 | 19.4 | 19.5 | 17.1 | 15.3 | 15.9 |
| Metering Device II : | 16.8 | 20 | 18.2 | 16.4 | 16 | 15.4 |
| Car : | 7 | 8 | 9 | 10 | 11 | 12 |
| Metering Device I : | 16.3 | 18.4 | 17.3 | 19.1 | 17.8 | 18.2 |
| Metering Device II : | 16.5 | 18 | 16.4 | 20.1 | 16.7 | 17.9 |

(ii) A large hospital hires most of its nurses from the two major Universities in the area. Over the last year, they have been giving a test to the newly graduated nurses entering the hospital to determine which University if either, seems to educate its nurses better. Based on the following scores (out of 100 possible points),

help the personnel office of the hospital determine whether the Universities differ in quality. Use the Mann-Whitney U-test with a 10% level of significance.

| | Test Scores | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| University A : | 97 | 69 | 73 | 84 | 76 | 92 | 90 | 88 | 84 | 87 | 93 | 91 |
| University B : | 88 | 99 | 65 | 69 | 97 | 84 | 85 | 89 | 91 | 90 | 87 | 72 |

14. (a) (i) The following zero-order correlation coefficients are given : $r_{12} = 0.98$, $r_{13} = 0.44$ and $r_{23} = 0.54$. Calculate $R_{1.23}$. (6)

(ii) Calculate the Pearson's coefficient of correlation between the values of $X$ and $Y$ from the data given below : (10)

| | | | | | | |
|---|---|---|---|---|---|---|
| $X$ : | 15 | 16 | 17 | 18 | 19 | 20 |
| $Y$ : | 80 | 75 | 60 | 40 | 30 | 20 |

Or

(b) From the data given below, compute the regression equations by the method of least squares. Plot the two regression lines and from the graph obtain a value of $X$ when $Y$ is 110 and a value of $Y$ when $X$ is 23. Verify the result algebraically

| | | | | | |
|---|---|---|---|---|---|
| $X$ : | 10 | 15 | 35 | 40 | 50 |
| $Y$ : | 100 | 90 | 110 | 80 | 120 |

15. (a) (i) Fit a second degree parabola to the following data. Estimate the value for 2000.

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

(ii) Assuming that trend is absent, calculate the seasonal indices for various quarters in the following data :

| Year | Ist Quarter | IInd Quarter | IIIrd Quarter | IVth Quarter |
|---|---|---|---|---|
| 1996 | 37 | 41 | 33 | 35 |
| 1997 | 37 | 39 | 36 | 36 |
| 1998 | 40 | 41 | 33 | 31 |
| 1999 | 33 | 44 | 40 | 40 |

Or

(b) (i) Explain the following regards to time series analysis :
Cyclical variations and Irregular variations.

(ii) Write the steps involved in obtaining a seasonal index by the Ratio-to-trend and Link relative methods.