**V 2038**

M.B.A. DEGREE EXAMINATION, JANUARY 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. Define Central limit theorem. Unit-2
2. What are the assumptions made when using F distribution? Unit-3
3. Define level of significance. — Unit-3
4. Define point estimate. — Unit-3
5. Explain Type I and Type II error. Unit-3
6. What are the tests used to evaluate goodness-of-fit test? Unit-4
7. Name any three non-parametric test. Unit-4
8. Explain regression. Unit-5
9. Differentiate between population and sample. Unit-3
10. Define standard error. — Unit-5

PART B — (5 × 16 = 80 marks)

11. A quality control engineer in an electronics plant has sampled the output of three assembly lines and recorded the number of defects observed. The samples involve the entire output of the three lines for 10 randomly selected hours from a given week. Do the data provide sufficient evidence to indicate that at least one of the line tends to produce more defects than the others. Test at the 5% level of significance using suitable non-parametric test. **(16)**

| Number of defects | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Line 1 | 6 | 38 | 3 | 17 | 11 | 30 | 15 | 16 | 25 | 5 |
| Line 2 | 34 | 28 | 42 | 13 | 40 | 31 | 9 | 32 | 39 | 27 |
| Line 3 | 13 | 35 | 19 | 4 | 29 | 0 | 7 | 33 | 18 | 24 |

Unit-4

12. (a) The length of the machined part is known to have a normal distribution with a mean of 100 mm and a standard deviation of 2 mm.

Unit-1

(i) What proportion of the parts will be above 103.3. mm?

(ii) What proportion of the output will be between 98.5 and 102 mm?

(iii) What proportion of the parts will be shorter than 96.5 mm?

(iv) If no more than 5% of the parts should be oversized, what specification limit should be recommended? $(4 \times 4 = 16)$

Or

(b) (i) The output voltage of a power source is known to have a standard deviation of 10 V. Fifty readings are randomly selected, yielding an average of 118 V. Find a 95% confidence interval for the population mean voltage. (6)

Unit-2

(ii) Two operators perform the same operation of applying a plastic coating to a part. A random sample of 100 parts from the first operator shows that 6 are non-conforming. A random sample of 200 parts from the second operator shows that 8 are non-conforming. Find a 90% confidence interval for the difference in the proportion of non-conforming parts produced by the two operators. (10)

Unit-2

13. (a) (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 kilograms. Test the hypothesis that $\mu = 8$ kilograms against alternative hypothesis $\mu \neq 8$ 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-3

(ii) A commonly prescribed drug on the market for reliving nervous tension is believed to be only 60% effective. Experimental results with a new drug administered a random sample of 100 adults who were suffering from nervous tension showed that 70 received relief. Is this sufficient evidence to conclude that the new drug is superior to the one commonly prescribed? Use a 0.05 level of significance. (8)

Unit-3

Or

(b) (i) A meteorologist is studying the annual rainfall in a desert region. With all available records the average rainfall is 7.8 cm/year. For the past 5 year rainfall has been 8.0, 6.2, 4.1, 6.9 and 5.6 cm/year. The meteorologist wants to know if the decrease is statistically significant. Use 5% significance level. (8)

Unit-5

(ii) Two quality control engineers want to compare the average strength of a plastic made by similar processes at 2 plants. The processes are well established, and the $\sigma$ values are known. The data is

Unit-3

| Process | $n$ | $\overline{X}$ (kg/cm$^2$) | $\sigma$ (kg/cm$^2$) |
|---|---|---|---|
| 1 | 9 | 39 | 3 |
| 2 | 16 | 35 | 5 |

Are the means equal? Use $\alpha = 0.05$. (8)

14. (a) An information systems company investigated the computer literacy of managers. As a part of their study, the company designed a questionnaire. To check the design of the questionnaire (i.e., its validity), 19 managers were randomly selected and asked to complete the questionnaire. The managers were classified as *A*, *B* and *C* based on their knowledge and experience. The scores appear in the Table below. Is there sufficient evidence to conclude that the mean scores differs for the three groups of managers? Use $\alpha = 0.05$. (16)

Unit-4

Scores

| Level | | |
|---|---|---|
| *A* | *B* | *C* |
| 82 | 128 | 156 |
| 114 | 90 | 128 |
| 90 | 130 | 151 |
| 80 | 110 | 140 |
| 88 | 133 | |
| 93 | 130 | |
| 80 | 104 | |
| 105 | | |

Or

(b) (i) A company has to choose among 3 pension plans. The opinions of a random sample of 500 employees are shown in Table below :

Unit-4

| | Pension Plan | | |
|---|---|---|---|
| Job Classification | 1 | 2 | 3 |
| Salaried workers | 160 | 140 | 40 |
| Hourly workers | 40 | 60 | 60 |

Determine whether the preference of plans is independent of job classification. Use $\alpha = 0.05$. (8)

(ii) A researcher has found over a long period of time that his pressure gauge has a standard deviation of $\sigma = 1$ kg/cm$^2$. In a recent experiment, he recorded the following measurements, 38.5, 41.5, 40, 42.2, 37.8 kg/cm$^2$. Has the pressure gauge altered? Use $\alpha = 0.10$. (8)

15. (a) (i) A technician, is asked to analyze the results of 22 items made in a preparation run. Each item has been measured and compared to engineering specifications. The order of acceptance 'a' and rejections 'r' is

Unit-4

aarrrarraaaaarrarraara

Determine, if this is a random sample. Use $\alpha = 0.05$. (8)

(ii) A new air conditioner company has grown steadily during the past 5 years (Table given below) :

| Year : | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|
| Sales : | 450 | 495 | 518 | 563 | 584 | ? |
| Forecast : | 410 | – | – | – | – | – |

Unit-5

The sales manager had predicted in 1997 that 1998 sales would be 410 air conditioners. Using exponential smoothing with a weight of $\alpha = 0.30$, develop forecasts for 1999 through 2003. (8)

Or

(b) A new variety of tree was planted 6 years ago, and the trunk diameters were taken after each year of growth.

| Year : | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Diameter (cm) : | 1.3 | 2.5 | 3.7 | 5.3 | 6.4 | 7.2 |

Neglect all environmental factors.

Unit-5

(i) Determine the regression line equation

(ii) Estimate the average diameter for 3.5 year old trees

(iii) Calculate the error sum of squares for the regression line.

(iv) The line for a similar tree was found to be $Y = 0.2 + 0.95X$ . Test if the 2 lines have the same intercept at $\alpha = 0.05$. (16)

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