[This question paper contains 8 printed pages.]

Your Roll No

Sr. No. of Question Paper : 5166 **H**

Unique Paper Code : 2922102402

Name of the Paper : Statistics for Business Economics–II

Name of the Course : **B.A. (Hons.) Business Economics (2024)**

Semester : IV

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **all** questions. Choice is available within each question.
3. Use of simple calculator is allowed.
4. Required statistical tables are attached with this paper.

P.T.O.

1. Attempt any **two** questions : (10×2=20)

(a) A certain brand of Sugar is sold in three packs: pack A costing Rs. 30, pack B costing Rs. 50 and pack C costing Rs 80. If 20% of all purchasers choose the pack A, 30% choose the pack B and 50% choose the pack C. Let X and Y denote the package sizes selected by two independently selected purchasers.

(i) Determine the sampling distribution of $\bar{X}$ and calculate $E(\bar{X})$.

(ii) Determine the sampling distribution of the sample variance S^2 and calculate $E(S^2)$.

(b) A random variable X is the number of packages being shipped by a randomly selected customer to a particular shipping facility. Forty five percent of times only a single package is shipped, 30% of times two packages are shipped and 25% of times three packages are shipped. If a sample of two customers is selected such that T_0 is the sample total number of packages shipped independently.

(i) Determine the sampling distribution of T_0.

(ii) Calculate $E(T_0)$ and relate it with the population total.

(c) (i) What is a point estimator? Distinguish between a point estimate and a point estimator? Discuss any three properties of a good point estimator.

(ii) Suppose certain type of fertilizer has an expected yield per acre of μ_1 with variance σ^2, whereas the expected yield for a second type of fertilizer is μ_2 with the same variance σ^2. Let s_1^2 and s_2^2 denote the sample variances of yields based on sample sizes n_1 and n_2 respectively, of the two fertilizers. Show that the pooled estimator

$$\hat{\sigma}^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

is an unbiased estimator of σ^2.

2. Attempt any **five** questions : (7×5=35)

(a) (i) What is meant by the terms 'parameter' and 'statistic'?

(ii) Consider a normal population distribution with the value of σ known. What is the confidence level for the interval $(\bar{x} \pm 2.51\,\sigma/\sqrt{n})$ and $(\bar{x} \pm 1.44\,\sigma/\sqrt{n})$.

(b) The average heights of a random sample of 16 people from a city is 1.75 m with a standard deviation of 0.04 m. It is known that the heights of the population are random variables that follow a normal distribution.

(i) Determine the 95% confidence interval for the average height of the population.

(ii) With a confidence level of 90%, what would be the minimum sample size needed for the true mean of the heights to be within 2 cm from the sample mean?

(c) Extensive monitoring of a computer time-sharing system has suggested that response time to a particular editing command is normally distributed with standard deviation 30 millisec. A new operating system has been installed, and we wish to estimate the true average response time for the new environment. Assuming that response times are still normally distributed, what sample size is necessary to ensure that the resulting 90% Cl has a width of 10? How should the sample size change if the width is to become half of its earlier value.

(d) A random sample of size 8 is taken from a normal population with $\bar{X} = 51$ and $s = 6$. Construct an upper one-sided 95% Confidence Interval for the mean. What will be the upper bound if the sample size was 49 instead?

(e) Construct a 94% confidence interval for the difference between the mean lifetimes of two kinds of light bulbs, given that a random sample of 40 light bulbs of the first kind lasted on the average 418 hours of continuous use and 50 light bulbs of the second kind lasted on the average 402 hours of continuous use. The population standard deviations are known to be $\sigma_1 = 26$ and $\sigma_2 = 22$.

(f) A sample standard deviation was 3.81 for a sample of 12 containers. Determine a 95% confidence interval for population standard deviation and population variance assuming normality.

3. Attempt any **five** questions : (7×5=35)

(a) Mean height of a certain population in a district is found to be normally distributed with a mean of 67 inches and standard deviation of 3 inches. A sample of 100 people, however have a mean height of 64 inches. Test the hypothesis that the mean height of the population has decreased overtime at 0.05 level of significance? Also find out the p-value of the test.

(b) Suppose that 100 high-performance tires made by a certain manufacturer lasted on the average 21,819 miles with a standard deviation of 1,295 miles. Test the null hypothesis $\mu = 22{,}000$ miles against the alternative hypothesis $\mu < 22{,}000$ miles at the 0.05 level of significance. Calculate the p–value?

(c) The mean yield of wheat from district A was 210 kg with standard deviation of 10 kg. per acre from a sample of 100 plots. In another district B, the mean yield was 220 kg. with Standard deviation of 12 kg from a sample of 120 plots. Assuming wheat yield to be normally distributed, test whether there is any significant difference between the mean yield of crops in the two districts. Also construct a 99% confidence interval for difference between mean yield of wheat from the two districts

(d) A test of the breaking strengths of 6 ropes manufactured by a company showed a mean breaking strength of 7750 lb and a standard deviation of 145 lb, whereas the manufacturer claimed a mean breaking strength of 8000 lb. Can we support the manufacturer's claim at a level of significance of (a) 0.01 (b) What is the p value of the test?

(e) The IQs (intelligence quotients) of 16 students from one area of a city showed a mean of 107 with a standard deviation of 10, while the IQs of 14 students from another area of the city showed a mean of 112 with a standard deviation of 8. Can we say that the IQ of the second city is higher at a (a) 0.01, (b) 0.05 level of significance?

P.T.O.

(f) In the past the standard deviation of weights of certain 40.0 kg packages filled by a machine was 0.25 kg. A random sample of 20 packages showed a standard deviation of 0.32 kg. Is the apparent increase in variability significant at 0.05 level of significance?