

**2025/FYUG/ODD/SEM/
STAIDC-201T/042**

FYUG Odd Semester Exam., 2025

STATISTICS

(3rd Semester)

Course No. : STAIDC-201T

Sampling and Elements of Hypothesis Testing)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks
for the questions

UNIT—I

Answer any four from the following : $1 \times 4 = 4$

- (a) Define variance and covariance of a random variable.
- (b) State the multiplication theorem of expectation.
- (c) Define census and sample survey.
- (d) What is Pilot survey?
- (e) What is non-sampling error?

(Turn Over)

(2)

2. Answer any one from the following :
- (a) Show that if X is a random variable, then $U(aX + b) = a^2 U(X)$ where a and b are constants.
- (b) Define covariance between two random variables X and Y . What happens if X and Y are independent?
3. Answer either [(a) and (b)] or [(c) and (d)] :
- (a) State addition and multiplication theorem of expectation.
- (b) What are sampling errors? Discuss some sources of sampling errors.
- (c) What are non-sampling errors? Discuss some sources of non-sampling errors.
- (d) Two unbiased dice are thrown. Find the expected values of the sum of numbers of points on them.

UNIT—II

4. Answer any four from the following : $1 \times 4 = 4$
- (a) Define simple random sampling with replacement.
- (b) Define simple random sampling without replacement.

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- Give an example of non-probability sampling.
- Name a probability sampling procedure.
- Define a sample.
- Answer any one from the following : 2
- (a) Discuss very briefly the method of non-probability sampling.
- (b) Mention the methods of selecting a simple random sample.
- Answer either [(a) and (b)] or [(c) and (d)] : $4 \times 2 = 8$
- (a) How are the population mean and population total estimated from a simple random sample? Give reason.
- (b) Discuss the advantages of sample survey over complete enumeration.
- (c) Distinguish between simple random sampling with replacement and without replacement.
- (d) Discuss the method of selecting a simple random sample using random numbers method.

UNIT—III

1. Answer any four from the following : $1 \times 4 = 4$
- (a) Define a random sample.
- (b) Define a statistic.

(Turn Over)

(4)

- (c) What are the different types of hypothesis used in tests of significance?
- (d) Define level of significance.
- (e) Define critical region.

8. Answer any one from the following :

- (a) What is meant by P -value?
- (b) What type of error arises when a wrong decision is made about the null hypothesis when it is true?

9. Answer either [(a) and (b)] or [(c) and (d)] :

- (a) Define a statistical hypothesis. Differentiate between simple and composite hypothesis.
- (b) Write a short note on null hypothesis.
- (c) Fill in the blanks :
 - (i) Statistical hypothesis under test is called _____.
 - (ii) The probability of type I error is given by _____.
 - (iii) The probability of _____ error is given by β .
 - (iv) The level of significance of a test is the probability of type _____ error.
- (d) Write a short note on sampling distribution of a statistic.

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UNIT—IV

Answer any four from the following as directed : 1×4=4

- (a) The unbiased estimator of the population mean is given by _____.
(Fill in the blank)
- (b) The unbiased estimator of the population variance is given by _____.
(Fill in the blank)

- (c) State the null hypothesis for testing that the population mean μ (for large samples).
- (d) State the alternative hypothesis for testing the population mean μ (for large samples).
- (e) State the null hypothesis for testing that the population mean is greater than μ .

11. Answer any one from the following : 2

- (a) State the test statistic to be used along with the null and alternative hypothesis for testing the population mean μ for large samples.
- (b) A sample of 900 members has a mean of 3.4 cm and s.d. 2.61 cm. Is the sample from a population mean 3.25 cm and s.d. 2.61 cm? Given $P\{|z| \leq 1.96\} = 0.95$.

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(6)

12. Answer either [(a) and (b)] or [(c) and (d)] :

- (a) Show that the sample mean is an unbiased estimator of the population mean.
- (b) A sample of 400 observations has mean 95 and s.d. 12. Could it be a random sample from a population with mean 98? Given $P\{|z| \leq 1.96\} = 0.95$.
- (c) Describe the procedure for testing the significance for difference of means for large samples.
- (d) Samples of students were drawn from two universities and their mean weights in kg and s.d. were calculated. Test the significance of difference of means :

	Mean	SD	Sample Size
University A	55	10	400
University B	57	15	100

UNIT—V

13. Answer any four from the following as directed :

- (a) Which statistic will you use to test whether a sample has come from a normal population with mean μ and variance σ^2 (for small samples)?

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(Continued)

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(b) Write down the test statistic for testing the hypothesis that a sample of size 20 with mean 97.2 has come from a normal population with mean 100 and variance 10.

(c) Mention two applications of chi-square distribution in testing of hypothesis.

(d) State the hypothesis you would use to test using the chi-square statistic for attributes in a 2×2 contingency table.

(e) For the validity of chi-square test it is always necessary that the sample observations should be _____.
(Fill in the blank)

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14. Answer any one from the following :

- (a) What are the assumptions made in Student's t-test?
- (b) Mention two uses of t-statistic giving the formula for each.

15. Answer either [(a) and (b)] or [(c) and (d)] : $4 \times 2 = 8$

- (a) The heights of 10 males in a given locality are found to be 70, 67, 62, 68, 61, 68, 70, 64, 64 and 66 inches. Is it reasonable to believe that the average height is greater than 64 inches? Given $t_{0.05, 9} = 1.833$ (for single tail).

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- (b) A reading test is given to an elementary school class that consists of 12 Anglo-American children and 10 Mexican-American children. The results of the test are given below :

Anglo-American	Mexican-American
$\bar{x}_1 = 74$	$\bar{x}_2 = 70$
$s_1 = 8$	$s_2 = 10$

Is the difference of means between the two groups significant? Given $t_{.05}$ for 20 d.f. = 2.09.

- (c) From the following data, test the hypothesis that the population mean is 0.700 inch :

$$\bar{x} = 0.742 \text{ inch}, s = 0.040 \text{ inch and } n = 10$$

- (d) Test the hypothesis $H_0 : \sigma_1^2 = \sigma_2^2$ against $H_1 : \sigma_1^2 \neq \sigma_2^2$ from the following data :

$$n_1 = 8, \Sigma(x_i - \bar{x})^2 = 84.4$$

$$n_2 = 10, \Sigma(y_j - \bar{y})^2 = 102.6$$

Given $F_{0.05}$ for (7, 9) d.f. = 3.29.

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