

**2024/FYUG/ODD/SEM/
STAIDC-201T/153**

FYUG Odd Semester Exam., 2024

**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

1. Answer any four from the following : 1×4=4

- (a) Define random variable.
- (b) Define expectation of a random variable.
- (c) State the addition theorem of expectation.
- (d) Define population and sample.
- (e) What are sampling errors?

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(Turn Over)

(2)

2. If X and Y are two independent random variables, then show that—

$$\text{var}(aX + bY) = a^2 \text{var}(X) + b^2 \text{var}(Y) \quad 2$$

OR

3. Find the expectation of the number on a die when thrown. 2
4. Answer either (a) and (b) or (c) and (d) : $4 \times 2 = 8$
- (a) Compare complete enumeration with sample survey. 4
 - (b) Explain sampling and non-sampling errors. 4
 - (c) What are the basic principles of sample survey? 4
 - (d) Explain what is a pilot survey. 4

UNIT—II

5. Answer any four from the following : $1 \times 4 = 4$
- (a) What is probability sampling?
 - (b) What is non-probability sampling?
 - (c) What are the two types of simple random sampling?
 - (d) Write down the formula for an estimator of the population mean.
 - (e) How is the population total estimated from a sample?

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(3)

6. Define simple random sampling with replacement and without replacement. 2

OR

7. Name the methods of selecting a simple random sample. 2
8. Answer either (a) and (b) or (c) and (d) : $4 \times 2 = 8$
- (a) What are the different methods of sampling? Describe them. 4
 - (b) Describe briefly the procedure of selecting a simple random sample by lottery method. 4
 - (c) Describe how the random number tables are used to select a simple random sample. 4
 - (d) Describe the different random number tables used to select a simple random sample. 4

UNIT—III

9. Answer any four from the following : $1 \times 4 = 4$
- (a) What is parameter? Define with an example.
 - (b) What are null hypothesis and alternative hypothesis?
 - (c) Define simple and composite hypotheses.
 - (d) Define Type-I error.
 - (e) Define Type-II error.

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(4)

10. Define critical region and level of significance. 2

OR

11. Identify the simple and composite hypotheses from the following : 2

(i) $H_0: \mu \leq 0, \sigma^2 = 1$

(ii) $H_0: \mu = 0, \sigma^2 = 0$

(iii) $H_0: \mu \leq 0, \sigma^2 \geq 2$

(iv) $H_0: \mu \geq 5, \sigma^2 \geq 5$

12. Answer either (a) and (b) or (c) and (d) : 4×2=8

- (a) Write a note on sampling distribution of a statistic. 4

- (b) What is meant by a statistical hypothesis? What are the two types of error that arise in testing a hypothesis? 2+2=4

- (c) Write a short note on P-value. 4

- (d) Find out which are parameters and which are statistics from the following : $\frac{1}{2} \times 8 = 4$

(i) Population variance

(ii) Sample mean

(iii) Sample mean square

(iv) Population median

(v) Sample mode

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(vi) Population mode

(vii) Harmonic mean calculated from the population

(viii) Harmonic mean calculated from the sample

UNIT—IV

13. Answer any four from the following : 1×4=4

(a) Write down the formula for standard error of sample mean.

(b) Write down the test statistic for testing for a single mean for a large sample.

(c) Name the test statistic and give its formula for testing the significance of the difference of means for large samples.

(d) How is the population mean estimated from a sample?

(e) What is the unbiased estimator of population variance?

14. What is meant by standard error of the sample mean? 2

OR

15. A sample of size 400 was drawn and the sample mean was found to be 99. Test whether this sample would have come from a normal population with mean 100 and standard deviation 8 at 5% level of significance. 2

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(6)

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

- (a) Derive the formula for standard error of the sample mean. 4
- (b) A sample of 900 members has a mean 3.4 cm and standard deviation 2.61 cm. Is the sample from a large population of mean 3.25 cm and s.d. 2.61 cm? 4
- (c) The means of two large samples of 1000 and 2000 members are respectively 67.5 inches and 68 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2.5 inches? 4
- (d) A sample of 450 items is taken from a population whose standard deviation is 20. The mean of the sample is 30. Test if the sample has come from a population with mean 29. 4

UNIT—V

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

- (a) Mention two uses of t-distribution.
- (b) What is the test statistic for testing the significance of difference of means for small samples?
- (c) What statistic is used to test the equality of two population variances?

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(7)

(d) Write down the formula for testing the goodness of fit of a distribution.

(e) What is the statistic for testing the independence of attributes?

18. Mention the conditions for the validity of chi-square test. 2

OR

19. For the following data :

n_1 = number of observations in the first sample = 8

n_2 = number of observations in the second sample = 10

$$\sum_{i=1}^8 (x_i - \bar{x})^2 = 84.8$$

$$\sum_{j=1}^{10} (y_j - \bar{y})^2 = 102.6$$

test if the samples come from populations having the same variance. Given

$$F_{0.05}(7, 9) = 3.29$$

Symbols hold their usual meanings. 2

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

- (a) Write a note on the chi-square test of goodness of fit. 4

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- (b) Test for the independence of voting preference and nature of area from the following :

4

Area	Votes for		Total
	A	B	
Rural	620	380	1000
Urban	550	450	1000
Total	1170	830	

- (c) From the following data, test the hypothesis that the population mean is 0.700 inch. Given $\bar{x} = 0.742$ inch, $s = 0.040$ inch and $n = 10$.

4

- (d) From the following data, test if the samples come from a homogeneous population :

$$n_1 = 8, n_2 = 10$$

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

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

Symbols hold their usual meanings.

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