2019/TDC/ODD/SEM/STSDSC/STSGE–301T/120

TDC (CBCS) Odd Semester Exam., 2019

STATISTICS

(3rd Semester)

Course No. : STSDSC/STSGE–301T

(Sampling Distribution, Testing of Hypothesis, Inference)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *three* of the following questions : 1×3=3

(a) Define critical region.

(b) Define critical value.

(c) What is statistical hypothesis?

(d) Define level of significance.

2. Answer any *one* of the following questions : 2

(a) Define null and alternative hypotheses.

(b) Define parameter and statistics.

3. Answer any *one* of the following questions : 5

(a) (i) Define producer's risk and consumer's risk. Between them, which is more serious? 2+1=3

(ii) Define the following terms : 2

(1) Type–I error

(2) Type–II error

(b) Define simple and composite hypotheses. Write a note on one-tailed and two-tailed test. 2+3=5

UNIT—II

4. Answer any *three* of the following questions : 1×3=3

(a) What is sampling distribution of a statistic?

(b) Define standard error.

(c) Define test statistic.

(d) If $\overline{x}$ be the sample mean, then find the value of $SE(\overline{x})$.

5. Answer any *one* of the following questions : 2

(a) If $x_1, x_2, \cdots, x_n$ be a random sample of size n and s^2 be the variance of the sample of size n, and σ^2 is the population variance, then what is the unbiased estimate of σ^2?

(b) Write the test statistic for testing the difference of means of a large sample, when the population variances are unknown.

6. Answer any *one* of the following questions : 5

(a) Prove that sample mean is an unbiased estimate of population mean. Write the test statistic for testing the difference of standard deviation of two population. 3+2=5

(b) Explain the various steps in testing a statistical hypothesis for large sample in a systematic manner. For large n, what is the distribution of $\overline{x}$, where $\overline{x}$ is the sample mean? 4+1=5

UNIT—III

7. Answer any *three* of the following questions : 1×3=3

(a) Define χ^2-statistic with n degrees of freedom.

(b) If $t \sim t_{(n)}$, then find the value of $E(t)$.

(c) State Snedecor's F-statistic.

(d) State the relation between mean and variance of χ^2-distribution.

8. Answer any *one* of the following questions : 2

(a) Write the moment-generating function and cumulant-generating function of χ^2-distribution.

(b) Write the applications of Student's t-distribution.

9. Answer any *one* of the following questions : 5

(a) (i) State the conditions of validity of χ^2-distribution. 2

(ii) For a 2×2 contingency table

a	b
c	d

prove that χ^2-test of independence of attributes gives

$$\chi^2 = \frac{N(ad - bc)^2}{(a+b)(a+c)(b+d)(c+d)}, \quad N = a+b+c+d$$

3

(b) Define Student's t-statistic. Explain the test procedure to test the hypothesis for single mean, when the sample size is small. 1+4=5

UNIT—IV

10. Answer any *three* of the following questions : 1×3=3

(a) Define parameter space.

(b) If e be the efficiency, then what is the maximum limit of e?

(c) State the sufficient conditions for consistency.

(d) Define minimum variance unbiased estimator.

11. Answer any *one* of the following questions : 2

(a) Define estimate and estimator.

(b) Define consistency of an estimator.

12. Answer any *one* of the following questions : 5

(a) Define unbiasedness of an estimator. If $x_1, x_2, \cdots, x_n$ is a random sample from a normal population $N(\mu, 1)$, then show that

$$t = \frac{1}{n}\sum_{i=1}^{n} x_i^2$$

is an unbiased estimator of $\mu^2 + 1$. 1+4=5 *(b)* Define Neyman factorization theorem. If $x_1, x_2, \cdots, x_n$ be a random sample from a Bernoulli population with parameter p, then prove that $\sum_{i=1}^{n} x_i$ is a sufficient statistic for p. 2+3=5

UNIT—V

13. Answer any *three* of the following questions : 1×3=3

(a) State Cramer-Rao inequality.

(b) What is power of a test?

(c) Define likelihood function.

(d) What is maximum likelihood estimation?

14. Answer any *one* of the following questions : 2

(a) State the assumption of maximum likelihood estimation.

(b) Write a note on confidence interval.

15. Answer any *one* of the following questions : 5

(a) Find the maximum likelihood estimate for the parameter λ of a Poisson distribution, when the size of the sample is n. Whether maximum likelihood estimators are always consistent estimator or unbiased estimator? 4+1=5

(b) State and prove Neyman-Pearson lemma. 5

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