2021/TDC/CBCS/ODD/
STSDSC/GE-301T/115

TDC (CBCS) Odd Semester Exam., 2021 held in March, 2022

STATISTICS

(3rd Semester)

Course No. : STSDSC/GE-301T

(Statistical Inference)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *fifteen* of the following as directed : 1×15=15

1. What is critical value?

2. If z is the test statistic, z_α is the tabulated value at α % level of significance and $|z| < z_\alpha$, then whether null hypothesis is rejected or accepted?

3. If w be the critical region, then $P(t \in w^c | H_1) =$ _____

(Fill in the blank)

4. Between type–I and type–II errors, which is more serious?

5. What is standard error (SE)?

6. Define unbiasedness.

7. If s^2 be the sample variance, then $E(s^2) =$ _____.

(Fill in the blank)

8. Define sampling distribution of a statistic.

9. Define Student's t-statistic.

10. If $\chi^2 \sim \chi^2(n)$, then state the relation between mean and variance of χ^2-distribution.

11. Define Snedecor's F-statistic.

12. In χ^2-test, the sample observations should be _____.

(Fill in the blank)

13. Define parameter space.

14. Define unbiased estimator.

15. State the invariance property of sufficient estimator.

16. State the conditions of MVUE.

17. State Cramer-Rao inequality.

18. What is likelihood function?

19. State the invariance property of MLE.

20. Define power of a test.

SECTION—B

Answer any *five* of the following questions : 2×5=10

21. Define test statistic. What is critical region?

22. Stating illustration, define parameter and statistic.

23. Write the test statistic for testing the difference of standard deviations.

24. If $x_1, x_2, \cdots, x_n$ be a random sample of size n having sample mean $\bar{x}$, then find $SE(\bar{x})$, where $v(y_i) = \sigma^2$.

25. State χ^2-statistic for goodness of fit. What is degrees of freedom?

26. Write the applications of Student's t-distribution.

27. Define consistent estimator.

28. State the factorization theorem of sufficient estimator.

29. State the properties of maximum likelihood estimator (MLE).

30. Write a note on confidence interval for large samples.

SECTION—C

Answer any *five* of the following questions : 5×5=25

31. Define the following : 3+2=5

(a) Producer's risk and consumer's risk

(b) Null hypothesis and alternative hypothesis

32. *(a)* Define Type—I error and Type—II error. 2

(b) Write a note on one-tailed and two-tailed tests. 3

33. Explain the procedure of testing of single mean for a large sample data.

34. The means of two large samples of 1000 and 2000 members are 67·5 inches and 68·0 inches respectively. Can the samples be regarded as drawn from the same population of standard deviation 2·5 inches? (Test at 5% level of significance.)

35. *(a)* For a 2×2 contingency table

a	b
c	d

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

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

$$N = a + b + c + d$$ 3

(b) State some applications of χ^2-distribution. 2

36. If $t \sim t_{(n)}$, then find the variance of t-distribution. Also find $E(t)$. 4+1=5

37. (a) If $x_1, x_2, \cdots, x_n$ be a random sample from a normal population $N(\mu, 1)$, then show that $\frac{1}{n}\Sigma x_i^2$ is an unbiased estimate of $\mu^2 + 1$. 2

(b) Show that $\frac{\Sigma x_i(\Sigma x_i - 1)}{n(n-1)}$ is an unbiased estimate of θ^2 for the sample $x_1, x_2, \cdots, x_n$ drawn on X which takes the value 1 or 0 with respective probabilities θ and $(1-\theta)$. 3

38. Let T_1 and T_2 be unbiased estimators of $\gamma(\theta)$ with efficiencies e_1 and e_2 respectively and $\rho = \rho_\theta$ be the correlation coefficient between them, then prove that

$$\sqrt{e_1 e_2} - \sqrt{(1-e_1)(1-e_2)} \le \rho \le \sqrt{e_1 e_2} + \sqrt{(1-e_1)(1-e_2)}$$

39. State and prove Neyman-Pearson lemma.

40. If a sufficient estimator exists, then prove that it is a function of maximum likelihood estimator (MLE).

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