Reg. No. : ....

Name : ....

IV Semester B.Sc. Honours in Mathematics Degree (CBCSS – OBE-Regular) Examination, April 2023

(2021 Admission)

4B17 BMH : ADVANCED STATISTICAL TECHNIQUES – II

Time : 3 Hours

Max. Marks : 60

PART – A

Answer any 4 questions. Each question carries one mark.

(4×1=4)

1. Write down the variance of chi-square distribution with 10 degrees of freedom.

2. Define Student's t statistic.

3. What do you understand by point Estimation.

4. What is the M.G.F. of a chi-square distribution with n degree of freedom.

5. Define unbiasedness.

PART – B

Answer any 6 questions. Each question carries two marks.

(6×2=12)

6. What is contingency table ?

7. Test the hypothesis that $\sigma = 10$, given that $s = 15$ for a random sample of size 50 from a normal population.

8. Write the assumptions for Student's t–test.

9. The mean weekly sales of soap bars in departmental stores was 146.3 bars per store. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2. Was the advertising campaign successful ?

P.T.O.

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10. Show that the sample mean is an unbiased estimate of the population mean.

11. Obtain the Maximum Likelihood estimates for θ in a population given by $f(x, \theta) = \frac{1}{\theta} e^{-\frac{x}{\theta}}, x \geq 0, \theta \geq 0$.

12. State sufficient condition for consistency of an estimator.

13. Define Yate's correction.

14. Explain the concept of interval estimation.

PART – C

Answer any 8 questions. Each question carries four marks.

(8×4=32)

15. State and prove additive property of chi square distribution.

16. Define chi square distribution and state it uses.

17. In a cross between red flowered and white flowered plants, it was found that of the 452 flowers obtained 119 were white and the rest red. Is this consistent with the hypothesis that red and white flowers are in the ratio 3 : 1.

18. The standard deviation of two samples of size 10 and 14 from two normal populations are 3.5 and 3.0 respectively. Examine whether the standard deviation of the population are likely to be equal.

19. Show that $t = \frac{n\bar{x}}{n+1}$ is a consistent estimate of μ where $\bar{x}$ is the mean of samples of size n taken from a Poisson population.

20. X_1, X_2, X_3 are three independent observations from a population with mean μ and variance σ^2. If $t_1 = X_1 + X_2 - X_3$ and $t_2 = 2X_1 + 3X_2 - 4X_3$, compare the efficiencies of t_1 and t_2. Also find relative efficiency of t_1 with respect to t_2.

21. Define sufficiency, examine whether the sample mean $\bar{x}$ is sufficient for estimating the parameter μ in a Poisson distribution.

22. Define F statistic. What is its p.d.f. ? Explain any important use of it in statistical analysis.

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23. Find the characteristic function of chi square distribution with n d.f.

24. Examine whether the sample variance is an unbiased estimate of the population variance for a normal population N (μ, σ^2).

25. Illustrate with an example that consistent estimator need not be unbiased.

26. A certain stimulus administered to each of the 12 patients resulted in the following increase of blood pressure : 5, 2, 8, –1, 3, 0, –2, 1, 5, 0, 4 and 6. Can it be concluded that the stimulus will, in general, be accompanied by an increase in blood pressure ?

PART – D

Answer any 2 questions. Each question carries six marks.

(2×6=12)

27. Fit a Poisson distribution to the following data and test the goodness of fit

X	:	0	1	2	3	4	5	6
F	:	275	72	30	7	5	2	1

28. A random sample of size n is drawn from a normal population N (μ, σ^2)

Find the maximum likelihood estimators for

a) μ when σ^2 is known.

b) σ^2 when μ is known.

29. What are the desirable properties of a good estimate ? Give one example each of estimates possessing each of the desirable properties.

30. Define the statistics t and F and write down their sampling distribution. State the important assumptions in respect of them.

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