



K25U 3084

Reg. No. :

Name :

**III Semester B.Sc. Honours in Mathematics Degree (C.B.C.S.S. – O.B.E. –
Supplementary/Improvement) Examination, November 2025
(2021 to 2023 Admissions)
3B12BMH : ADVANCED STATISTICAL TECHNIQUES – I**

Time : 3 Hours

Max. Marks : 60

SECTION – A

Answer **any four** questions from the following. **Each** question carries **1** mark.

1. What is the line of "best fit" ?
2. Given that $Y - 2.8X = 5$ and $X - 0.5Y = 3$ be the estimated regression equations of Y on X and X on Y respectively. Find b_{xy} and b_{yx} .
3. Does two independent variables are correlated ? Justify.
4. Give an example of a two-tailed test.
5. What is the critical value of a test statistic ?

(4×1=4)

SECTION – B

Answer **any six** questions. **Each** question carries **2** marks.

6. Write the normal equations for the best fit of the parabola $Y = a + bX + cX^2$.
7. Convert the curve $Y = 4X^3$ into a straight line.
8. Given that $U = \frac{X-a}{h}$, $V = \frac{Y-b}{k}$. Show that $\text{Cov}(X, Y) = hk\text{Cov}(U, V)$.
9. Define the following terms : (i) Linear Regression (ii) Curvilinear Regression.
10. Evaluate $r(X, Y)$ for $X \sim N(0, 1)$ and $Y = X^2$.
11. What is an alternative hypothesis ?

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12. Point out the difference between one-tail and two-tail tests.

13. Let $x_1, x_2, \dots, x_n$ be a random sample of size n from a large population $X_1, X_2, \dots, X_N$ (of size N) with mean μ and variance σ^2 . Then show that the sample mean $\bar{X}$ is an unbiased estimate of the population mean μ .

14. The standard deviation of a population is 2.70 inches. Find the probability that in a random sample of size 66 will exceed the population mean by 0.75 inch or more.

(6×2=12)

SECTION – C

Answer **any eight** questions. **Each** question carries **4** marks.

15. Fit a straight line to the following data.

X	Y
1	2.4
2	3
3	3.6
4	4
6	5
8	6

16. If $Z = aX + bY$ and r is the correlation coefficient between X and Y , show that $\sigma_z^2 = a^2\sigma_x^2 + b^2\sigma_y^2 + 2ab\rho_{xy}\sigma_x\sigma_y$.

17. Explain what are regression lines. Also derive their equations.

18. If X and Y are discrete random variables. If $\text{Var}(X) = \text{Var}(Y) = \sigma^2$ and $\text{Cov}(X, Y) = \sigma^2/2$. Find (i) $\text{Var}(2X + 3Y)$ and (ii) $\text{Cor}(2X - 3, 2Y + 3)$.

19. Define the following terms : (i) Type I Error (ii) Type II Error (iii) Critical Region (iv) Level of Significance.

20. In two large populations there are 30 and 25 per cent respectively of blue-eyed people. Is this difference likely to be hidden in samples of 1,200 and 900 respectively from the two populations ?

21. A coin is tossed 10,000 times and it turns up head 5,195 times. Discuss whether the coin may be regarded as unbiased one or not.



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22. Let $x_1, x_2, \dots, x_n$ be a random sample of size n from a large population $X_1, X_2, \dots, X_N$ (of size N) with mean μ and variance σ^2 . Then show that the sample variance s^2 is not an unbiased estimate of population variance.

23. A survey is proposed to be conducted to know the annual earnings of the old statistics graduates of a University. How large should the sample be taken in order to estimate the mean annual earnings within plus and minus Rs. 1,000 at 95% confidence level ? The standard deviation of the annual earnings of the entire population is known to be Rs. 3,000.

24. The manufacturer of television tubes knows from past experience that the average life of a tube is 2,000 hours with a standard deviation of 200 hours. A sample of 100 tubes has an average life of 1950 hours. Test at the 0.05 level of significance if this sample came from a normal population of mean 2,000 hours. State your null and alternative hypothesis and indicate clearly whether a one-tail or a two-tail test is used and why ? Is the result of the test significant ?

25. Show that if $x_1, x_2, \dots, x_n$ is a random sample of size n from a normal population with mean μ and variance σ^2 , then, the sample mean is distributed normally with mean μ and variance $\frac{\sigma}{\sqrt{n}}$.

26. If for one-half of n events, the chance of success is P and the chance of failure is q while for the other half the chance of success is q and the chance of failure is P , show that the standard deviation of the number of successes is $\sqrt{npq}$ and the mean of the number of successes is $n/2$.

(8×4=32)

SECTION – D

Answer **any two** questions. **Each** question carries **6** marks.

27. Fit a curve of the form $Y = ab^X$ to the following data.

X	Y
2	144
3	172.8
4	207.4
5	248.8
6	127.4

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28. Obtain the rank correlation coefficient for the following data :

X	Y
68	62
64	58
75	68
50	45
64	81
78	68
40	48
55	50
64	70

29. Describe the following :

- i) Purposive sampling.
- ii) Random sampling.
- iii) Stratified sampling.
- iv) Systematic sampling.

30. In a survey of incomes of two classes of workers, two random samples gave the following details. Examine whether the differences between the standard deviations, are insignificant.

Sample	Size	Mean Annual Income in Rupees	Standard Deviation in Rupees
I	100	582	24
II	100	546	28

(2×6=12)