

Perform an analysis of the variance on these data and show that significance test does not reject their homogeneity.

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(b) Explain the terms main effect and interactions in factorial experiments. A complete 2^3 experiment is replicated r times. Describe the procedure for testing the presences of different main effects and interactions.

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8. (a) If the population consists of a linear trend, than prove that

$$V(\bar{y}_{st}) \leq V(\bar{y}_{sys}) \leq V(\bar{y}_n)_{random} .$$

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(b) What are Ratio and regression estimates ? Define.

Also give Biases of the ratio and regression estimators.

8

9. (a) Define the concepts of :

(i) Sampling distribution and standard error

(ii) Null and Alternative hypothesis

(iii) Type I and Type II errors and

(iv) Critical region and level of significance.

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(b) What is Likelihood Ratio test ? Explain. Give its properties.

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10. (a) Explain Wald Wolfowitz run test. Mention their usefulness.

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(b) Let X have the distribution $f(x, \theta) = \theta^x (1-\theta)^{1-x}$, $x = 0, 1$; $0 < \theta < 1$.

For testing $H_0 : \theta = \theta_0$ against $H_1 : \theta = \theta_1$, construct SPRT and obtain its O.C. function.

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Roll No.

Total No. of Pages : 4

1(ADS)1
STATISTICS-I
X-O

Time : Three Hours]

[Maximum Marks : 100

Note :- (i) Each question or part thereof shall begin on a fresh page.
(ii) Your answers should be precise and coherent.
(iii) Attempt any **FIVE** questions.

1. (a) Given $\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2.8182$,
 $\log_{10} 659 = 2.8189$, $\log_{10} 661 = 2.8202$; find $\log_{10} 656$.

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(b) Find $f(7.60)$ from the following table :

x	7.47	7.48	7.49	7.50	7.51	7.52	7.53
$f(x)$	193	195	198	201	203	206	208

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2. (a) An urn contains 9 balls, two of which are red, three blue and four black. Three balls are drawn from the urn at random. What is the probability that

(i) the balls are of different colours

(ii) two balls are of the same colour and third is of different colour

(iii) the three balls are of the same colour ?

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(b) The chances that doctor A will diagnose a disease X correctly is 60%. The chances that a patient will die by his treatment after correct diagnosis is 40% and the chance of death by wrong diagnosis is 70%. A patient of a doctor A, who had disease X, died. What is the chance that his disease was diagnosed correctly ?

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3. (a) State and prove Chebychev's inequality. 10
 (b) A symmetric die is thrown 600 times. Find the lower bound for the probability of getting 80 to 120 sixes. 4
 (c) A box contains 'a' white and 'b' black balls. 'c' balls are drawn at random. Find the expected value of the number of white balls drawn. 6

4. (a) Find the moment generating function of the standard binomial variate $\frac{(X - np)}{\sqrt{npq}}$ and obtain its limiting form as $n \rightarrow \infty$. 8

(b) Show that for the bivariate normal distribution

$$dp = \text{const.} \exp\left[-\frac{1}{2(1-s^2)}(x^2 - 2\rho xy + y^2)\right] dx dy,$$

Moment generating functions is

$$M(t_1, t_2) = \exp\left[\frac{1}{2}(t_1^2 + 2\rho t_1 t_2 + t_2^2)\right].$$

Also show that, the moments obeying the recurrence relation

$$\mu_{rs} = (r + s - 1)\rho \mu_{r-1, s-1} + (r - 1)(s - 1)(1 - \rho^2)\mu_{r-2, s-2}.$$

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5. (a) A sample of 800 families with four children each revealed the following distribution :

No. of sons :	0	1	2	3	4
No. of girls :	4	3	2	1	0
No. of families :	32	178	290	236	64

Is this result consistent with the hypothesis that male and female births are equally probable? 10

- (b) The heights of six normally chosen sailors are (in inches) 63, 65, 68, 69, 71 and 72. Those of 10 randomly chosen soldiers are 61, 62, 65, 66, 69, 69, 70, 71, 72 and 73. Discuss, the light that these data throw on the suggestion that sailors are on the average taller than soldiers (significant value at 5% level of significance for 14 degrees of freedom is 1.76). 10

6. (a) The equation of two regression lines obtained in a correlation analysis of 60 observations are :
 $5x = 6y + 24$ and $1000y = 768x - 3708$.
 What is the correlation coefficient and what is its probable error ?

Show that the ratio of the coefficient of variability of x to that of y is 5/24. 8

- (b) Following are the means, standard deviation and correlation of X_1 = seed by crop in units per acre, X_2 = spring rainfall in inches, X_3 = accumulated temperature above 42 °F in spring, in a certain district of England during twenty years :

$$\bar{X}_1 = 28.02, \bar{X}_2 = 4.91, \bar{X}_3 = 594$$

$$\sigma_1 = 4.42, \sigma_2 = 1.0, \sigma_3 = 85$$

$$r_{12} = .80, r_{13} = -.4, r_{23} = -.056.$$

Find the partial correlations and the regression equation for hay-crop on spring rainfall and accumulated temperature. 12

7. (a) The following table shows lives in hours for four batches of electric lamps :

Batches	Lives in hour						
1	1610	1610	1650	1680	1700	1720	1800
2	1580	1640	1640	1700	1750		
3	1460	1550	1600	1620	1640	1660	1740 1820
4	1510	1520	1530	1570	1600	1680	