

PLEASE SOLVE THE PROBLEMS IN WHITE PAPERS AND SUBMIT. SQUARE PAPERS ARE NOT REQUIRED.]

Practical problems (online teaching programme)

STSA (Sem IV)

Exercise - 1

Exact tests and related confidence intervals relating to a single univariate normal distribution.

1. A manufacturer of bars of steel claims that the average breaking strength of his product is not less than 52. The breaking strength of each bar in a sample of 15 is noted below:

47.5, 51.3, 50.2, 52.5, 49.3, 48.2, 52.1, 51.9, 50.7, 48.3, 47.8, 50.3, 50.0, 49.3, 48.1.

Examine if the manufacturer's claim is supported by these data. Whatever may be your conclusion, find 95% confidence interval for the average breaking strength.

2. It has been said by some educationists that mathematical ability varies widely. To examine this suggestion, 15 students of class XI are given a mathematical aptitude test carrying 100 marks. The scores of the students on the test are shown below:

73, 37, 52, 16, 53, 91, 84, 68, 12, 20, 19, 25, 13, 40, 17

Test the more specific suggestion that the standard deviation of score per student is higher than 20. Also find the 95% confidence interval for the standard deviation of score per student.

Exercise - 2

Exact tests and related confidence intervals relating to two univariate normal distributions.

1. In a certain industrial experiment, a job was performed by 15 workmen according to a particular method (say Method I) and by 15 other workmen according to a second method (Method II). The time (in minutes) taken by each workman to complete the job is shown below:

Method I | 55 53 57 55 52 51 54 54 53 56 50 54 52 56 51

Method II | 54 53 56 60 58 55 56 54 58 57 55 54 59 52 54

Examine whether method I takes, on the average, ~~the~~ less time than Method II. Also find the relevant confidence intervals for the difference of the averages, and the ratio of the averages.

2. The weekly earnings (in Rs.) of 12 workers of a group and 10 workers of a second group are shown below:

Group I: 392.7, 389.2, 384.2, 379.8, 378.1, 394.2, 384.1, 395.0, 387.5, 391.6, 400.2, 381.0

Group II: 378.5, 375.3, 387.2, 389.1, 387.2, 390.2, 384.3, 379.5, 383.7, 391.2.

~~It is~~ Judge whether there is greater variability in weekly earnings for all workers in the first group than for those in the second. Also find the 95% confidence interval for the ratio of the variances of the weekly earnings of the workers of the two groups.



Exercise-3  
Problems relating to Bivariate normal distribution.

- The correlation coefficient between nasal length and stature for a group of 20 Indian adult males was found to be 0.203. Test whether there is any correlation between the characters in the population.
- In a certain industrial experiment 15 workmen performed a job by Method I and also by Method II. The times taken (in minutes) for the 15 workmen are recorded below:

Social No. of workman	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Method I	54	52	50	53	55	49	50	55	52	48	51	54	58	53	47
Method II	60	52	51	55	60	52	49	57	51	54	55	52	60	51	49

Judge whether Method I takes, on the average, less time than Method II. Find the relevant interval estimates of the difference between the averages and the ratio of the averages.

- For the data set in question 2 test whether the standard deviations of the times taken in Method I and Method II are assumed to be equal. Whatever may be your conclusion estimate the interval within which the ratio of the standard deviations will lie with 95% confidence.

Exercise-4  
Problems relating to simple regression equation.

- For 20 pairs of fathers and sons, the regression equation  $y = \alpha + \beta x$  of height of son ( $y$ ) on height of father ( $x$ ), both measured in inches, was found to be  $Y = 3.66 + 0.932x$ . (i) Test whether  $\alpha$  differs significantly from zero and  $\beta$  differs significantly from unity.

(ii) Find 95% confidence limits to the conditional mean  $\eta_x$  of  $y$  for a given  $x$ , say for  $x = 70$  inches.

(iii) Also estimate the interval within which the height of a son will lie when the height of the father is known to be 70 inches.

- The age in years ( $x$ ) and chest-girth in inches ( $y$ ) were recorded for two groups of school boys consisting of 15 and 18 boys respectively. On the basis of those data, the following values were obtained:

Group I:  $\sum x_i = 202.71$ ,  $\sum y_i = 23.29$ ,  $\sum x_i^2 = 2742.562$ ,  $\sum y_i^2 = 44.775$ ,  $\sum x_i y_i = 314.921$

Group II:  $\sum x_i = 244.12$ ,  $\sum y_i = 53.78$ ,  $\sum x_i^2 = 3314.014$ ,  $\sum y_i^2 = 174.407$ ,  $\sum x_i y_i = 729.604$

Determine for each group the linear regression equation of  $y$  on  $x$ . Hence examine if the corresponding population regression equations (assumed linear) may be supposed to be identical or parallel.