CSc.108-2073 ✡

Tribhuvan Univesity
Institute of Science and Technology
2073
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Bachelor Level / First Year/ First Semester/ Science
Computer Science and Information Technology (STA. 108)
(Statistics I)

Full Marks: 60
Pass Marks: 24
Time: 3 hours.

Candidates are required to give their answers in their own words as for as practicable.
All notations have the usual meanings.

Group A

Attempt any Two: (2×10=20)

1. Discuss simple random sampling method for drawing a random sample of size n from a population size N.
   Prove the following relation.

$$\left(V_{srswr} - V_{srswor}\right) = \frac{n-1}{Nn} S^2$$

   Where V_{srswr} = Variance of unbiased estimator of the population mean under simple random sampling with replacement and V_{srswor} = variance of unbiased estimator of the population mean under simple random sampling without replacement and other notations have their usual meanings.

2. Explain the Friedman two way analysis of variance (ANOVA) test: A study was conducted in order to compare three models (M_1, M_2 and M_3) of low-volt electrical stimulators. Seven physical therapists were asked to rank their preferences of the low-volt electrical stimulators where 1 indicates first preference and the results are given the following table.

Therapist		A	B	C	D	E	F	G
Model	M_1	1	3	3	1	2	3	1
	M_2	3	1	2	2	3	1	2
	M_3	2	2	1	3	2	1	3

   With the help of the above information, to test the hypothesis that three models (M_1, M_2 and M_3) are equally preferred at 5% level of significance.

3. The following information was available with n = 25.

   Multiple regression model: $\hat{Y} = -422 + 11.2\ X_1 - 0.6\ X_2$

   (SE) (339.76) (3.66) (0.94)

   Total variation: $\sum \left(Y_1 - \bar{Y}\right)^2 = 55300$

   Explained variation: $\sum \left(Y_1 - \bar{Y}_1\right)^2 = 38283$

   (a) Calculate the standard error of the estimate.
   (b) Calculate the value of R^2 and its adjusted value.
   (c) Estimate the value of Y when $X_1 = 95$ and $X_2 = 87$.
   (d) Test the significance of slop regression coefficients, and also carry out the overall goodness of fit test of the model at 5% level of significance.

Group B

Answer any eight questions: (8×5=40)

4. Explain the systematic sampling method with example and also compare to the simple random sampling method.

5. The following information was obtained from a sample survey.

Stratum	N_h	N_h	$\bar{y}_h$	S_h^2
1	115	3	4	0.5
2	125	4	5	0.4
3	135	5	6	0.6
4	145	6	7	0.5

with above information compute sample estimate of population mean and population total, variance of the estimate of sample mean and estimate of the total variance, and also to estimate the standard error of $\bar{y}_{st}$ where the notations have their usual meanings.

6. Explain the Mann Whitney U test method with example.

7. A survey conducted in order to measure physical fitness scores of the children from two childcare centers. The reported scores of the children are given below.
Physical fitness scores: Center A: 39, 57, 53, 32, 47, 45, 46, 42
Physical fitness scores: Center B: 37, 36, 29, 57, 35, 21, 35, 42, 22
Use the Median test to carry out the test statistics at 5% level of significance whether there is a difference of the physical fitness scores of the children from two child care centers or not.

8. Explain the Wilcoxon matched pairs signed rank test with example.

9. The following information was available from the four industrial firms.

Industrial firm (n)	1	2	3	4
Output (Q)	50	65	80	95
Labour (L)	1.1	1.4	1.7	2.1
Capital (K)	2.2	2.5	2.6	1.9

Fit the Cobb-Douglas production function and interpret the results.

10. Explain the problems of multicollinearity and state that what measures do you suggest to remove the effect of multicollinearity?

11. Explain the main consequences of heteroscedasticity in the estimates of parameters in a linear model and how do you detect it?

12. State the assumptions and properties of partial correlation. The simple correlation coefficients are: $r_{12} = 0.57$, $r_{13} = 0.45$ and $r_{23}=0.75$. Computer r_{123}, r_{132} and coefficient of partial determination.

13. Write short notes on the following:
(a) Cochran Q test
(b) Kolmogorov Smirnov test