STAT 501 Statistical Methods for Research Workers 2+1

Objectives:

To expose students to various statistical techniques for analysis of data and interpretation of results.

Unit-I

Probability and probability distributions. Principle of least squares. Linear and non-linear regression. Multiple regression. Correlation analysis. Selection of variables. Validation of models. Sampling techniques. Determination of sample size. Sampling distribution of meanand proportion.

Unit-II

Hypothesis testing. Concept of p-value. Student's t-test. Large sample tests. Confidence intervals. ANOVA and testing of hypothesis in regression analysis. Analysis of variance forone way and two way classification (with equal cell frequency).Transformation ofdata.

Unit-III

Advantages and disadvantages of nonparametric statistical tests. Scales of measurements. Run-test. Sign test. Median test. Wilcoxon-Mann Whitney test. Chi-square test. Kruskal- Walli's one way and Friedman's two way ANOVA by ranks. Kendall's Coefficient of concordance.

Practical:

Fitting of distributions. Sample and sampling distributions. Correlation analysis. Regression analysis (Multivariate, quadratic, exponential, power function, selection of variables, validation of models, ANOVA and testing of hypothesis). Tests of significance (Z-test, t-test, F-test and Chi-square test). Analysis of variance. Non-parametric tests.

Course Outcome:

The students will be able to understand different techniques for analyzing the data of their research work.

Teaching Schedule

S.No.	Topic	No. of lectures
1	Elementary statistics	1
2	Probability theory	1
3	Probability distributions (Binomial, Poisson and Normal)	2
4	Sampling techniques, Determination of sample size	2
5	Sampling distribution of mean and Proportion	1
6	Hypothesis testing concept of p-value	1
7	Large sample (mean, proportion)	1
8	Student's t-test (Single mean, Difference of mean for independent samples and paired observations) and F-test	3
9	Analysis of variance (one way and two way), Transformation of data	2
10	Correlation analysis and testing (Bivariate, Rank, Intra-class, Partial, Fisher's Z-transformation)	2
11	Multiple linear regression and model validation	2
12	Testing of coefficient of determination and regression coefficient	2
13	Selection of variables in regression (forward substitution method andstep-wise regression)	1

14	Non-Linear regression (Quadratic, exponential and Power)	2
15	Introduction to Non-parametric and scales of measurements	1
16	Chi-square test (Goodness of fit, Independence of attributes, homogeneity of variances)	2
17	One Sample test (Sign test, Median test, Run rest,)	2
18	Two sample test (Wilcoxon Sign test, Mann Whitney test, Chi square test for two independent samples)	1
19	K-Sample (Kruskal-Walli's test and Friedman's two way ANOVA)	2
20	Kendall's coefficient of concordance	1
	Total	**32**

List of Practicals

S.No.	Topics	No. of Practicals
1	Elementary statistics	1
2	Probability distributions (Binomial, Poisson and Normal)	1
3	Sampling techniques, Determination of sample size,	1
4	Sampling distribution of mean and Proportion	
5	Large sample (mean, proportion)	1
6	Student's t-test (Single mean, Difference of mean for independent samples and paired observations) and F-test	1
7	Analysis of variance (one way and two way), Transformation of data	2
8	Correlation analysis and testing (Bivariate, Rank, Intra-class, Partial,Fisher's Z-transformation)	1
9	Multiple linear regression and model validation	1
10	Testing of coefficient of determination and regression coefficient	
11	Selection of variables in regression (Forward substitution method andstep-wise regression)	1
12	Non-Linear regression (Quadratic, exponential and Power)	2
13	Introduction to Non-parametric and scales of measurements	
14	Chi-square test (Goodness of fit, Independence of attributes, homogeneity of variances)	2
15	One Sample test:Sign test, Median test, Run rest, Two sample test: Wilcoxon Sign test, Mann Whitney test, X^2 test for two independentsamples	1
16	K-Sample: Kruskal-Walli's test and Friedman's two way ANOVA, Kendall's coefficient of concordance	1
	Total	**16**

Suggested Reading:

1. Anderson T W 1958. *An Introduction to Multivariate Statistical Analysis*. John Wiley.
2. Dillon W R and Goldstein M. 1984. *Multivariate Analysis - Methods and Applications*.John Wiley.
3. Electronic Statistics Text Book: http://www.statsoft.com/textbook/stathome.html
4. Goon A M, Gupta M K and Dasgupta B. 1977. *An Outline of Statistical Theory*. Vol. I.The World Press.
5. Goon A M, Gupta M K and Dasgupta B. 1983. *Fundamentals of Statistics*. Vol. I. TheWorld Press.
6. Hoel P G. 1971. *Introduction to Mathematical Statistics*. John Wiley.
7. Hogg R V and Craig T T. 1978. *Introduction to Mathematical Statistics*. Macmillan.
8. Montgomery and Runger 2014. *Applied Statistics and Probability for Engineers*. John Wiley
9. Morrison D F. 1976. *Multivariate Statistical Methods*. McGraw Hill.
10. Siegel S, Johan N and Casellan Jr. 1956. *Non-parametric Tests for Behavior Sciences*.John Wiley.