CHAPTER 53

STATISTICS

Doctoral Theses

01. GOEL (Rashmi)
Designs for Mixture Experiments Through Projections.
Supervisor : Prof. Poonam singh and Dr. Vandana Sarin Walia
Th 24433

Abstract
(Not Verified)

Mixture experiments involve blending two or more ingredients or components. In this type of experimentation, the quality of the end product depends on the relative proportion of the components in the mixture. Some of the key fields where mixture experiments have been widely applied include the drugs and pharmaceutics industry, the food industry and the physical and engineering sciences. Box and Hau (2001) introduced the idea of projection in experimental designs for mixture experiments. Prescott (2000, 2004) has used augmented pair designs for projection of response surface designs onto mixture space and obtained orthogonally blocked designs. Definitive Screening Designs (DSDs) given by Jones and Nachtsheim (2011), Xiao et al. (2012), Nguyen and Stylianou (2013) and Phoa and Lin (2015) have been used to construct mixture designs. These designs are space filling designs as compared to the traditional designs. Georgiou et al. (2013) proposed a new concept of three level Quantitative Screening Designs (QSDs) from weighing matrices. QSDs based on weighing matrices, Hadamard matrices and Plackett and Burman (PB) designs have been used to construct mixture designs. Uniformity and optimality measures for these designs for Scheffé's linear model and Darroch and Waller quadratic model have been calculated and compared. Orthogonal blocking of the constructed designs has been presented. Finally, projection property of PB designs is utilised to construct two types of mixture designs. Uniformity and optimality measures for these designs for Scheffé's linear model have been calculated. The number of design points in the constructed designs has been kept to 2n+1 where n is the number of components in the mixture. This makes the constructed design appropriate for estimating all the parameters of Scheffé's linear Model as well as Darroch and Waller Quadratic Model. These designs can be used in situations where one has to economize on resources.

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02. KAUSHIK (Sakshi)
Quantifying Different Aspects of mental disorders through Statistical Modelling.
Supervisor : Prof. Gurprit Grover and Dr. Alka Sabharwal
Th 24435

Abstract
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Mental disorders are common non-communicable diseases rising with epidemic rates globally and are generally characterized by some combination of abnormal thoughts, emotions, behaviour, and relationships with others. This thesis has undertaken exercises on problems concerning the estimation, comparison, and prediction of factors associated with the diagnosis, progression and remission of mental disorders. This thesis is divided into seven chapters. Chapter 1 provides a brief introduction to mental disorders. Chapter 2 provides a procedure for estimating variables affecting the progression of mental disorders, such as length of stay in the hospital (LOS) and total duration of illness (TDI), for psychiatric inpatients using multivariate modeling. In chapter 3, the significant predictors for estimating the severity of mental illness from a wide range of clinical variables consisting information on both laboratory test results and psychiatric aspects are identified using LASSO regression model. Here, the laboratory test results collectively indicate the measurements on vital signs and blood test results for the evaluation of complete blood count (CBC). The psychiatric aspects consist of information on the variables such as family history, onset, and course of illness, etc. In chapter 4, the inter episodic time between successive episodes of recurring mental illness is estimated and hence the time to occurrence of the next episode is predicted based on the previous inter episodic times using order statistics. In chapter 5, the difference between bipolar disorder and schizophrenia are tested based on the severity of symptoms using C() test. In chapter 6, time series modeling is applied to the Positive and negative syndrome scale scores of the outpatients suffering from schizophrenia and hence the number of visits required to achieve remission are forecasted. This thesis concludes with chapter 7, which discusses several directions for future research. To conduct this research, two retrospective datasets have been used.

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03. NARENDRA KUMAR
Inferences for Some Reliability Models Based on Progressive Type II Right Censoring.
Supervisor : Prof. Ajit Chaturvedi
Th 24432

Abstract
(Not Verified)

The lifetime experiments are time consuming and expensive in nature. To reduce the cost and time of experimentation, various types of censoring schemes are used in life testing experiments. Progressive censoring scheme is a useful method for deriving

inferential conclusions for the life testing and reliability studies. Recently it has become very popular in the reliability and life testing experiments. In this thesis, statistical inferences of parameter(s), reliability function and stress-strength reliability of different lifetime models based on progressive type II censoring are carried out. Chapter 1 gives a brief literature review on some of the important contributions in the area of classical and Bayesian inferential procedures developed for reliability models. In chapter 2, a new technique of obtaining point estimation and testing procedures for reliability functions of a generalized family of distributions under progressive type II right censoring scheme are developed. In Chapter 3, the reliability functions based on progressive type II right censored data are estimated for GISFD with classical inferences. In chapter 4, point estimation and testing procedures under progressive type II right censoring scheme for Moore and Bilikam family of lifetime distributions described. Chapter 5 proposes the classical and Bayesian estimation for the reliability functions of the three parameter Burr distribution under progressive type II right censoring scheme. In chapter 6, the classical and Bayesian estimation for the reliability functions of the PHRM under progressive type II right censoring scheme are developed. Chapter 7 deals with the Bayesian estimation of the reliability functions, when the available data have the form of progressively type II right censored samples from GISFD. In chapter 8, the robust Bayesian inference for the GISFD under an ε-contamination class of prior distributions for the shape parameter with different possibilities of known and unknown scale parameter.

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1. The apperception and accretion of the reliability inference 2. Statistical inferences for the reliability functions of family of lifetime distributions based on progressive type II right censoring 3. Classical estimation procedures for the reliability functions of generalized inverted scale family of distributions based on progressive type II right censored data 4. Estimation and testing processors for the reliability functions of the moore and bilikam family of lifetime distributions under progressive type II right censoring 5. Extimation and testing procedures for the reliability functions of the three parameter burr distribution based on progressively censored data 6. Statistical inferences for the reliability functions in the proportional hazard models based on progressive type II right censoring 7. Bayesian estimation procedures for generalized inverted family of distributions based on progressive type II right censoring under squared error and entropy losses 8. Numerical study of robust Bayesian analysis of generalized inverted family of distributions based on progressive type II right censoring, Bibliography.

04. SHARWAN KUMAR
Statistical Modeling for the Progression of Chronic Kidney Disease in the Presence of Prognostic factors
Supervisor : Prof. Gurprit Grover and Dr. Alka Sabharwal
Th 24434

Abstract
(Verified)

to stage 5, based on the value of glomerular filtration rate (GFR), denotes very mild damage to complete kidney failure. All stages of CKD are associated with increased risks of cardiovascular morbidity, premature mortality, and/or decreased quality of life. The thesis is divided into seven chapters. Chapter 1 deals with a brief introduction about CKD and an extensive review of the underlying concepts, literature related to statistical methods employed in the thesis. The research work is based on two data sets: cross sectional data set (of 100 patients) used in chapters 3 and 4 and retrospective data set (of 117 patients) used in chapters 2, 5, and 6

respectively. Chapter 2 develops a multistate Markov model for studying the progression of CKD to higher stages. Identification of prognostic factors and development of a multinomial logistic regression model for predicting the stages of CKD in the presence of prognostic factors is done in Chapter 3. The statistical significance of the difference in the value of each prognostic factor stage wise is tested using likelihood ratio test and permutation test on real data and simulated data in Chapter 4. A hidden Markov model (HMM) is developed in Chapter 5 to address the problem of misclassification. The comparison of survival function of two groups based on the grouping variable Sex, Diabetes and Hypertension is done in Chapter 6. The thesis concludes with Chapter 7, which contains derivation from various chapters and discusses the directives for future work.

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