# Estimation Methods for Three-Way Repeated Measurements Model

**Fatima H. Al-Kanan**

Department of Mathematics, College of Education for Pure Sciences, University of Basrah, Basrah, Iraq.

| **A R T I C L E   I N F O** | **A B S T R A C T** |
|---|---|

In this paper, we study two estimation methods for a three-way repeated measurements model. We estimated the variance components by using the maximum likelihood method and penalized likelihood method. We determine the moments of each estimator, also we define the likelihood ratio test statistic. We look at the various factors that contribute to accuracy, such as sample size, and biased estimation.

## 1. Introduction

Repeated measurements analysis is widely used in many fields, for example, in health and life science, psychological, and so on [1]. Repeated measurements is a terminology used to describe data in which the response variable for each experimental units is observed on multiple times and possible under different experimental conditions [2]. We use the mean square error to compare the maximum likelihood estimator with the penalized likelihood estimators[3]. Multi-sample repeated measures ANOVA model is supposed to be a model of repeated measurements a p time points that are obtained from q groups of subjects[4]. Al-mouel and jassim [5] study the two-way multivariate repeated measurements analysis of variance. Al-mouel and jassim [6] study the sphericity test for repeated measures model. Al-mouel and Fakhir [7] study of two-way multivariate repeated measurements analysis of covariance model. Al-mouel and abbas [8] study the one-way multivariate repeated measurements analysis of covariance model. Al-mouel and mustafa [9] study the roy's union-intersection test in one-way multivariate repeated measurements analysis of variance model. Al-mouel

*Corresponding author email : fatima.hameed@uobasrah.edu.iq