Abstracts of Dr. Abdullah Al-Shiha's Published Papers: (Nov. 9, 2007)

[1] **Al-Shiha, A. A.**, and Yang, S. S. (1996), "An Improved Approximation for the Shapiro-Wilk Test Statistic for Normality," Pakistan Journal of Statistics, Vol. 12(3), 215-230.

ABSTRACT:
The Shapiro and Wilk (1965) test statistic (W) for testing normality was approximated for sample sizes between 3 and 50. These approximations are not adequate for small sample sizes. The main objective of this paper is to suggest better approximations for the coefficients of W. These improved approximations, which are functions of n and the expected values of the order statistics of the standard normal distribution, are easier to compute than Shapiro-Wilk's approximation.

[2] Huda, S., and **Al-Shiha, A. A.** (1998), "Minimax Designs for Estimating the Slope of a Third-Order Response Surface in a Hypercubic Region," Communications in Statistics: Simulation and Computation, Vol. 27, Issue 2, 345-356.

ABSTRACT:
The design criterion considered is minimization of the variance of the estimated slope of a response surface maximized over all points in the factor space. Optimal designs under the minimax criterion, within some classes of commonly used designs, are derived for third-order polynomial models over hypercubic regions.

[3] **Al-Shiha, A. A.**, and Yang, S. S. (1999), "A Multistage Procedure for Detecting Significant Effects in Unreplicated Factorial Designs," Biometrical Journal, 41, 6, 659-670.

ABSTRACT:
A multistage procedure, which is based on the likelihood principle, is proposed to identify active effects in unreplicated factorial designs and their fractions. The proposed procedure controls the experimental error rate (EER) at any prespecified level in industrial and biomedical experiments. Extensive comparison with Lenth's (1989) test is discussed.

[4] Huda, S., and **Al-Shiha, A. A.** (1999), "On D-Optimal Designs for Estimating Slope," Sankhya, 61, Series B, 488-495.

ABSTRACT:
The concepts of D-. E-, and A-optimality are extended to consider designs for estimating the slopes of a response surface. Optimal designs under the D-optimality criterion are obtained for second-order models over spherical regions.

[5] Huda, S., and **Al-Shiha, A. A.** (2000), "On D-and E-Minimax Optimal Designs for Estimating the Axial Slopes of a Second-Order Response Surface over Hypercubic Regions," Communications in Statistics: Theory and Methods, Vol. 29, Issue 8, 1827-1849.

ABSTRACT:
Design of experiments for estimating the slopes of a response surface is considered. Design criteria analogous to the traditional ones but based upon the variance-covariance matrix of the estimated slopes along factor axes are proposed. Optimal designs under the proposed criteria are derived for second-order polynomial regression over hypercubic regions. Best designs within some commonly used classes of designs are also obtained and their efficiencies are investigated.

[6] **Al-Shiha, A. A.**, and Yang, S. S. (2000), "Critical Values and Some Properties of a New Test Statistic for Analyzing Unreplicated Factorial Experiments," Biometrical Journal, 42, 5, 605-616.

ABSTRACT:

Extended critical values of the test statistic proposed by Al-Shiha and Yang (1999) for analyzing unreplicated factorials are estimated by fitting an appropriate linear model. The asymptotic distribution of the test statistic is derived for large sample sizes. Some important properties of the test are also provided.

[7] Aboukalam, M. A. F., and **Al-Shiha, A. A.** (2001), "A Robust Analysis for Unreplicated Factorial Experiments," Computational Statistics and Data Analysis, 36, Issue 1, 31-46.

ABSTRACT:

A formal robust analysis for detecting active effects in unreplicated 2p factorial experiments and their fractions is proposed. Based on an extensive simulation study, the proposed method is shown to be simple and more powerful than the popular method derived by Lenth (1989). Two types of powers were used as criteria in comparing the proposed method with that of Lenth. Precisely, the newly proposed method provides a redescending M-estimator for scale based on the Cos-function. Critical values for the proposed test statistic were empirically computed and fitted with tabulated values of the t-distribution for different sample sizes.

[8] **Al-Shiha, A. A.** (2001), "On Maximum Likelihood Estimation of Experimental Error Variance in Saturated Factorial Designs," Proceedings of the First Saudi Science Conference, 3, 537-546.

ABSTRACT

In this paper, a new estimator for the standard deviation of the error term in non-replicated factorial experiments, called modified maximum likelihood estimator (MMLE) is proposed and discussed. The new estimator is introduced and compared with the ordinary maximum likelihood estimator (MLE}. Based on an extensive empirical simulation study, the efficiency of MMLE will be compared with that of MLE in terms of the empirical means, variances, and mean squared errors (MSE). In addition, the effects of the problems of overestimating and underestimating the true number of significant effects on both estimators will be empirically explored

[9] **Al-Shiha, A. A.**, (2001), "Inferences for Saturated Simplex Designs," Bulletin of International Statistical Institute, the 53rd Session, Seoul, Republic of Korea, 2001, Vol. 3, 343-344.

ABSTRACT:

A robust procedure is described for examining the significance of the effects in saturated simplex designs. The procedure described in this paper is motivated by the procedure used for analyzing unreplicated factorial experiments proposed by Aboukalam and Al-Shiha(2001).

[10] **Al-Shiha, A. A.**, and Yang, S. S. (2001), "A Multistage Test for Detecting Multiple Outliers in the Normal Case," Arab Journal of Mathematical Sciences, Vol. 7, No. 2, 43-63.

ABSTRACT

In this article, a multistage procedure for detecting multiple outliers is proposed. The proposed test statistic called Ln,k used in this procedure is based on the generalized likelihood ratio principle. In each sequential step of the proposed procedure, Ln,k is considered as a block test for testing multiple outliers in a random sample from a normal distribution with zero mean and unknown variance $\sigma 2$. The test statistic Ln,k is scale-invariant, and hence, it is suitable for any value of $\sigma 2$. The test statistic Ln,k is derived and compared with some well known single – and multiple outliers tests and found to be more powerful and less affected by the problems of swamping and masking. In addition, a real data is given as an example to demonstrate the use of the procedure.

[11] **Al-Shiha, A. A.,** and Yang, S. S. (2001), "The Asymptotic Distribution of $L_{n,k}$ Test Statistic for Analyzing Nonreplicated Factorial Experiments," Calcutta Statistical Association Bulletin, Vol.51, Nos.203-204, pp.205-212.

ABSTRACT:
The asymptotic distribution of the test statistic proposed by Al-Shiha and Yang (1999) for analyzing nonreplicated factorials is derived for large sample sizes. An extensive study is presented to compare the asymptotic percentiles with the empirical percentiles of the test statistic.

[12] **Al-Shiha, A. A.**, and Huda, S. (2001), "On E-Optimal Designs for Estimating Slope," Journal of Applied Statistical Science, Vol. 10, No. 4, 357-364.

ABSTRACT:
The concepts of D-, E- and A-optimality are extended to consider designs for estimating the slopes of a response surface. Optimal designs under the E-optimality criterion are obtained for second-order models over spherical regions.

[13] Huda, S., and **Al-Shiha, A. A.** (2001), "On D-Minimax Efficiency of Second-Order Rotatable Designs for Estimating the Slopes," Journal of Statistical Studies, Vol. 21, 1-12.

ABSTRACT:
Experimental designs for estimating the axial slopes of a response surface are considered. For the second-order polynomial model over hyperspherical regions the efficiency of rotatable designs in comparison with the D-minimax optimal designs is investigated. Results are derived for the commonly used classes of designs like Central Composite designs and those based on Balanced Incomplete Block Designs. The influence of the number of center points on the efficiency is investigated.

[14] **Al-Shiha, A. A.** (2002), "Inference for Saturated orthogonal Designs for Fitting First-Order Models," Journal of Applied Statistical Science, Vol. 11, No. 2, 123-131.

ABSTRACT:
A general procedure is described for examining the significance of effects in experiments utilizing saturated orthogonal designs for fitting first-order models. The simplex designs and Plackett-Burman are discussed as special cases. A 24 factorial design is also discussed as an illustrated example. The procedure described in this paper is motivated by the procedure used for analyzing unreplicated factorial designs proposed by Al-Shiha and Yang (1999a).

[15] **Al-Shiha, A. A.** (2003), and Huda, S., "Fitted Minimax Designs for Estimating the Slope of a Third-Order Polynomial Model in a Hypercubic Region," Pakistan Journal of Statistics, Vol. 19, No. 1, 53-72.

ABSTRACT:
The criterion of minimizing the variance of the estimated slope maximized over all points in the region of interest is considered for third-order polynomial regression models over hypercubic region. Optimal designs derived are then investigated as functions of the number of factors. Regression models are fitted to obtain the functional relationships which are useful for determining the optimal design for a given number of factors, especially when the number of factors is large.

[16] **Al-Shiha, A. A.**, and Yang, S. S. (2003), "A Method of Testing Interaction in a Nonreplicated Two-Way Classification Experiments." Arab Journal of Mathematical Sciences, Vol. 9, No. 2, 31-45.

ABSTRACT:
In this paper, we present a new statistical procedure to detect interaction in non-replicated two-

way cross-classification experiments. This procedure also enables us to identify individual nonzero interaction effects.

[17] **Al-Shiha, A. A.** (2005), "Modified Maximum Likelihood Estimation of Experimental Error Variance in Saturated Factorial Designs," Journal of Statistical Theory and Applications, Vol. 4, No. 2, 139-150.

ABSTRACT:
In this paper, a new estimator for the standard deviation of the error term in non-replicated factorial experiments, called modified maximum likelihood estimator (MMLE) is proposed and discussed. The new estimator is introduced and compared with the ordinary maximum likelihood estimator (MLE). Based on an extensive empirical simulation study, the efficiency of MMLE will be compared with that of MLE. In addition, the effects of the problems of overestimating and underestimating the true number of significant effects on both estimators will be empirically explored.

[18] **Al-Shiha, A. A.** (2006), "A Comparative Study Evaluating The Asymptotic Distribution of $L_{n,k}$ Test Statistic for Analyzing Unreplicated Factorials," Pakistan Journal of Statistics, Vol. 22, No. 3, 241-250.

ABSTRACT:
In this paper, we investigate the accuracy of the asymptotic distribution of the Ln,k test statistic derived by Al-Shiha and Yang (2001). We present an extensive comparison study between the exact percentiles simulated by computers and those computed by the theoretical asymptotic distribution. Our investigation reveals that the asymptotic distribution provides accurate percentiles for the test statistic for large sample sizes.

[19] **Al-Shiha, A. A.**, and Aboukalam, M. A. F (2006), "Quick and Easy Analysis of Unreplicated Factorial Designs Avoiding Shrinkage Deficiency," Journal of Statistical Theory and Applications, Vol 6, No. 1, 35-43.

ABSTRACT:
Lenth (1989) introduced a quick, easy and powerful method for assessing the sizes of contrasts of unreplicated 2p factorial designs. The computations of this method are easy to carry out by hand, and together with the advantage that it uses the original numerical measurments which makes the analysis easier to explain. This article suggests a competing method that is also quick, easy and more powerful. The proposed method is based on a one step of the scale-part of M-skipped estimate. Critical values and power-tables for three sample sizes often used were empirically computed in order to conduct several illustrative comparisons between the two methods.

[20] **Al-Shiha, A. A.**, (2007), "Estimation of Experimental Error Variance in Saturated Factorial Designs," Journal of Statistical Theory and Applications, Vol 6, No 3, 284-301.

ABSTRACT:
In this paper, a new estimator for the standard deviation of the error term in non-replicated factorial experiments, called modified simplified linear unbiased estimator (MSLUE), is proposed and discussed. The new estimator is introduced and compared with several other estimators. Based on the simulation results obtained from the empirical study in this paper, MSLUE is found to be competitive to the maximum likelihood estimator (MLE) and the simplified linear unbiased estimator (SLUE). In addition, MSLUE is found to be less affected by the problems of overestimating and underestimating the true number of significant effects than MLE and SLUE.

[21] **Al-Shiha, A. A.**, (2008), "A Goodness of Fit Test for Testing Spherical Symmetry of a Bivariate Distribution ," (To appear Journal of Applied Statistical Science, Vol. 16, 2008).

ABSTRACT:
Al-Shiha (2007) has proposed a simple test for testing spherical symmetry of a bivariate distribution. Even though, this test is powerful for some cases, it has a low power for rejecting the hypothesis of spherical symmetry for non spherically symmetric distributions that have an equal probability in each of the four quadrants. In this paper, we propose a simple test that avoids the deficiency of the test of Al-Shiha (2007). The proposed test is based on a goodness-of-fit chi-square test. The sampling distribution of the proposed test statistic follows approximately a chi-square distribution. We conduct a simulation study to evaluate the performance of the proposed test for testing spherical symmetry of a continuous bivariate distribution with known means.

[22] **Al-Shiha, A. A.**, (2008), "Bivariate Symmetry and a Simple Generalization of the Sign Test for Testing Spherical Symmetry of a Bivariate Distribution," Journal of King Saudi University (Science Section). To appear.

ABSTRACT:
Ahmad and Cerrito (1991) have proposed two definitions of bivariate symmetry, however; neither of these satisfies the property of exchangeability of two random variables considered by many authors in the literature. This has led us to propose another definition of symmetry that satisfies the desirable properties. We also propose an extension of univariate sign test to test the spherical symmetry of a bivariate distribution. The sampling distribution of the proposed test statistic follows approximately a chi-square distribution. We conduct a simulation study to evaluate the performance of the proposed test for testing circular symmetry of a continuous bivariate distribution.