Institute of Mathematical Statistics

LECTURE NOTES — MONOGRAPH SERIES

# AN OVERVIEW OF THE SYMPOSIUM ON ESTIMATING FUNCTIONS

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The Symposium on Estimating Functions was held at the University of Georgia from March 21, 1996 to March 23, 1996. The Symposium was co-sponsored by the Institute of Mathematical Statistics and the Statistical Society of Canada and represented continuing efforts by the two professional societies to focus special attention on some of the more prominent directions in probability and statistics. Partial funding by the University of Georgia's "State-of-the-Art" Conference Program and a National Security Agency Grant contributed to the success of the Symposium and is gratefully acknowledged. The Symposium attracted 119 registered participants from several countries including Australia, Canada, Denmark, England, Germany, Hong Kong, India, Japan, Kuwait, Sweden, and the United States of America. The program consisted of 13 sessions with 35 invited speakers and 14 contributed talks.

The main theme of the Symposium can be summarized as "Statistics at a Juncture of a Synthesis." The 'likelihood function' has provided a basic methodology for the parametric inference for decades. On the other hand semi-parametric inference has been primarily based on the 'least-squares' methodology for a longer time. The unification and extension of the two methodolgies, achieved during recent years through estimating functions was the main theme of the opening talk of the Symposium by V. P. Godambe. The discussions and presentations which followed were energetic and covered a wide variety of topics: C. C. Heyde suggested avoiding the likelihood; J. A. Nelder presented extensions to quasilihood; N. Reid discussed higher order significance; J. Durbin discussed applications to nonlinear state space time series; J. D. Kalbfleish presented bootstrap using estimating functions. There appeared to be a consensus at the Symposium that Statistics was at

a juncture of a synthesis of the two of its main methodologies, namely the likelihood and least squares, brought about by estimating functions.

Many of the major results which were presented at the Symposium are summarized in these selected proceedings. Specifically, the papers are organized into eight sections. A general historical paper by V. P. Godambe precedes the following sections:

1. 'Likelihood' with papers by P.Greenwood & W. Welfelmeyer, C. C. Heyde, J. F. Lawless, and P. A. Mykland. Topics which are central to this section include likelihood, partial likelihood, pseudo-likelihood and other alternatives to the likelihood.

2. 'General Theory' with papers by A. Amari & M. Kawanabe, V. P. Bhapkar, D.A.S. Fraser, N. Reid & J. Wu, and B. Li. Papers in this section deal with problems on estimating functions in semiparametric models, nuisance parameters, higher order significance and consistency.

3. 'Quasilikelihood' with papers by J.A. Nelder & Y. Lee, and W. Wefelmeyer. Extended quasilikelihood and regression models for Markov chains are discussed in this section.

4. 'Applications to Linear Models and Econometrics' with papers by A. C. Singh & R. P. Rao, B.C. Sutradhar & V. P. Godambe, H. D. Vinod, and T. Wirjanto. Papers in this section address problems in instrumental variable estimation, generalized linear mixed models, Godambe-Durbin estimating functions in econometrics and over- identified models.

5. 'Applications to Time Series, Biostatistics and Stochastic Processes' with papers by B. Abraham, A. Thavaneswaran & S. Peiris, I. V. Basawa, R. B. Lund & U. N. Bhat, J. Durbin, R. L. Prentice & L. Hsu, M. Sorensen, and D. L. McLeish & A. W. Kolkiewicz. Applications in this section are in nonlinear state space models, prediction, failure time data analysis, queueing parameter estimation, diffusion processes and models in finance.

6. 'Applications to Spatial Statistics' with papers by A. F. Desmond, J. L. Jensen, and S. Lele. Prediction in geostatistics, pseudo-likelihood estimation for lattice models and semivariogram estimation are covered in papers in this section.

7. 'Nonparametrics, Robust Inference and Bootstrap' with papers by R. J. Carroll, S. J. Iturria & R. G. Gutierrez, F. Hu & J. D. Kalbfleisch, and P. K. Sen. These papers contain results for estimating covariance matrices, nonparametrics and robustness and bootstrap techniques.

8. 'Futher Topics' with papers by H. El Barmi & P. I. Nelson, and T. Yanagimoto & Hiejima. The two papers in this final section are concerned with inference from stable distributions and inference for the ruled exponential family.

The editors of these selected proceedings of 29 papers are very grateful to numerous referees who very carefully and critically reviewed all papers which

were submitted for publication in the proceedings. Also, the willingness of individual authors to limit the number of pages of their articles helped produce this volume in the IMS Lecture Notes Series.

Special thanks go to Connie Durden for the preparation of this Volume. Ms. Durden worked tirelessly and patiently with the various authors in securing software files of their papers, providing uniformity of margins, spacing and similar editorial changes which greatly enhanced the general appearance of this volume.