Workshop on Stein's Method and Applications
11 – 15 August 2003

Opening remarks by Louis Chen

Good morning, everybody.

~~I am glad that I finally get to use this auditorium.~~

First of all, welcome to IMS (the one in Singapore, of course, namely the Institute for Mathematical Sciences). I apologize for not being able to be with you last week due to my new and unexpected commitments to the other more well-known IMS (i.e. Institute of Mathematical Statistics) which required me to be in San Francisco to attend a number of meetings.

This auditorium and the four surrounding offices took less than five months to build. It was targeted to be completed in time for this program. This is a feat which would not have been possible without the extraordinary efforts put in by the Office of Estate and Development, the architects at CPG Consultants, and the contractor Kienta. It involved careful planning of the construction schedule, special arrangements to expedite approvals by the relevant authorities for each stage of the construction, and long working hours for the workers.

This program "Stein's Method and Applications" is in honor of Charles Stein, who is one of the most distinguished statisticians in the world. Charles has made many fundamental contributions to statistics and probability. His work is characterized by deep insight, profound ideas and ingenuity, all of them at the highest order. He began his illustrious career with the discovery of a two-stage t-test for which the power is independent of the variance while he was in the Air Force during the Second World War. This work arose from a question on the need to treat a sequential version of the t-test with power independent of the

variance. It later became his PhD thesis at Columbia University and was published in 1945 in the Annals of Mathematical Statistics.

In a paper published in the Proceedings of the 3rd Berkeley Symposium on Math Statist and Probab. 1956, Charles surprised the statistical community by proving the inadmissibility of the usual estimator of the mean of a multivariate normal distribution in 3 or higher dimensions. In a subsequent paper published in the Proc. of the 4th Berkeley Symposium on Math Statist and Probab. 1961, he constructed a better estimator than the usual estimator. It is now known as the James-Stein estimator or the shrinkage estimator. Jerzy Neyman regarded this work as one of the two breakthroughs in statistical decision theory, the other being Herbert Robbins' work on empirical Bayes procedures.

In another paper published in the Proc. of the 3rd Berkeley Symposium 1956, Charles developed the theory of efficient nonparametric testing and estimation. This work provided the heuristics underlying the later development of the field of semiparametric statistics.

Charles has a habit of leaving his work unpublished. One of his unpublished works establishes that for abelian or compact groups, the best invariant test is also minimax. This result is now known as the Hunt-Stein theorem.

These are a just a few examples of Charles' fundamental work. Perhaps his most important and influential work is his method of probability approximation which he invented and applied to normal approximation in a paper published in the Proc. of the 6th Berkeley Symposium on Math Statist and Probab. 1972. Although the method in the paper is in a form for normal approximation, his ideas are general and applicable to other probability approximations.

In the ensuing 30 years after this seminal paper, Stein's method has been extended, developed and related to other areas. It has been applied to many

other settings such as Poisson approximation, compound Poisson approximation, Poisson process approximation, multivariate normal approximation, and more recently, chi-square approximation, polynomial birth-death approximation and Gibbs measure approximation. As it works remarkably well for dependent random variables, Stein's method has been applied to a wide range of fields. These include spatial statistics, computer science, the theory of random graphs, computational molecular biology, interacting particle systems, the bootstrap, the mathematical theory of epidemics, algebraic analogs of probabilistic number theory, insurance and financial mathematics, population ecology and the combinatorics of logarithmic structures.

Despite all the progress made, the reasons for the effectiveness of Stein's method still remain something of a mystery. There are still many open problems, even at a rather basic level. Controlling the behavior of the solutions of the Stein equation, fundamental to the success of the method, is at present a difficult task, if the probabilistic approach cannot be used. The field of multivariate discrete distributions is almost virgin territory. Point process approximation, other than in the Poisson context, is largely unexplored. The list can go on.

This program aims to re-focus interest on understanding the essence of the method and on the various open problems associated with it. It also seeks to foster collaboration in the many fields of application now being studied. There is a great diversity of topics among the talks in this workshop, all on different aspects of Stein's method, offering an unprecedented opportunity for the participants to cross-fertilize their ideas through interactions.

Let us take advantage of this opportunity and make this workshop a great success.

Thank you.