Editor's Foreword

On October 20, 2010, the United Nations celebrated its first World Statistics Day.   In Hong Kong, our Society also organized a series of celebration activities.   In this issue, the President reports on the many interesting and meaningful activities that were held on the wonderful Day.   A report on the public seminar entitled "Widening the Scope of General Knowledge Recognizing the Fallacies of Statistics" and the opening address for the dinner in commemoration of the World Statistics Day as delivered by Mrs Lily OU-YANG are also included, in this particular issue.

We also conduct an interview with Professor Kai-Wang NG, the honorable speaker of the Day, on his unexpected journey to the converse of Bayes' Theorem.   The excitement and experiences gained during his journey are found to be very stimulating.

In addition, there are also articles by Professor Frederick HO, Mr Hing-wang FUNG and Dr Shir-ming SHEN, giving their wonderful thought and sharing on the First World Statistics Day.

I am sure you would enjoy reading this special issue on the First World Statistics Day.

I would like to take this opportunity to wish all of you a Happy Chinese New Year, and have some breakthroughs in the new year.

Teresa NG

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(Vol. 33/No.2, January 2011)

It is my honour to have an opportunity to say a few words in this Forum.

It was a very special day for the statistical community on 20 October 2010. That was the first World Statistics Day (WSD) as designated by the United Nations, to acknowledge the importance of reliable and timely statistics to informed policy decisions. On that day, the Hong Kong Statistical Society organized a series of events and activities to celebrate the achievement of the Hong Kong statistical community. This Special Issue briefly reports these activities. The details and pictures are available in the Academic Events 2010 section at the Society's URL:

http://www.hkss.org.hk/Events/Academic.htm.

In addition to reports on these activities, this Issue contains contributed articles kindly by Mr FUNG Hing-wang, Professor Frederick HO and Dr SHEN Shir-ming. I am sure you would enjoy reading their wonderful sharing.

Let me summarize the events organized by the Society on the first World Statistics Day. In the afternoon, a Public Seminar entitled "Widening the Scope of General Knowledge -- Recognising the Fallacies of Statistics (擴闊通識思維 「識」破統計謬誤)" was organized jointly with the Education Bureau, the Census and Statistics Department and the Department of Statistics and Actuarial Science of The University of Hong Kong. Some 200 participants attended the seminar which was held at Chiang Chun Studio Theatre at the Polytechnic University. The Public Seminar aimed to provide insights on how to be smart users of sample survey from the perspectives of compiler of official statistics, academia, and the user.

The public seminar attracted some 200 secondary school teachers and post-secondary students.

There were three sessions, "*Making sense of sample surveys — be a smart data user*", "*Certainty among randomness*" and "*Common pitfalls in using data*".   More details are available in this Issue.

The Public Seminar was well received by attendants, particularly teachers of Liberal Studies and Mathematics in secondary schools and students of tertiary institutes.   Most participants found the contents well-organized and useful to them.   Indeed, nowadays there are statistics everywhere, but it is no simple task to interpret and use statistics appropriately.   In fact, it is beneficial to the entire society if everybody can use statistics smartly and correctly so as to facilitate scientific and rational discussion on public issues.

Later there were also two celebration events in the evening; both took place in the Customs and Excise Department Senior Officers' Mess, a very good venue for transportation purpose.   The first was an Academic Seminar organized by the Society and the speaker was Professor NG Kai-Wang, Head of Department of Statistics and Actuarial Science, The University of Hong Kong.   The second was a Commemorative Dinner for WSD, which was co-hosted by the Society and the Census and Statistics Department.

The venue was completely filled in both events.   Participants were Members of the Society and guests from many other places of the world.

Professor NG Kai-Wang illustrated an enlightening example of how he arrived at the Converse of Bayes' Theorem by going back further to the basics.

The talk by Professor NG, "*An Unexpected Journey to the Converse of Bayes' Theorem*", was very informative and interesting. We all know Bayes' Theorem, but perhaps not that many know that it was developed from scratches in a paper of 49 pages, which was published by the Royal Society of the UK two years after Bayes' death, thanks to his friend who had found it among inherited documents. There have been interesting conjectures by prominent academics on the mystery why Bayes withheld the paper. Professor NG has added a new one to

the list, based on his discovery of the Converse of Bayes' Theorem.   In the talk, he explained the logic behind the new conjecture and shared with the audience his amazing journey leading him to the Converse.   His presentation slides are in the Society's web: http://www.hkss.org.hk/Events/2010/20101020/OCT20WorldStatDayFinal1.pdf.

I agree with the comment on the talk by Mrs Lily OU-YANG, the Acting Commissioner for Census and Statistics, that Professor NG has "left a legacy in the history of the Hong Kong statistical community."   What did I learn from the Seminar?   Firstly, it is important to ask questions if we want to develop original and fundamental ideas.   In some occasions we ask "why"; in some other occasions we ask "why not," and quite frequently we ask "what if."   Secondly, if we would go back to basics frequently enough, we could discover significance out of the ordinary and would not miss a forest for its trees.

After the seminar, Professor NG had kindly agreed for an interview with two of our members to share more about his experience and satisfaction in his journey that spanned 15 years.   See the interview report in this Issue.

Right after the Academic Seminar, the audience joined the commemorative dinner. That was a valuable opportunity for statistics professionals to celebrate the special occasion of the first World Statistics Day together.

The dinner started with an opening address (which is available in this Issue) by Mrs Lily OU-YANG, the Acting Commissioner for Census and Statistics. She appealed to all participants to join hands to continue practicing the common core values of the World Statistics Day – "Service, Integrity and Professionalism" in each and every part of our statistical endeavours. I share the view of Mrs OU-YANG that the World Statistics Day signified the beginning of further collaboration and communication among statisticians, academics and other parties in the community.

Mrs Lily OU-YANG appealed to everyone to join hands to continue practicing the core values of "Service, Integrity and Professionalism" in our statistical endeavours.

In her speech, Mrs OU-YANG had also conveyed the personal message of Mr FUNG Hing-wang, Commissioner for Census and Statistics, who was attending an observance ceremony at the World EXPO Shanghai, which was jointly organized by the National Bureau of Statistics of China and the United Nations.

Mr FUNG Hing-wang (third from left) met Mr SHA Zukang, the United Nations Under-Secretary-General for Economic and Social Affairs (fourth from left) when attending the World Statistics Day Observance event in the World Expo at Shanghai.

In the conveyed message, Mr FUNG thanked all the staff of the Census and Statistics Department for their professionalism and dedication in building up a reputable official statistics system for Hong Kong. He expressed that the Census and Statistics Department had been working closely over the years with the international and local statistical communities in enhancing the quality of official statistics and promoting their applications; and that such efforts had made and would continue to make the Department a vital and valued institution in the community. On behalf of the Society, I would also like to thank the Census and Statistics Department for its support in many of our activities throughout the years.

The Declaration on Professional Ethics 2010 was promulgated on the first World Statistics Day by the International Statistical Institute. Professor Frederick HO, an Honorary Member of the Hong Kong Statistical Society and the former Commissioner for Census and Statistics, was invited to speak about this Declaration. He mentioned that the Declaration was an update of the Code of Conduct promulgated in 1985, incorporating developments and changes since then. He briefly introduced its emphasis on the

Professor Frederick HO introduced the Declaration on Professional Ethics 2010, which emphasized on the "Shared Professional Values" of Respect; Professionalism; and Truthfulness and Integrity.

"Shared Professional Values" of Respect; Professionalism; and Truthfulness and Integrity. He also mentioned that twelve ethical principles had been listed, with some annotations for highlighting the underlying issues and clarifying possible ambiguities. The audience was referred to the ISI website (http://isi-web.org). At the end, he said that the Society's hosting of the Academic Seminar was "simply wonderful" in view of the speaker's persistence in "his 15 years' search of the truth", which "had not been an easy one," and the speaker's demonstration of professional integrity, which "was particularly appropriate for highlighting" on the occasion in respect of the Declaration. I truly agree with what he said. (The synopsis of his remarks is in this Issue.)

Professor GU Ming-gao showed the statistical evidence in assessing whether the horse racing betting market in Hong Kong is efficient and how investment strategies can work.

Professor GU Ming-gao, the Graduate Division Head in the Department of Statistics, the Chinese University of Hong Kong, was invited to speak about the statistical application on market efficiency, and investment strategies by means of a case study of racetrack betting in Hong Kong as an illustrative example.

Professor LAM Kin, Professor Emeritus of the Hong Kong Baptist University (formerly Chair Professor and Head of the Department of Finance and Decision Science) shared with the audience his experience in applying statistical methods in finance.

The presentations of Professor GU and Professor LAM showed us that Statistics are everywhere and have a wide range of applications in our everyday life.

A newly reprinted edition of the booklet "Kaleidoscope in Probability" (概率萬花筒), co-authored by Professor LAM Kin (left) and Professor SIU Man-keung was distributed during the dinner.

To promote literacy on probability and statistics, a newly reprinted edition of the booklet "Kaleidoscope in Probability" (概率萬花筒) written by Professor SIU Man-keung and Professor LAM Kin was distributed during the dinner.

Your presence and support in all the above meaningful activities was the most valuable contribution to the success of the events.   Of course, I must express my appreciation to the hard work of all the colleagues and helpers involved in the preparation.   Thank you very much!

Everyone enjoyed a wonderful dinner on the First World Statistics Day.

The World Statistics Day was celebrated for the first time on 20 October 2010 in more than 100 national statistical offices worldwide, in order to acknowledge the importance of reliable and timely official statistics to informed policy decisions. The aim of this initiative, which was pioneered by the United Nations, was to raise awareness of the many achievements of official statistics premised on the core values of "Service, Professionalism and Integrity".

Joining Mrs Lily OU-YANG (third right), Acting Commissioner for Census and Statistics, are Dr Catherine CHAN (third left), Deputy Secretary for Education; Mr Leslie TANG (first left), President of the Hong Kong Statistical Society; Mr MAK Nak-keung (second right), Chief Economist of the Sun Hung Kai Properties Ltd; Dr Philip YU (first right), Associate Professor of the Department of Statistics and Actuarial Science of The University of Hong Kong; and Miss Amy YU (second left), Senior Statistician of the Census and Statistics Department.

To mark this special occasion, the Hong Kong Statistical Society organized a Public Seminar, which is entitled "Widening the Scope of General Knowledge -- Recognizing the Fallacies of Statistics," on 20 October 2010, in collaboration with the Census and Statistics Department; the Education Bureau; and the Department of Statistics and Actuarial Science of The University of Hong Kong. The Public Seminar was officiated by Mrs Lily OU-YANG, Acting Commissioner for Census and Statistics; and Dr Catherine CHAN, Deputy Secretary for Education. More than 200 participants attended the Seminar, comprising mainly secondary school teachers and post-secondary students.

The objective of the Public Seminar was to provide insights on how to be smart users of sample survey from the perspectives of compiler of official statistics, academia, and the users.   There were three sessions in the Public Seminar.   The first session on "Making sense of sample surveys — be a smart data user" was presented by Miss Amy YU, Senior Statistician of the Census and Statistics Department.   Illustrated with many real life examples, Miss YU highlighted the proper ways of conducting sample surveys.   Issues such as the sampling frame, sample design, questionnaire design, sample size and response rate have been discussed.

Miss Amy Yu answered questions from the audience about sample surveys.

Dr Philip YU gave an interesting talk on "Certainty at haphazard".

Dr Philip YU, Associate Professor of the Department of Statistics and Actuarial Science of The University of Hong Kong, gave an interesting talk on "Certainty at haphazard".   Instead of presenting difficult theorems, Dr YU used interactive games and examples to demonstrate how unlikely events (e.g. a video showing a person tossing a coin ten times with heads appearing ten times in a row) could happen.   He played an interactive game with the audiences to demonstrate how a person can win a guessing game five times in a row.   Firstly, he asked the audiences to stand up, holding a coin on either the left hand or the right hand.   Secondly, he asked part of the audiences to sit down based on a rule (e.g. those holding the coin on the right hand).   This repeated and after six rounds, only one person remained.   It was known that the probability of winning six times in a row was only one out of 64, and Dr YU demonstrated that it could happen.   All the audiences enjoyed the game very much.

The participants played an interactive game to experience how unlikely events could happen.

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The third speaker was Mr MAK Nak-keung, Chief Economist of the Sun Hung Kai Properties Ltd. In his talk on "Common pitfalls in using data", Mr MAK used a number of real life examples to illustrate how statistics could be mis-interpreted. For instance, he showed why nominal Gross Domestic Product (GDP) is a better indicator in reflecting the economic situation during deflation

Mr MAK Nak-keung illustrated how statistics could be mis-interpreted by a number of real life examples.

period than real GDP. He also gave examples on how the change in coverage could affect the interpretability of the statistics. Another typical example was the illusion of increasing fertility rates of Hong Kong women caused by the drastic increases in the number of babies born in Hong Kong to Mainland women.

Mr Leslie TANG, President of the Hong Kong Statistical Society, concluded the seminar with some take-home tips.

The Seminar attracted enthusiastic responses with many Q&As addressed in the last session. Mr Leslie TANG, president of the Hong Kong Statistical Society and also the moderator, concluded the Seminar by highlighting the gist of assessing the reliability of survey results; developing a scientific mind to understand the assumptions behind the models; avoiding instinct in interpretation; and recognizing the possible motives (e.g. commercial interest) behind the figures compiled by some organizations.

By looking at the faces of the participants, the Public Seminar was a real success. Every audience has picked up useful information from the Seminar. It is hoped that they will pass on the knowledge to their students and others so as to heighten the awareness of the many contributions and achievements of official statistics.

Distinguished guests, ladies and gentlemen,

Good evening.   I am very pleased to join you all this evening in celebration of the first World Statistics Day.   Let me first extend a very warm welcome to all of you.

Today is an important day for the statistical community.   Thanks to the United Nations, it is the first time that all places around the world are drawn together to celebrate the achievements of statistics on the same day, as a recognition of the growing importance and influential role played by official statistics at global, regional and national level.

As you may be aware of, there are numerous celebration activities organized internationally and locally to mark this day.   Internationally and at this moment, the National Bureau of Statistics of China and the United Nations are jointly organizing an observance ceremony at the World EXPO Shanghai.   Mr FUNG Hing-wang, the Commissioner for Census and Statistics, is now in Shanghai attending the ceremony and cannot join us for dinner tonight.   Mr FUNG would like to express his heartfelt thanks to all of you for your support in organizing and participating in the World Statistics Day activities.   He has asked me to convey his personal message to you.

"On behalf of the Census and Statistics Department of the Hong Kong SAR Government, I would like to express my gratitude and appreciation to our co-organizer of this dinner, the Hong Kong Statistical Society (HKSS) for their unfailing efforts over the years in promoting fellowship and the sharing of knowledge and expertise in the statistical community.   The active participation and support from members of the HKSS, from both the private and public sectors and the academia, in activities organized by the Society have been the key factors leading to the success and harmony we have achieved in our statistical community.

I would also like to take this opportunity to thank all the staff of the Census and Statistics Department for their professionalism and dedication in building up a reputable official statistics system for Hong Kong.

Over the years, our department has been working closely with the international and local statistical communities in enhancing the quality of official statistics and promoting their applications.   Such efforts have made and will continue to make our statistical office a vital and valued institution in the community. I would also like to extend our warmest welcome to our friends from the Statistical Institute of Asia and the Pacific (SIAP) and statistical offices of Mainland China, Macao, Malaysia and Singapore.   This week SIAP and C&SD are jointly organizing a sub-regional workshop on "Measuring and Improving Survey Quality" and we are pleased that the lecturers and participants of this workshop can join us on this special occasion of the World Statistics Day.   Yet, fellow members of the HKSS, fellow colleagues of the C&SD and dear friends from SIAP and participants of the sub-regional workshop, it is your presence and contributions that would truly make the World Statistics Day events a great success.   I wish every one of you a very memorable and meaningful dinner gathering tonight."

Without wishing to keep you from your dinner for too long, allow me to say a few more words about the World Statistics Day activities in Hong Kong.   A series of activities have been organized starting from early October to mark the World Statistics Day.   This afternoon, the public lecture to promote statistical literacy was well received by about 200 teachers and students.   Feedbacks from participants indicated that the lecture has enriched their knowledge and understanding in statistics as well as their applications.

About an hour ago, Professor NG, the Head of Department of Statistics and Actuarial Science of The University of Hong Kong, delivered a talk on the Converse of Bayes Theorem.   His journey in discovering the Converse of Bayes Theorem, unveiled to us just now, is extremely enlightening.   I would like to congratulate Professor NG on this great academic achievement.   Professor NG, it's most inspiring and rewarding for all of us to have such an opportunity to hear your exciting intellectual discovery on this special day, the first World Statistics Day.   You have indeed left a legacy in the history of the Hong Kong statistical community.   Thank you very much, Professor NG.

We are also much honoured to welcome our friends who came all the way from the Mainland, Macao, Malaysia and Singapore to join us this evening to celebrate the World Statistics Day.   Thank you very much for your participation despite your busy schedule.

May I extend a very warm welcome to you and hope you would enjoy our beautiful and vibrant city during your stay in Hong Kong.

I trust you are, same as me, eager to hear the enlightening sharings from Professor GU and Professor LAM on interesting aspects of statistical applications. Professor GU is the Graduate Division Head of the Department of Statistics in the Chinese University of Hong Kong. He will explore the application of statistics in a case study of Hong Kong's racetrack betting with regard to market efficiency and investment strategies. Professor LAM is the Emeritus Professor of Hong Kong Baptist University, an active and influential member in the local financial community, and also an Honourary Member of the Hong Kong Statistical Society. He will share with us his experience in applying statistical methods in the financial sector. Thank you, Professor GU and Professor LAM, for coming tonight to share with us your insights in statistical application.

Finally, I would like to add that this dinner does not mark an end to the celebration of the World Statistics Day. Indeed, it signifies the beginning of further collaboration and communication among statisticians, academics and other parties in the community. Let's all join hands to continue practicing the common core values of the World Statistics Day – "Service, Integrity and Professionalism" in each and every part of our statistical endeavours.

Thank you very much for your great support to tonight's event. We are very much honoured to have the presence of each and every one of you here this evening. I hope you all have a great time of reunion, sharing, professional exchange and enjoyment.

World Statistics Day
20.10.2010

**Synopsis of Professor Frederick W H HO's Remarks
during the World Statistics Day Commemorative Dinner**

At the Dinner, the President invited Professor Frederick HO, an Honorary Member of the Hong Kong Statistical Society, to speak about the Declaration on Professional Ethics 2010, which the International Statistical Institute (ISI) had taken the opportunity to promulgate on the World Statistics Day, in his capacity as a member of the Committee on Professional Ethics of the Institute.

Prof. HO, currently Honorary Professor at The University of Hong Kong and Adjunct Professor at the Chinese University of Hong Kong, was a former Commissioner for Census and Statistics of Hong Kong (1992-2005) and a former President of the Hong Kong Statistical Society (1986-88).

Prof. HO mentioned that this Declaration was an update of the Code of Conduct promulgated in 1985. During the 25 years since 1985, a lot of developments and changes had obviously taken place, in areas such as developments in statistical methodology, statistical applications, information technology, global connectedness, citizen rights, commercial practices and intellectual property issues. An updating would be necessary to respond to these.

In drawing up the current version of the Declaration, the 1985 Code had been studied in great detail. Many of the fundamental ideas had actually been preserved. It was maintained that the aim of the Declaration on Professional Ethics would be to document shared professional values and experience as a means of providing guidance rather than regulation; and that the Declaration would be adopted as an affirmation of the membership's concern with these matters and of its resolve to promote knowledge and

interest in professional ethics among statisticians worldwide. Given that the influence of statistics and statisticians in many other fields of human endeavours had significantly widened over the 25 years, it would be necessary to ensure that other parties also understand the way that statisticians would operate and behave in terms of professional ethics.

Prof. HO said he would not have time to go into details of the Declaration but would refer the audience to the ISI website (http://isi-web.org) from which the full version could be downloaded. He just briefly introduced that the Declaration emphasized on the "Shared Professional Values" of Respect; Professionalism; and Truthfulness and Integrity; and mentioned that twelve ethical principles had been listed, with some annotations for highlighting the underlying issues and clarifying possible ambiguities.

In concluding his remarks, Prof. HO expressed that it was simply wonderful that the Hong Kong Statistical Society had hosted the Seminar "An Unexpected Journey to the Converse of Bayes' Theorem", given by Prof. Kai Wang NG earlier in the day. Apart from introducing and explaining the significant technical issues, Prof. NG revealed most subtly (as he always being such a modest gentleman) during his talk as how the journey in his 15 years' search of the truth had not been an easy one. Observant listeners would have, however, noted the quotes he made, "It requires a very unusual mind to undertake the analysis of the obvious" (Alfred Whitehead) and "All great truths begin as blasphemies" (Bernard Shaw), and the reference to the story of The Emperor's New Clothes. Prof. HO applauded Prof. NG's persistence in the search of truth and his demonstration of professional integrity; the latter was particularly appropriate for highlighting on the special occasion of the World Statistics Day with the promulgation of the 2010 Declaration of Professional Ethics of the ISI.

Interview with Professor NG Kai-Wang on

His Unexpected Journey to the Converse of Bayes' Theorem

Pauline TSANG and James CHENG

On 20 October 2010, the Hong Kong Statistical Society organized the first World Statistics Day Seminar, and the speaker was Professor NG, Head of Statistics and Actuarial Science, The University of Hong Kong. Below was the Seminar banner.

CHENG:

Professor NG, in Hong Kong's first World Statistics Day Seminar, you introduced the Converse of Bayes' Theorem. What was the key message you wished to convey to the audience?

NG:

As the foundation of the recently popular Bayesian inference, Bayes' Theorem is taught in any first course on probability and statistics. The Theorem was developed from the most basic axiomatic premises in Bayes' manuscript, "*An Essay towards Solving a Problem in the Doctrine of Chances.*" The 49-page self-contained *Essay* was published posthumously in 1763, more than two years

after Bayes' death, when his friend, Richard Price, had found it among inherited papers and sent it to the Royal Society for reading at a Society meeting.   There were interesting conjectures about the mystery why Bayes, himself a Fellow of the Society, did not communicate the *Essay* during his lifetime.   Sir R. A. Fisher and Prof. Stephen M. Stigler (who is an expert in history of statistics and whose father George Stigler won the Nobel Memorial Prize in Economic Sciences in 1982) both conjectured that Bayes had <u>withheld</u> the *Essay*, but for different reasons.

In my conjecture, Bayes withheld the *Essay* because he had obtained the converse of the main theorem in the *Essay*, or he had recognized a logical implication of such a possible converse, and wanted more time to re-write it in those days of writing with feather and ink.   Logically, a converse implies that one can always determine the prior probabilities as a result of reverse-engineering from the compatible posterior probabilities that one wishes to get in the end.   Unfortunately, Bayes was ill by the age of 53 and died at 59.   Otherwise, according to my conjecture, his revamped *Essay* would have presented the theorem together with its converse, plus a very careful argument for his paradigm of inference in order to avoid the impression (or criticism) of inviting possible misuses of his theorem via its converse.   Note that Bayes' paradigm was the first ever in history, contrary to many researchers' labeling of the much later frequentist approach as "classical" or "orthodox."   I also wish that people could see that although the reason in my conjecture and those of Fisher and Stigler are very different, they are not in conflict with each other at all.

The more I think about Bayes' background, the more I believe he actually saw the converse.   If I can derive it without any mathematics invented after Bayes' time, it is unbelievable that he was unable to do the same.   After all, his intellectual capability and academic standing in mathematics had earned him Fellowship in the Royal Society at the age of 40 and, needless to say, he was the person most familiar with the subject of his own theorem which was developed in a paper of 49 pages.   So I hope I have convinced the audience that it was a matter of more time for Bayes to rewrite his *Essay*.   I also look forward to the days when the Converse will be part of introductory courses in probability and statistics, as a sequel to the Theorem.

TSANG:

Professor NG, what inspired you towards the Converse of Bayes' Theorem?

NG:

It all started with a key integral equation in the Data Augmentation (DA) Algorithm, which Martin A. Tanner and Wing H. Wong proposed to solve by a method in functional analysis called "successive substitutions," in their seminal paper published in the *Journal of American Statistical Association* (JASA) in 1987, on which discussions by prominent statisticians in the ASA were invited. More details were given in a Springer-series monograph by the first author, Tanner, who was a Ph.D. student of Wing Wong and later an editor of JASA. In the early 1990's, the Bayesian Missing Data Problems (BMDP), which the DA Algorithm aimed to handle, was a very hot topic in the US statistical community. The first edition of Tanner's monograph "*Tools for Statistical Inference*" went into 3rd printing in 1993 and became the 2nd Edition in 1994 (and 3rd Edition in 1996). It was among the references on a course in statistical inference at HKU. In 1994, Wing Wong became the Head of Statistics at CUHK (I received a B.Sc. in 1967 from CUHK) and was actively promoting more research in statistics. A statistical conference was organized by the Hong Kong Statistical Society in January 1995.

Against this background, I was attracted to the integral equation underpinning the DA Algorithm, partly due to my past interest in fixed-point theorems in the late 1960's before I joined statistics. Since the sufficient conditions ensuring the convergence of the DA Algorithm were too difficult to verify in common practice, I planned to replace them with plainer ones for easier checking. This turned out to be the starting point of my unexpected journey.

TSANG:

After your journey started, what were the milestones?

NG:

My initial approach was to define a suitable distance measure (or norm) in the space of density functions in a particular application such that the integral operator of the successive substitutions was a contractive mapping and hence that the convergence was automatically guaranteed. It worked in a good number of applications, so I reviewed them with a view of getting a set of guidelines for defining suitable distance measures in different circumstances. I found the common point that the specific data as provided in

all those cases were not vital at all in defining the distance measures. Then certain thoughts struck me and changed my direction in 1995 as follows.

In any BMDP, where Y is observable and Z represents the missing part, the aim is to find $\pi(\theta \mid y)$ based on $f(z \mid y, \theta)$ and $p(\theta \mid y, z)$, where the density functions are connected by the integral equation which Tanner and Wong set out to solve in the paper:

$$\pi(\theta \mid y) = \int p(\theta \mid y, z) \left\{ \int f(z \mid y, \phi) \pi(\phi \mid y) d\phi \right\} dz$$

The given Y becomes a constant throughout the whole formulation, just like a given parameter value for the family of joint distributions of (θ, z). So we can simply drop y in all density functions at this level of abstraction without any loss of generality. This is equivalent to finding $\pi(\theta)$ in terms of $f(z \mid \theta)$ and $p(\theta \mid z)$. I thus recognized that the real issue for BMDP was the Inversion of Bayes Formula (IBF). This true nature was totally unexpected as BMDP was supposed to find a "posterior" density, not a "prior" one. Now a moment's reflection on the relativity makes it clear: $\pi(\theta \mid y)$ is "posterior to" the observed Y and at the same time "prior to" the unobserved Z.

It reminded me of the famous lines in a poem: "Being well inside the mountains, one can't tell their true appearance." (不識廬山真面目, 只緣身在此山中) It is a situation where "Stakeholders are entrenched, but bystanders can comprehend." (當局者迷, 旁觀者清) So the first milestone of the journey is my recognition of BMDP as IBF.

Not knowing any results on reversing the Bayesian process, I looked at the basic identity, $g(z) / \pi(\theta) = f(z \mid \theta) / p(\theta \mid z)$, which holds if both $f(z \mid \theta)$ and $p(\theta \mid z)$ are non-zero (they are simultaneously zero or non-zero). If a particular θ is such that the non-zero region of $f(z \mid \theta)$ equals that of $g(z)$, I could integrate both sides over this common region to get rid of the marginal density $g(z)$, obtaining $\pi(\theta)$ for this particular θ as a harmonic mean of the posterior $p(\theta \mid z)$ w.r.t. the likelihood $f(z \mid \theta)$ -- the "point-wise IBF". By symmetry, if the non-zero region of $p(\theta \mid z)$ for a particular z equals that of $\pi(\theta)$, I could get $g(z)$ for this z with the point-wise IBF, and then substitute it into the above identity to get the function $\pi(\theta)$ for all θ -- the "function-wise IBF". Note that under the strong positivity condition that the conditional densities are non-zero for all (θ, z) in the product space, as assumed in the DA Algorithm, both point-wise and function-wise IBF hold. When I put back the observed data y in the original positions in all densities involved, I got the

explicit solution to the Tanner & Wong integral equation in dual forms.   You may notice the dual solutions which were printed on the top of the banner decorated in the room of the first WSD Seminar.   Thanks to the Society, I have that banner as a souvenir to keep.

The ease with which to obtain the IBF in this way reminded me of Thomas Fuller's words: "All things are DIFFICULT before they are EASY."   In sequel to the elaborative and glamorous method of successive substitutions in functional analysis, the sudden appearance of the direct and simple IBF also reminded me of a few lines in a famous poem describing a lover's unexpected discovery: "Seeking him [the solution] in the party place over hundreds and thousands of times; suddenly I turned around, and there he was under the dim light."   (眾裡尋他千百度; 驀然回首, 那人卻在燈火闌珊處。)   So the second milestone of the journey is the explicit IBF together with their interesting meanings.   I must say that given its simplicity, the IBF might have already appeared in other research fields without the attention of statisticians.   Only history can tell.

The point-wise and function-wise IBF, both of which arise from BMDP, are just solutions under special conditions, because in general a non-zero region can be irregular in various ways.   So in 1996 I went further back to Bayes' Formula in the original form of events.   You know, it is about the probabilities of member events of two partitions of the sample space, labeled *antecedent* and *consequential* respectively for easy distinction here.   Based on the set of conditional probabilities of the consequential events given the antecedent events, Bayes' Formula inputs the set of marginal probabilities of antecedent events and outputs the set of the conditional probabilities of antecedent events given consequential events, and so an inversion of the formula is expected to reverse this process.   Note that as both sets of conditional probabilities are viewed as given in the inversion, determining one set of marginal probabilities means determining all the joint probabilities, and hence the other set of marginal probabilities as well. Note also that the labeling of the two partitions is just for convenient reference and can be exchanged throughout by symmetry without affecting the mathematical reasoning.

Surprisingly, a general algorithm for the inversion based on an elementary principle on positive numbers could handle all patterns of zero-probability regions.   I'm sure you can recall that a set of positive numbers are uniquely determined by their relative proportions together with their total, and there is a simple way to calculate the numbers. If, however, the set of positive numbers is composed of subsets where proportions are known within subsets, but not between subsets, then the numbers are not uniquely determined and will depend on how the total is divided into subtotals of the subsets.

Since the marginal probabilities of the antecedent events sum to one, the key is thus to find the proportions between the marginal probabilities, which turns out to be not difficult at all as shown below. This pleasant surprise to me can be described by an old Chinese saying which roughly means: "Finding an object in nowhere can wear out all tough shoes; yet it can turn up as if no effort is made." (踏破鐵鞋無覓處，得來全不費功夫)

For any (antecedent) event A and any (consequential) event C, we have $P(A)/P(C) = P(A|C)/P(C|A)$, whenever the conditional probabilities are not zero (note: they are both zero or both positive depending on whether the intersection of A and C is void or not). If A1 and A2 are two antecedent events, both having non-void intersection with a particular consequential event C, then $P(A1)/P(A2)$ equals the ratio of $\{P(A1|C)P(C|A2)\}$ to $\{P(A2|C)P(C|A1)\}$, which is given. So A1 and A2 are proportionable via C. In particular, if there is a single C that has non-void intersection with all antecedent events, then all proportions are available immediately. Of course this case can also be handled by the special function-wise IBF that gives the same result as in this general algorithm. Under the strong positivity condition that each antecedent event intersects with each consequential event, the general algorithm gives the same result as that by the point-wise and function-wise IBF.

In general, if A1 and A2 are proportionable and A2 and A3 are also proportionable, whether via two different consequential events or via the same one, then A1 and A3 are proportionable, because $P(A1)/P(A3)$ equals the product of two given ratios, $P(A1)/P(A2)$ and $P(A2)/P(A3)$. Thus the algorithm examines all consequential events to collect all the available proportions between marginal probabilities of antecedent events. If the complete set of proportions is available, the marginal probabilities are determined by the principle on positive numbers. If after exhausting all consequential events, however, the proportions are available only within subgroups of the marginal probabilities, but not between the subgroups, then there will be more than one set of legitimate joint probabilities that can produce the same given conditional probabilities according to the principle on positive numbers. I called that process the "IBF algorithm" at the time and this is the third milestone.

The fourth milestone of the journey is handling density functions with irregular supports (irregular regions of non-zero density) in a similar way to the IBF algorithm for events. Note that determining marginal probabilities by their proportions relative to that of a

particular event is like determining the marginal density $\pi(\theta)$ by its ratio relative to a fixed $\theta 1$, $\pi(\theta) / \pi(\theta 1)$. We can obtain the constant $1/\pi(\theta 1)$ by integrating the expression(s) of $\pi(\theta)/\pi(\theta 1)$ over all θ, and then obtain $\pi(\theta)$ by substituting $\pi(\theta 1)$ back into the expression(s) of $\pi(\theta)/\pi(\theta 1)$. By symmetry, we can also get $g(z)$ through the ratio $g(z)/g(z1)$ and then $\pi(\theta)$, if this route is more convenient in a particular situation.

Since only conditional density functions are given, the support of $\pi(\theta)$ is to be recovered as a union of the projections of the supports of $p(\theta\,|\,z)$ for as many z as it takes. Hence the composition of branches for $\pi(\theta)/\pi(\theta 1)$ depends on the composition of the union of projections. For example, if the projection of the support of $p(\theta\,|\,z)$ for one particular z equals the entire support of $\pi(\theta)$, then we have one branch for all θ in the entire support: for an arbitrary $\theta 1$, $\pi(\theta)/\pi(\theta 1)$ equals $\{\, p(\theta\,|\,z)\; f\!\left(z\,|\,\theta 1\right)\}/\{\, p(\theta 1\,|\,z)\; f\!\left(z\,|\,\theta\right)\}$. In this case we can integrate both sides of this equality over all θ to get $1/\pi(\theta 1)$ and, in turn, to get $\pi(\theta)$ by substitution, which ends up with the same function-wise IBF that was derived in the second milestone in a special approach that cannot generalize. In my talk, I have demonstrated this general approach in cases of multi-branches where the support of $\pi(\theta)$ needs more than one z to recover, and so I'll skip this part because of time. It's important to conclude that there is a unique solution in finding the marginal density functions if and only if the recovered support of $\pi(\theta)$, or of $g(z)$, can be expressed as a union of projections in a manner where there is overlapping [that has non-zero measure if the rigorous measure-theory is to be used] between any two consecutive projections -- a condition where the support of the joint density is said to be "projection-connected."

During the Sydney International Statistical Congress in July 1996, I presented the IBF algorithm and the associated treatment of density functions with projection-connected supports. In the *International Encyclopedia of Statistical Science* which is published by Springer this year, my entry "*Inversion of Bayes' Formula for Events*" contains the IBF algorithm without the treatment on density functions due to the agreed limit of pages when accepting the invitation from the Editor back in June 2009.

In this summer, I learned more of the history of Bayes' 1763 paper and about Bayes as a mathematician, while preparing a plenary-session talk "*A Journey from Posterior to Prior and Its Aftermath*" for the 14th international IME conference in Toronto on 18 June 2010 and an invited talk "*Bayesian Inference Is a Two-way Street*" at Peking University on 5 July 2010 in

an international conference (http://www.stat.pku.edu.cn/hsu100/) in celebration of the 100th birthday of P. L. Hsu.

Enlightened by the historical facts and documents I gathered about the topic, I finally recognized that the IBF algorithm based on the elementary principle on positive numbers should be the Converse of Bayes' Theorem and all other results can be viewed as its corollaries.   So I organized the material under this synthesis as presented in Hong Kong's first WSD Seminar.   This marked the ultimate destination of my journey.

TSANG:

During the journey, did you face any obstacles?   How did you overcome them?

NG:

Yes, a lot of them.   As time is tight, I'll recall only a few here.   In 1995 when I offered to give a seminar in a university, a super-Bayesian who was in charge declined my offer and said to me, "We Bayesians don't need IBF."   I couldn't stop myself replying, "You've missed a forest for its trees."

In the 1995 conference in Montreal jointly organized by the Statistical Society of Canada and the Institute of Mathematical Statistics, I presented the IBF in a contributed session. In the questions period, a young gentleman in his early 30's stood up and said "I have skipped all other parallel sessions to listen to your talk," and so I replied "I'm grateful." He continued, "It's a rip off of my time."   I asked why and he replied, "It's too simple." After a moment of surprise, I asked: "Do you mean the solution, or the problem?"   "I mean your IBF," replied he.   I said: "Do you mean you have seen them before, or you didn't expect such a simple solution before my talk?"   He said: "I have not seen them before, all right.   Such simple expressions with simple derivations must have been obtained already by someone else."   I said: "Well, the IBF might have appeared without my notice."   He said: "Now you're getting my point."   I replied: "In that case I wish to have the reference and I wonder why Bayesians never refer to it; e.g., in the DA Algorithm in the new edition of Tanner's Springer monograph.   The original problem was not mine, you see.   If the 30 minutes of my talk were a rip off of your time, what about the large amount of time …" But I couldn't finish my sentence because the young gentleman was already rushing his way out at the door.   It was time for the next talk in all parallel sessions.

The following is a remarkable record, I believe. The official journal of a well established society published an invited paper that proposed an elaborate solution for an integral equation by means of functional analysis, including discussions from experts of high standing in that society. Less than 10 years later, the same journal rejected a rather simple paper that contained an explicit and simple solution to the integral equation, which (for the first time) can be checked easily by direct substitution, together with the solution's various meanings, possible implications and ramifications.

Thanks to the quiet encouragements and supportive advices of many people who know me, I have overcome my frustrations. More than one of them urged me to get the IBF results in print as soon as possible anywhere and in any form, saying that the ideas were too obvious once said. So I sent the paper, entitled "*Inversion of Bayes formula: Explicit formulas for unconditional pdf,*" in April 1996 to the editors of "*Advances in the Theory and Practice in Statistics: A Volume in Honor of Samuel Kotz,*" which was published in 1997 by John Wiley. A big boost to me in morale was a reference to the saying of Max Planck: "A scientific truth does not triumph by …" Other encouraging and supportive quotations include George Bernard Shaw's on "blasphemies" and Alfred Whitehead's on "the analysis of the obvious." One reference to how Oskar Morgenstern "was acutely conscious of the sociology of science as well as science *per se",* in a paper by Martin Shubik of Yale University (*International Journal of Game Theory*, Vol. 7, 131-135), helped me digest the deeper dynamics inside the academia. The most touching and telling reference was the story of the "Emperor's New Clothes."

Moreover, my mindset and spirits have provided crucial support in some difficult times. My philosophy of life is to be a "person with Laoist mind, Buddhist heart and Confucian style" (老佛儒). I mean the broad and yet nuanced mind of Lao-tzu (老子：胸襟廣闊、思辨細密), the benevolence and compassion of Buddha (佛家：慈悲為懷、善心柔腸) and the modesty and mild attitude of Confucius (儒家：溫良恭儉讓). Of course, I'm far, far from the state which I have aspired to reach. At the same time, I believe everyone has a destiny; or in Christian words, God has a plan for everybody. Some of my friends happen to know that I'm very religious in my own way. I do believe these spirits could in fact help anyone tide over hard times.

CHENG:

In the World Statistics Day Seminar, you quoted a dialog, "We Bayesians don't need the Converse" and "Don't miss the forest for the trees", which sounded similar to your dialogue with a super-Bayesian as you just mentioned, could you tell us more about this?

NG:

The one in the Seminar was only an analogy of the real one mentioned above. At the time of the real dialog, IBF was aiming at a special "forest" – BMDP. In the Seminar, the Converse is aiming at a general "forest", namely de-conditioning (DC) in distribution theory, where unconditional probabilities or density functions are to be reconstructed from the conditional ones in a very general setting of non-zero region. A valid DC procedure can also be used to detect the incompatibility (i.e., inconsistency) of certain supposed conditional probabilities or density functions which are not really coming from any set of joint probabilities or any joint density function. Simple examples are: the (Binomial) number of success in a Bernoulli process and the (Negative Binomial) stopping number in order to get the successes; the (Poisson) count of an event in a Poisson process and the (Gamma) waiting time in order to get the count. Besides, "inversion" to a formula is "converse" to a theorem, but the latter is broader in our context.

CHENG:

In 2009, you have co-authored a monograph, *Bayesian Missing Data Problem: EM, Data Augmentation and Non-iterative Computation,* in the Chapman and Hall/CRC Biostatistics Series. This monograph introduces many applications of IBF in solving data augmentation and Bayesian missing data problems. Could you talk about the significance of your discovery in this regard?

NG:

My co-authors are Prof. Ming T. Tan, Division Head of Biostatistics and Bioinformatics in the Department of Epidemiology and Public Health, University of Maryland School of Medicine (which was ranked No. 18 in USA in 2009 by the Association of American Medical Colleges), and Dr Guo-Liang Tian who worked with Prof. Tan before joining HKU in 2008. Since the book was mainly for applications in biostatistics, which was not my main research area, the three co-authors jointly took the view that the agreed order of authorship (Tan, Tian and Ng) was good for the purpose of promoting the application of IBF methods in the profession of biostatistics. It was also agreed to

highlight in the back-cover of the book that the methods were based on my discovery of IBF in 1995.

In more than 20 years, the practical computation in BMDP has been relying on either the DA algorithm for finding density functions or the iterative sampling methods, MCMC, for calculating probability intervals and other quantities by simulations. Common practitioners very often overlook three vital points of MCMC methods: (a) Checking convergence in distribution upon termination of iterations is still an unsolved issue, albeit software is now abundant for any desirable number of iterations as wished. (b) Even if an iterative sampling series has attained the stationary state, the variates generated in the same series are not independent and so we should not use a segment of n realizations as an i.i.d. sample of size n; i.e., we need n independent iterative series to get a sample of size n, only one from each series. (c) Without the functional form of the target density, it is difficult to construct highest density regions and so we have to accept equal-tail intervals for skewed distributions, unfortunately.

This monograph is the first book illustrating the applications of IBF in handling BMDP without the DA Algorithm and the MCMC sampling methods.

TSANG:

What were the lessons learnt in the unexpected journey towards the Converse of Bayes' Theorem? Could you describe your satisfaction in the discovery?

NG:

I totally agree with Mr Leslie TANG, the President of the Society, who said in his concluding remarks in the Seminar that we should always ask various questions and go back to basics more frequently. Moreover, we need persistence in achieving our goals and don't give up easily unless proved wrong.

My greatest satisfaction is that the Converse is basic enough to be taught in introductory courses on probability and statistics. With the discovery I take great comfort in making my contribution to solving the puzzle why Bayes withheld his *Essay*. It is my great honor to present it in the Society's Academic Seminar on the special occasion of the first World Statistics Day. Moreover, I am deeply grateful to Mrs Lily OU-YANG, the Acting Commissioner for Census and Statistics, for her kind comment: "You have indeed left a legacy in the history of the Hong Kong statistical community" and to Professor

Fred HO for his fine words about my talk and the discovery.

CHENG:

Could you offer some advices to students and young researchers in academic research?

NG:

First: 'Whenever in doubt, go back to basics.' Second: 'Read nurturing books in humanity, in addition to the journal articles in your field.' Third: 'Strike a good balance between the scholarship of "an old-time scholar" who learns for satisfying oneself (古之學者為己) and the entrepreneurship of "a later-day scholar" who learns for satisfying others (今之學者為人).'

CHENG:

Thank you very much, Professor NG for sparing you valuable time for this interview.

22 October, 2010

The First World Statistics Day – 20.10.2010

H W FUNG
Commissioner for Census and Statistics, HKSARG

At its 64th Session, the United Nations (UN) designated 20 October as World Statistics Day (WSD) to acknowledge the importance of reliable and timely statistics to informed policy decisions.

The first WSD on 20.10.2010 was an historic moment for official statisticians around the globe.   On this Day, we celebrated the many achievements of official statistics which embraced the three core values of Service, Professionalism and Integrity.   I feel honored to have participated in the observance event for the first WSD at the United Nations Pavilion of the World EXPO Shanghai 2010 on 20 October this year.   Jointly organized by the United Nations Statistics Division and the National Bureau of Statistics of China, the event helped reinforce recognition of the global statistical systems and strengthen public awareness of and trust in official statistics.

The UN Secretary-General BAN Ki-moon has rightly put it at the observance event "Statistics permeate modern life.   They are the basis for many governmental, business and community decisions.   They provide information and insight about the trends and forces that affect our lives."   We are living in an era of profound changes.   The world is changing at an unprecedented pace, and Hong Kong is no exception.   In the face of challenges and uncertainties posed by the future, more and more people are looking to statistics and evidence-based analysis to make informed decisions in different endeavours – from macro-economic analysis to government administration and policy formulation, to the decision-making of industrial and business firms, just to name a few.

To stay competitive in the global league, it is important that our official statistics should respond quickly in reflecting the rapidly evolving social and economic environments both locally and internationally, as well as meeting the rising aspirations of the community.

Yet, statistics would be meaningless and useless if they lack quality. The provision of quality statistics could not be made possible without the hard work, professionalism and integrity of the dedicated people in statistical authorities and agencies in Hong Kong and around the world. As professional statistical practitioners, we are committed to producing, analyzing and disseminating quality statistics – statistics that address users' needs and concerns, statistics that can help us respond to new challenges and bring about policy changes.

The Hong Kong Statistical Society (HKSS) has played a vital role in solidifying fellow statistical researchers and practitioners, and advocating proper interpretation and application of statistics in the community. Since its founding, the Society has helped the community build up better statistical knowledge, adopt a scientific attitude in understanding social and economic issues and analyzing problems, and be more competent in using statistical information to distinguish reality from myth.

Sharing the same vision as the HKSS, the Census and Statistics Department (C&SD), as the central statistical office in Hong Kong, has been sparing no efforts to develop and open up new frontiers, with the aim of providing adequate, relevant, reliable and timely statistics for reference by the Government and various sectors of the community.

C&SD attaches great importance to the quality of its statistical services. This is clearly reflected in the Department's vision statement – to provide high-quality statistical services, contributing to the social and economic developments of Hong Kong.

Over the years, C&SD has managed to foster an enabling working environment for continuous quality improvement by drawing on international practices and guiding principles. Thanks to the concerted efforts of each and every member of our staff, we have cultivated a quality-oriented organizational setting. This in turn has helped build a reputable official statistical system in Hong Kong.

But there is no room for complacency. Along with the rapidly evolving environment and the rising aspirations of the community, the demand for official statistics, in terms of both quantity and variety, is running ever higher than before. Notwithstanding this, it is the quality of official statistics that underpins its widespread use. The ongoing pursuit of excellence in quality is by no means an easy task. It pivots on professional statistical practitioners to contemplate their experience, analyze successes and failures, integrate new ideas and refine practices with a view to improving and strengthening the official statistical system.

The momentous occasion of the first WSD provides an opportune time for us, professional statistical practitioners, to reflect on the past and to sculpt the future. It is but another starting line. The first WSD marks the beginning of further collaboration and communication among statisticians and other stakeholders in the community for fostering the common goal of wider use of statistics in both the public and private sectors. Anchored in the shared values of Service, Professionalism and Integrity, I trust we will work hand-in-hand and strive to further bolster the official statistical system in the quest for excellence in serving the community.

Some Reminiscences of My Statistical Career

Frederick W H HO
Former Commissioner for Census and Statistics (1992 - 2005), HKSARG

Having been a statistician with the Census and Statistics Department of the government since 1972, I have on several occasions been asked the following question: "Did you ever aspire to be a statistician or, to make statistics your lifelong career, when you were a young kid?"

No, I did not know the word "statistics" in a technical sense until late senior secondary school days. And I did not know of a profession called "statistics" even when I was about to get my first degree.

I took Mathematics and Chemistry in my undergrad course. Within the subject of Mathematics there was, in Year 2 and 3, an optional paper called "statistics", which I took. And, I took this option thinking that the subject matter might be of some use in my future employment.

Was it "love at first sight" on encountering the subject? Or, did I find statistics so attractive on studying the subject that it became my lifelong companion thereafter? The answer is again "No".

On obtaining my first degree (in 1966) I joined the Civil Service as a teacher in mathematics and science of senior classes in a government secondary school. Statistics occupied a small part in the syllabus of the subject Applied Mathematics, which was one of the subjects I had to teach. Out of the wish to use the knowledge I had acquired, I did apply some statistical methods in looking at students' scores and performance, including the correlation between school examination scores and their performance at public examinations. During the second and third years in the school, among various extra-curricular duties I was appointed the Careers Master of the school. In that capacity I also did statistical surveys on students' preferences in furthering studies and employment.

Like many fresh graduates taking up initial employment, I took up evening studies to widen my knowledge base. I did some short courses in statistics and computers. For the former, I did it to assist myself in taking the Examinations of the Institute of Statisticians [IoS] of the United Kingdom (which was merged with the Royal Statistical Society later on), which would lead to a professional Membership. For the latter, it was a rather new thing then and I was simply curious.

Just at that time, the Examinations Division of the Education Department required an officer to handle computer processing of examination arrangements and to perform statistical analysis of examination scores. Somehow I was spotted and after an interview I was transferred to the Division, despite they were initially looking for an officer of higher seniority. (The Division was made the Examinations Authority and separated from the Education Department in the late 1970's)

In discharging my duties at the Examinations Division I had to handle several public examinations, each of which involving tens of subjects /papers, tens of thousands of candidates and hundreds of thousands of scripts and scores.

In arranging examination venues and markers of answer scripts, a lot of administrative statistics had to be prepared and applied. Then, allocation of scripts to markers had to be done in such a way that each allotment represented a random sample of candidates so that subsequent application of statistical techniques to the analysis of scores and control of marking quality could be implemented.

Without the computer, and without the proper application of programming-cum-statistical methods, it would not have been possible to achieve such a high level of precision and fairness in awarding scores to individual candidates as was the case then, especially in consideration of the tight time frame that had to be adhered to.

It was hard work, but challenging and interesting. Apart from huge volumes, precision requirements and timeliness, there was another significant element in the work – handling of confidential information and documents. Imagine the care required to ensure that absolutely no unauthorized people would see the question papers before the examination, that all examination scripts would be well kept and that every single examination score would not be unduly tempered with!

To administer the examinations well, the systems and procedures had to be prepared with thorough considerations based on good understanding of the situations of all stakeholders. Good communication skills, applied to the communication with a wide range of people through the written media and face-to-face contact, were required. My teaching experience, in ensuring that there was good communication between my students (and the parents) and myself helped me a great deal in understanding the needs, difficulties and mind-sets of my counterparts and in explaining complicated procedural issues to huge groups of invigilators, markers, school personnel, students and even the mass media.

I thoroughly enjoyed the challenging work and the team of effective and efficient staff that I had the fortune to work with. But at the end of the third year in the Division I was to face a hard decision to remain in the field of Education or to transfer to the Census and Statistics Department (C&SD) as a Statistician.

I have dwelt in considerable length in describing my earliest duties (some statistical and some non-statistical) in the government. This is because my learning and working experience in those years had very positive influence on how I performed in my subsequent career.

Like any other career decision, a host of factors came into play and I would not recount them here; but obviously a major one underlying my decision to become a full fledged statistician was that by that time I had completed my examinations with the Institute of Statisticians and qualified myself as an M.I.S. (Member of the IoS)

On my landing at the C&SD, they obviously wanted to use my skills in training (as I had been a teacher before), in computer systems analysis and in applying statistics in operations studies and planning. So, I started as Statistician (General), which means that I had to undertake a wide variety of duties – including many undefined duties. But it was great. I ran courses on statistics for staff in the Department and for other government officials. I did consultancies with the Post Office to estimate the volume of postal traffic, with the Agricultural and Fisheries Department to spot grounds of rich fishery yields, with the Police on correlating crime rates with the architectural design of different types of buildings, and so on. I participated in inter-departmental teams for long-term program plans (e.g. on Law and Order, Medical and Health, Housing). Meanwhile, many government departments were finding statistics useful and so I was

asked to go around them and to help setting up statistical systems and forming Statistical Sections to maintain and further develop the systems.

After some 3 years I was sent to study in the Institute of Social Studies in Holland. In eight months I had the opportunity to learn in considerable depth a full range of official statistics — statistics on population; international trade; labour and employment; prices; economic structure, performance and development; social phenomena and development; and so on. The studies provided me with good theoretical background on some of the work that I had actually been performing in the Department. I was given much exposure to practical methods commonly used by statistical agencies world-wide, too. And most importantly was the international perspective that I gained. I learned how other people in the world went about their work against divergent social, economic and cultural backgrounds. I also made some foreign friends who subsequently became important contacts to learn about global developments in the field from time to time.

Around the end of the course Professor Leslie Kish of the University of Michigan came to the Institute to select a few persons to attend a summer program in survey sampling methods in Michigan. I was among the fortunate ones. Not only did I benefit greatly from the program in the classroom, the day-to-day contact with Prof. Kish, who was (and still is up to this date) recognized as the top expert in survey sampling and a most inspiring mentor, brought me knowledge and an attitude towards statistical work that I treasured and held on to throughout my subsequent career.

Returning to Hong Kong, I worked in the field of national accounting statistics. It was the period when the Department started a massive program in the area of economic statistics, thanks much to the keen support of a Financial Secretary of the Government who was very fond of statistics. Of course, the enhanced attention to statistics was also related to the socio-economic progress of Hong Kong at that time when commerce, industry and financial services saw significant advances, more scientific handling of public policies (in terms of more rational and quantitative analysis of social needs) was called for and ever-increasing demand for statistics from the private sector was seen. From the late 70's and throughout the 80's, a rather comprehensive official statistics system was built up.

Not only then were most of the fields covered, the profoundness in the sub-systems was also gradually enhanced. In terms of the number of professional statisticians, there

were several-fold increases. The same expansion was seen with sub-professionals — those who were not full professionals but had a good training in statistics up to the diploma level and had good execution abilities. Without these well-trained support workers, work could not have been done so well.

The 80's and early 90's was a period of some political uncertainty in Hong Kong (with the return of sovereignty of Hong Kong to China). We had to deal with loss of quite some experienced statistical staff; meanwhile we had to get prepared for Hong Kong' transition in July 1997.

I held the view that several important aspects should be attended to –

1. Our own people in Hong Kong must know the value of statistics -- trustworthy statistics. One way to achieve this was significant improvement in statistical literacy, all the way from youngsters to mature citizens in all walks of life. They would then be keen and shrewd users of statistics, they would be willing suppliers of raw information for the compilation of statistics and they would be citizen-watchers who would trust and respect statistics and who would not bear statistics to be falsified, mis-used or abused.

2. The international community should have established faith in our statistics and therefore having full trust in making reference to the data in dealing with Hong Kong in trading and investment and in looking at her social progress.

3. Our mainland counter-parts should know what we were doing in various fields of official statistics and could learn something from us in their process of getting their statistical systems gradually aligned with international practice.

I was moving up to top leadership in the Government Statistical Service of Hong Kong in the late 80's and arranged for implementation of measures with the above in mind. We intensified communication with all stakeholders – raw data suppliers, statistics users, policy makers, the mass media, the business circle, social groups, students, and so on. We enhanced relationship with international statistical organizations and national statistical agencies – we actively participated in and contributed to international statistical activities and development. We also received many groups from the mainland of China and paid them visits. Internally, we enhanced staff training and exposure to world-level

statistical undertaking and got staff to realize that problems arising from staff mobility could be more than offset by the vigor and motivation of those staying.

These proved to be good moves. After I assumed the position of Commissioner in 1992, naturally the policy continued. The last significant shot in making our Statistical System comprehensive was to get systems set up for statistics on outflow from (and inflow into) Hong Kong of income and capital. This was not an easy task at all since this could have been construed, in an environment of some political uncertainty, as prelude to exchange control. With appropriate groundwork we managed to alleviate possible misconceptions and undue worries and finally got the job done.

Meanwhile it happened that the United Nations promulgated the "Fundamental Principles of Official Statistics" (1994) and the International Monetary Fund invited subscription to its 'Special Data Dissemination Standard" (around 1996). These were behavioral standards set up for statistical agencies to abide by so that integrity and trust could be achieved. We had no hesitation. We wrote to pledge observance to the former and took some necessary actions which led to our successful subscription (in 1997) to the latter.

Meanwhile, our active participation in international statistical affairs continued. In 1994, Hong Kong, represented by myself, was elected Chairman of the Committee on Statistics of the Economic and Social Commission for Asia and the Pacific (ESCAP). At the expiry of the two-year term in 1996, Hong Kong was re-elected for one more term; and I was given to understand that many of the members voted for a second term for Hong Kong as a reflection of their faith that Hong Kong would remain an active member of the international statistical community after her re-unification with China. Indeed they thought a term of chairmanship for Hong Kong that straddled July 1997 would be a gesture of staunch support for the Hong Kong Government Statistical Service. (It may be noted here that under the "One Country, Two Systems" regime, Hong Kong Special Administrative Region could participate as a separate entity from China in organizations like the ESCAP.) I was personally much touched by this.

The political transition in July 1997 was smooth. With official statistics work, nothing whatsoever changed. But our work had to continue to respond to constant changes in economic and social situations and business practices. The advancement in information and communications technology also impacted greatly on our work. (It provided great

opportunities for development in statistical work but meanwhile the ensuing statistics users' expectations also increased, sometimes even more!)   And we had to take up tasks to provide relevant statistics to tackle special situations from time to time.

In 1999 we had to undertake a rather tough task of conducting a survey to estimate the number of children born in the mainland of China to Hong Kong parents "outside registered marriage", in connection with the issue of estimating the number of persons who might come to Hong Kong for permanent residency under a certain court ruling. In view that the subject was an extremely sensitive one, we employed the "Randomized Response Technique" in the survey.   The number which came out was huge. This got translated into huge requirements of housing and other social services.   Great political and legal implications arose – on what would be done to the court ruling.   I would not go into further details here as the story would become too long to tell.   The important point of the story was that some people queried whether the estimates were right, and the basis of the query was not so much on the techniques or how it was implemented but that whether there was political pressure or administrative intervention on us.   In the event, we managed to convince people, generally speaking, that the estimates were right; but then there were still some people who "did not like the figures" (mainly because they did not like the consequential legal and administrative decisions and actions) constantly querying the correctness of the data.

When Severe Acute Respiratory Syndrome (SARS) struck us in 2003, statistical staff in the Health Department did a great job in getting the relevant data to help plan policies and measures to combat the spread of the disease.   At C&SD we rendered support as and when required, including participating in technical consultations and deploying additional human resources to the Health Department as soon as such was needed. After the SARS, the economic situation was bad and a lot of additional work, including surveys and analyses, was done in order to monitor the situation and to spot what sort of action the government might take to improve situations.

There are many more interesting matters that I would love to recall but I have to stop here. What I would say, in concluding this article, is that I am very pleased with the development in official statistics in Hong Kong over the last three to four decades and to see that there is now general appreciation in our community that statistics really can help guide us in times of uncertainty and help show us the proper way to the future.

The Road Map of Statistical Education

S M SHEN

Statistical education in Hong Kong entered a new era when Statistics became one of the examination subjects for the Secondary 6 and 7 students preparing for the Advanced Level Examinations administered by the Hong Kong Examination and Assessment Authority (HKEAA).

Before the introduction of the examination, there were several years of heated debate on whether Statistics should be examined and how the subject could be taught prior to students' achieving a certain maturity in mathematics. Statistics, therefore, was combined with Mathematics as an examination subject where the necessary mathematical theories, concepts, techniques and skills were also covered. It became an Advanced Supplementary Level (ASL) Examination subject entitled "Mathematics and Statistics".

The ASL subject "Mathematics and Statistics" was first examined in 1994 and has proved to be exceptionally successful. In the very first round of examination, a total of 2,710 candidates chose to take the subject. Given that in Hong Kong, the number of A-level students is around 35,000 every year, and given also that there are a large number of subjects under the disciplines of arts, science, business and social sciences for students to choose, the figure was regarded to be high.

In fact, all universities welcomed the subject and many degree programs named it a required or preferred subject for admission. Students also found the course useful for their university study. The number of candidates taking the subject, therefore, continued to increase steadily to around 6,500 as shown in the following table.

This situation is going to change with the implementation of the new 3-3-4 education system and the winding up of the Hong Kong A-level examinations after the summer of 2012.

The introduction of the 3-3-4 system is a marked educational reform in Hong Kong. In September 2009, all secondary schools in Hong Kong started the New Senior Secondary (NSS) education for students who had completed Secondary 3. Upon

completion of this three-year NSS education, the students will take a new public school leaving examination leading to a Hong Kong Diploma of Secondary Education (HKDSE).

Candidature of ASL Mathematics and Statistics from 1994 - 2010

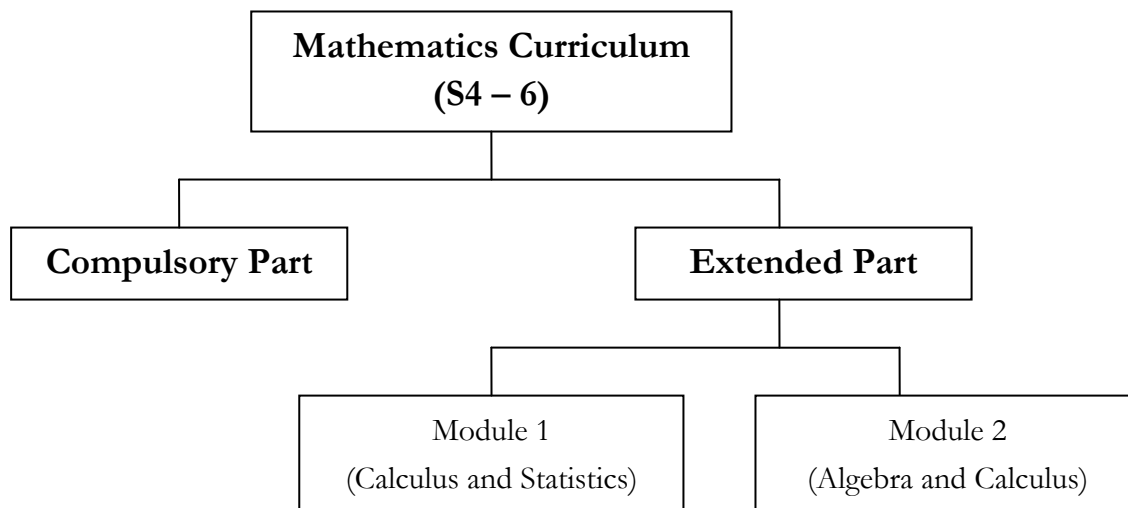| Year of Exam	Total no of candidates sitting the exam
1994	2710
1995	3311
1996	3534
1997	4131
1998	4706
1999	5416
2000	5907
2001	6242
2002	6616
2003	6680
2004	6396
2005	5954
2006	6496
2007	6566
2008	6682
2009	6598
2010	6754

In summer 2010, the secondary schools bade farewell to the Hong Kong Certificate of Education Examination (HKCEE) when its last round of territory-wide examination concluded in July. The HKCEE can date back to 1935 when The University of Hong Kong initiated the HKCEE for secondary school leavers. The Examination had undergone several stages of changes and over the years, it had established its status and was widely recognized locally and internationally.

In terms of secondary school leavers, there will be a vacuum in 2011 when no S5 students will leave the education system but all will continue their NSS study until they have completed S6 and attempted the new HKDSE examinations in 2012. This cohort of students will be competing to enter the four-year degree programs offered by all local universities together with the last cohort of Hong Kong A-level students who will enter the three-year degree programs.

The year 2012 also marks the very last round of the ASL Mathematics and Statistics examination in the territory. It does not, however, end the statistical education in the secondary schools. Instead, statistics is now part of the core subject Mathematics in the NSS. The NSS Mathematics, together with English Language, Chinese Language and

Liberal Studies, are the four compulsory subjects for all S4 to S6 students.

The structure of the NSS Mathematics Curriculum for S4 to 6 students can be represented diagrammatically as follows:

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                    ┌──────────────────────────┐
                    │  Mathematics Curriculum  │
                    │        (S4 − 6)          │
                    └──────────────────────────┘
              ┌──────────────┴───────────────┐
    ┌──────────────────┐          ┌──────────────────┐
    │ Compulsory Part  │          │  Extended Part   │
    └──────────────────┘          └──────────────────┘
                              ┌──────────┴──────────┐
                    ┌──────────────────┐  ┌──────────────────┐
                    │     Module 1     │  │     Module 2     │
                    │ (Calculus and    │  │ (Algebra and     │
                    │  Statistics)     │  │  Calculus)       │
                    └──────────────────┘  └──────────────────┘
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The NSS students may opt to take only the Compulsory Part of the Mathematics curriculum. Alternatively, they may opt to take also the Extended Part to better prepare themselves for university education in different disciplines. Taking the Extended Part means they will take the Compulsory Part together with either Module 1, Calculus and Statistics, or Module 2, Algebra and Calculus, but not both.

The statistical content in Module 1 is very similar to that of the ASL Mathematics and Statistics. Although students may take only the Compulsory Part, it is foreseeable that students aiming at degree education will opt to take also the Extended Part. Module 1 is likely to be a more popular choice since most degree programs related to business, life sciences and social sciences prefer students to have acquired knowledge in statistics.

This new Mathematics curriculum will be examined for the first time in 2012. It is expected that the proportion of students taking Module 1 with Statistics will be around the same as the A-level students taking Mathematics and Statistics. Since all 80,000 plus secondary students rather than only A-level students will take HKDSE, the total number of students studying Statistics will at least double. The number of students getting exposure to statistics at schools will be significantly increased. We can be quite confident that the statistical literacy among the younger generation will be very much enhanced with the implementation of the 3-3-4 education system. We can also be hopeful that there will be wider and wiser use of statistics and less abuse and misuse of statistics in the future.

News Column

A New Born Statistical Agency

A new research consultancy center, called the Center for the Advancement of Social Sciences Research (CASR), has been recently set up in the Faculty of Social Sciences of the Hong Kong Baptist University. The aim of the center is to provide knowledge transfer to the community through undertaking contract research and consultancy services for academic institutions, the HKSAR Government, NGOs, and business enterprises; to synergize inter-disciplinary research endeavors

Dr. Agnes Law is the Director of the newly established Center for the Advancement of Social Sciences Research.

within and beyond the Faculty of Social Sciences; and to enhance the visibility and image of the Faculty of Social Sciences as well as the University by promulgating research findings to the community at large.

The services of the Center include:

- Providing advice on the formulation of research questions;
- Providing advice on research design;
- Designing questionnaire;
- Carrying out qualitative study (e.g. focus groups, in-depth interviews);
- Conducting quantitative study (e.g. telephone interviews, face-to-face interviews, online surveys);
- Performing data analysis;
- Writing reports;
- Offering courses/ workshops on Survey Methods and Statistical Analysis.

Dr. Agnes Law, who is the Consultation Secretary of the Hong Kong Statistical Society and Certified Statistician, is in charge of the Center. She has been working in the survey research consultancy areas for more than 11 years, and leading more than 200 projects for universities, local government's departments, NGOs and business organizations such as Transportation Department, CityU, PolyU, Green Power, PCCW and TVB, etc. For any enquiries, please feel free to contact her at agneslaw@hkbu.edu.hk .

The Center provides a wide array of services relating to the conduct of research studies.

Best Wishes for the Year of Rabbit!