Workshop Summaries

Editor's Note

The workshops varied greatly in size and formality, and had a tendency, like primeval life, to form spontaneously under favourable conditions. To try and keep the records of the Conference complete, I have listed below the workshop titles and such short summaries of the workshop sessions as came to me before the Conference, or were given to me subsequently. A small number of substantive papers, prepared originally for presentation in a workshop, have been attached to the most relevant sessions; cross references to these papers will be found under the workshop concerned.

Workshop 1 : The Pocket Computer in the Classroom

Lennart Råde - Gothenburg, Sweden

This workshop concerned the use of pocket computers in the statistics classroom at the school level and, to some extent, also at the university level. General issues concerning the use of pocket computers were discussed, and classroom experience from Sweden was reported.

A number of specific pocket computer activities were presented and discussed during the workshop. These dealt with random number generators, testing of random number generators, calculation of basic probability distributions, simulation of probability distributions, and random experiments and statistical data analysis. Waiting time problems, Markov chain situations, and problems from stochastic geometry were also included. Participants received documentation concerning these activities.

The workshop ended with a discussion where participants had the opportunity to make short reports of their experience with pocket computers.

Workshop 2 : Middle-Aged Spreadsheets

Paul Brown - Christchurch, New Zealand

Spreadsheets came of age a long time ago. Spreadsheets are now big, serious, reliable, widely-accepted by the business community - in short, middle-aged.

Spreadsheet software is popular because it is understandable and easy to fix up. Not at all like statistics packages where you can't explore the formulae.

Spreadsheets enjoy having accountants lavish attention upon them. Spreadsheets can be just as flattering when scientists and mathematicians provide data to manipulate.

An effective way to learn about spreadsheets is to see lots of them in action. It's easy to see how they work, and you really learn the commands when you can see what they do.

This workshop was designed for secondary mathematics and computer studies teachers, and was intended to also have a wider appeal to any existing or potential users of spreadsheets. Those attending the workshop were able to literally play with Lotus spreadsheets. Games and many other forms of spreadsheet activity are used by the organiser as self-teaching devices.

Prime numbers provided an example of a mathematical investigation conducted using a spreadsheet. Primes can be "sieved" using a spreadsheet macro. The frequency distribution of the differences between consecutive primes can then be analysed and graphed. Does the curve look like a fractal? Do differences between random numbers have the same distribution?

Workshop 3 : Statistics for Primary School Teachers

Andrejs Dunkels - Luleå, Sweden

What is the height of? ... How far is it to? ... The tallest building in the world is? ... Are all minutes the same length? Why are people, young and old, interested in ages? What do birthdays and buses have in common? And heart-beats and yoghurt?

This workshop was developed to display, for primary school teachers, some enjoyable ways to present concepts of numerical measurement to young pupils. The pedagogical focus was on using data from the real world of the students' own propinquity, data of certain physical or emotional relevance to them.

Workshop 4 : Methods of Sample Surveys

Richard Penny - Christchurch, New Zealand

The number of surveys being done seems to increase year by year. Every group has the results of a survey that proves a point, or justifies a position. Considering the number of surveys being done, and their increasing importance, it appears doing a survey would be a good task for a senior student to undertake.

Superficially, it would appear easy to set up a survey. Many believe all one has to do is first write a questionnaire, or design some procedure for taking measurements. Next, some mathematics, found in many elementary statistics textbooks, is used to work out the sample size. Then one goes out and gets the number of observations required. After that comes the interesting part, the analysis and interpretation of the results. However, there are many traps for the unwary or inexperienced in carrying out those tasks. Also, there are many factors that affect the accuracy of one's survey that have been neglected.

The purpose of this workshop was to give those who are teaching Mathematics with Statistics a good grounding in survey design. The whole survey process was followed through from the moment someone decides they want to do a survey, to the final publication of the results. A practical exercise was used to illustrate many of the points.

Workshop 5 : Principles of Collection and Analysis of Demographic Statistics

Ian Poole - Hamilton, New Zealand
Mansoor Khawaja - Christchurch, New Zealand

The workshop was held over two sessions, and included papers by Jean Louis Rallu, Laurie Lewis, Abdelmegid Farrag, and Mansoor Khawaja.

Workshop 6 : Statistical Training Through Videos

Kenneth Bryson - Washington DC, USA
Solomon Garfunkel - Arlington, Massachusetts, USA

An abridged version of Kenneth Bryson's paper will be found with the papers from Sessions C1 and C5.

Workshop 7 : Using Computers for Teaching Statistics at Tertiary Level

Roger Mead - Reading, England

This workshop was intended as an opportunity to share experiences in the use of computers across the whole range of tertiary level statistics courses. Some of the organiser's own ideas are set out in his Invited Paper for Session B1.

Workshop 8 : Statistics in New Zealand Polytechnics

Mike Camden - Wellington, New Zealand

This workshop was intended primarily as a forum where tutors from New Zealand polytechnics could exchange views and plan changes. It started with very brief presentations on the following topics:

(i)   using spreadsheets for statistical exploration;
(ii)   exploring data with graphics: the skills behind the tricks;
(iii)   courses in Quality Assurance in New Zealand polytechnics;
(iv)   innovative methods in the learning of statistics.

The main part of the workshop consisted of discussion of issues raised by the participants, including:

(i)   updating the existing statistics subjects for polytechnic courses in Business and Accounting, Nursing, Computing, and increasing the statistics content of other polytechnic courses;
(ii)   identifying the most useful parts of statistics, and approaches to statistics, for the polytechnic students of the 1990s;
(iii)   finding suitable software;
(iv)   polytechnic roles in education for Quality Assurance;
(v)   cooperation among polytechnics: resource-sharing.

Workshop 9 : Geometry - A Visual Approach to Teaching Statistics

Graham Wood and Dave Saville - Christchurch, New Zealand

(i)   Is it possible to convey the basic ideas of statistics in a visual way?
(ii)   Does a visual approach clarify and unify the subject:
(iii)   Can anybody use the visual approach?

Participants attending this workshop were given some of the know-how to answer each of these questions.

What was the workshop all about? Back in 1912 Ronald Fisher perceived the geometry underlying the t-test. This insight enabled him to rapidly develop and unify the areas today known as "analysis of variance" and "regression". Generally today, these areas are taught using either very elementary cookbook methods or very sophisticated matrix methods. The purpose of this workshop was to present a middle-of-the-road approach which focusses on the geometric view which inspired Fisher. The method has been successfully used at the University of Canterbury since 1984.

The workshop focussed on one and two population questions. It was intended both to give an alternative view of this basic material, and to enrich tertiary teachers' knowledge of ideas frequently found in first and second year courses.

Workshop 10 : The Place of the Bayesian Paradigm

John Deely - Christchurch, New Zealand

The purpose of this workshop was to illustrate, via examples and discussion, that the Bayesian paradigm has a useful and important place in the teaching of statistics, both in high schools and universities. In fact, it was argued that this paradigm is more appropriate for the teaching of statistics than the classical or frequentist view. The workshop began with a definition of the Bayesian paradigm within the context of general statistical inference models. The various examples discussed included simple hyper-geometric inference problems as well as more complicated capture-recapture experiments and some multivariate inference applied to comparison of treatments. The examples showed that a Bayesian approach yields more satisfactory answers from a practical point of view and, in addition, allows the decision-maker to incorporate various kinds of prior information into the analysis. This latter point was emphasised by showing how frequentist statistical theory has been virtually hopeless in dealing with this concept. The usual difficulties expressed by non-Bayesians with respect to certain prior assumptions were discussed in the context of the various examples. References to relevant books and articles were given, and an opportunity for audience participation was

provided. The intention was to stimulate and enthuse participants about the use of the Bayesian paradigm in the teaching of statistics.

Workshop 11 : SUSAM - A Teaching Tool for Multicollinearity Analysis

Gianfranco Galmacci and Maria A Pannone - Perugia, Italy

SUSAM is an expert system for multicollinearity diagnosis devised for students taking a course on regression analysis.

The system aims at providing a tool for investigating the presence of multicollinearity in a wide range of situations, by means of some of the most significant methods proposed for multicollinearity detection. Each method (mainly correlation matrix analysis, variance inflation factors, condition indices, and variance-decomposition proportions) can be chosen by the user to carry out his own analysis, using real or simulated data.

Further details are given in the paper by Galmacci and Pannone in Session B3.

Workshop 12 : Spatial Coding in Correspondence Analysis

Multivariate Indicator Matrix : Implementation and Application of Data Pertaining to Research on "Survey on Nursing Attitudes and Turnover"

B Colin, B McGibbon and J de Tibeiro - Quebec, Canada

The purpose of this workshop was to show, through an example, a multidimensional statistical analysis technique applied to a sample survey on nurses and their attitudes in the Montreal region (Quebec), Canada.

Part I briefly discussed the basic principles of Correspondence Analysis, a Data Analysis technique in use now for about 30 years in French statistical circles.

The technique was illustrated in Part II by reference to the interpretation of a large data set of 177 questions to 1,148 nurses, of whom 53 intend to resign.

The preliminary conclusions obtained included notably that nurse discontent at work is largely due to heavy workload along with a negative perception of management support and esteem. Many staff nurses leave their jobs every day. This turnover affects all nurses in various ways, whether they are the person who leaves, or the person who stays.

The organisers are thankful to Professors V V Baba and M Jamal for making available the rich comprehensive data base which forms the basis of this project, and to

Professor Thomas Frank Robertson for providing extensive preliminary advice and numerous helpful suggestions with respect to coding.

Workshop 13 : Seasonal Adjustment

Mike Doherty and Alistair Gray - Wellington, New Zealand

Seasonal adjustment is a procedure used mainly in official statistical offices, and there is no good textbook reference. It is therefore seen, we suspect, by those other than practitioners, as outside the mainstream of the subject, and somewhat esoteric. The workshop aimed to dispel that impression, to explain what the area is about, and to connect it with other topics in statistics. The workshop was aimed at those with no previous knowledge of seasonal adjustment.

Statistics in general is concerned with the analysis of variation. Seasonal adjusters are concerned with variation in time series. They aim to decompose the series into long-term, seasonal, and irregular movements. This is accomplished by the standard computer packages, such as X-11. Some of the ideas behind these packages were explained.

Seasonal adjustment may be viewed as an exploratory data analysis technique, in Tukey's sense. Explaining seasonal adjustment involves widely applicable concepts such as:

(i)   outliers and robustness;
(ii)   fit and residual decomposition;
(iii)   iteration to improve fit;
(iv)   graphical display.

The workshop was intended not to train those attending in the use of seasonal adjustment packages, or to give a view of research topics in the area, but to reinforce some concepts important in statistics in general through examination of an area not well-known to most statisticians.

Workshop 14 : Computer Illustrated Texts

Adrian Bowman - Glasgow, Scotland

If students are to become proficient in the analysis of realistic sets of data, then a good computing environment is essential. Many modern statistics packages provide very effective environments where data can be handled and models fitted in convenient

and flexible ways. The main aim of these packages is to make a chosen analysis easy to carry out and they are usually not designed to teach the meaning of the models being fitted, or the principles of inference behind them. This workshop focussed on a type of software with the markedly different aim of assisting in the communication of the techniques and principles of the subject, and which uses the graphical facilities of a microcomputer in an attempt to develop a student's intuition and allow an exploration of key results and principles.

Animation is a very effective means of explaining some techniques, such as the construction of a stem-and-leaf plot or a two-sample nonparametric test statistic. The "electronic blackboard" use of a computer has the advantage of building pictures up step by step rather than presenting a finished diagram as in a book. Projected three-dimensional pictures can help in understanding the meaning and interpretation of a multiple regression model.

Participants were introduced to this software in a laboratory of microcomputers with the assistance of worksheets, and associated textbooks which integrate the usual verbal development of topics with invitations to explore the ideas through appropriate programs. In the final part of the workshop, a laboratory session on the design and analysis of a simple clinical trial was studied. This has been used in the first year teaching of statistics in Glasgow in a situation where there are large numbers of students and very limited access to hardware. The menu-based software has proved effective in illustrating the power of computing, and in reinforcing some elementary principles, when only a very short time is available for student access to computers and no previous computing experience can be assumed.

Workshop 15 : Improving Open-Ended Problem Solving

Stephen A Zayac - Livonia, Michigan, USA

See Dr Zayac's paper in Session A1.

Workshop 16 : Get it Together : Math Problems for Groups

Kay Gilliland - Berkeley, California, USA

EQUALS is a mathematics teacher education programme at the Lawrence Hall of Science, University of California, Berkeley. EQUALS has sites in fifteen states and four countries, notably New Zealand, Costa Rica, Australia, and Sweden. We are particularly concerned about students historically underserved in mathematics education (most females and many non-European males), and have developed classroom strategies

and materials to increase the number of students who participate successfully in mathematics.

One method of encouraging students is to let the students work together in groups. *Spinners* is a series of activities planned to give students experience in working together on mathematics problems in the classroom. Each member of the group has a different bit of information, so everyone must cooperate to solve the common problem. Students may read their information aloud, use a pencil and paper, and talk about the problem all they want; what a student may not do is give the slip of paper to someone else to read. Each person must be responsible for his or her own information.

Spinners activities help students learn concepts of probability such as the likelihood of independent events, the law of large numbers, combinations of numbers, and the probabilities of certain sums. *Spinners* is a section of the book *Get It Together*, and the activities can be challenging to students from about age 10 to 15.

Workshop 17 : Beyond Spreadsheets - Innovative Uses of Computers and Videos in Middle and High School Classes

Andee Rubin - Cambridge, Massachusetts, USA

Three examples of computers and/or video use in statistics education were demonstrated. The first was "Tape Measure", a video and computer-based system that allows students to make direct measurements on video frames. The second was "Sampling Laboratory", software that not only simulates sampling, but also helps students connect statistical inference with sampling through the building of confidence intervals. The third was "Elastic", a statistical analysis program with special modules that let students directly manipulate data representations.

Workshop 18 : Teaching Statistics and Practical Work with the Illustrative Computer Package STATION

Hans van Buuren - Heerlen, The Netherlands
Bert Nijdam - Maarssen, The Netherlands

This workshop subsumed the authors' paper (see Session B9) and followed it by a demonstration of the STATION package using a worksheet about the power of a test.

Workshop 19 : Interactive Statistical Software Using the (IBM) PC

Kevin Anderson - Hobart, Australia

Statistical training and endeavour in secondary and tertiary institutions, government agencies, industry, and commerce are on the threshold of a huge revolution because of the power of contemporary PCs and the ease of use of statistical software packages, especially those which are truly interactive. This revolution is to be welcomed because of potential cost savings and improved work satisfaction. And this will be partly due to statistics becoming more of a visual endeavour.

Participants were given the opportunity to use one of these state-of-the-art statistical software packages, Interactive Scientific Processor (PC-ISP), to examine several data sets and visually explore features of the data such as subsample variation, outliers, trends, and clusters.