for trials with two to four complete blocks and up to 24 varieties. Efficiency values are given and compared to upper and lower bounds. Average pairwise variances are computed for some values of the variance components. These pairwise variances are compared to those for other neighbour designs and also fully randomized designs.

5427 **LENE THEIL SKOVGAARD (Statistical Research Unit, University of Copenhagen, Blegdamsvej 3, DK-2200 Copenhagen N., Denmark), Analysis of Biomedical Data with Successive Measurements on each Unit.**

In recent years, a vast number of papers dealing with models for repeated measurements have been published in the statistical literature. These models include modifications of univariate analysis of variance, multivariate analysis of variance, growth curves, random effects models, time series models, etc. The typical paper focuses on a specific model, develops the theory of inference for this model, and illustrates with an example. From a practitioner's point of view, the problem is that of choosing an appropriate model or a reasonable analysis in the concrete setting. This requires a thorough knowledge, not only of the nature of the applied problem, but also of the different possibilities for choice of analysis, the merits and drawbacks of these, and the availability of software. An overview of existing methods is given, and the problem of model selection (selection of proper type of analysis) is discussed, in general as well as for some practical applications.

5428 **GUNNAR STEFÁNSSON (Marine Research Institute, PO Box 1390, Skúlagötu 4, IS-121 Reykjavík, Iceland), Analysis of Catch and Effort Data.**

In fisheries research, catch and effort data is sometimes available in great detail, even disaggregated down to individual tows. A method is presented to analyse such data, by initially selecting tows, then aggregating over small regions and time periods, and finally using linear models on a log-scale. An analysis is presented based on data on Icelandic cod from trawler reports for the period 1973 – 1989. This gives stock biomass indices, which can be age-disaggregated to form indices of stock abundance of individual year-classes. Survey data can be analysed using similar techniques. In Icelandic surveys, data points (tows) are fewer and time series are shorter, but much more detail is available on environmental factors.

5429 **JON STENE (Institute of Statistics, University of Copenhagen, Studiestræde 6, DK-1455 Copenhagen K, Denmark), Sampling and Analysis of Family Data: Methodological Issues.**

Data about families with one or more generations and with two or more specified categories of individuals are considered. The recorded categories could be determined by an inherited trait. The data were selected in order to determine the probability for members of the family to belong to the different categories either at birth or later. A common problem is to estimate the probability for a child to be affected by an abnormality, when the parents share a certain genetic constitution. Different selection procedures for such data are considered in some detail. Usually such traits are so rare that sufficiently large samples are not obtainable through standard sampling methods. Probability models for such data are discussed. The influence of the data selection procedure on the probability model is demonstrated, as well as the effect of utilizing all available information on the accuracy of estimation.

5430 **ADAM TAUBE (Dept of Statistics, Uppsala University, PO Box 513, S-751 20 Uppsala, Sweden) and BENGT THOLANDER (Uppsala University Hospital), Over- and Under-estimation of the Sensitivity of a Diagnostic Malignancy Test due to Various Selections of the Study Population.**

In characterizing indicators of malignancy, the sensitivity and specificity are commonly presented. These estimates are however dependent upon the structure of the basic data. This paper gives a simple model, and explains why some sensitivity estimates do not give a realistic picture of an indicator. The model is based on the assumption of three categories of diseased individuals — those having the illness in such a form that the indicator is not sensitive at all, those for whom the indicator is of great practical value, and finally those who are so seriously ill that the sensitivity of the indicator is 100% but the diagnosis is apparent anyway. The model has been applied to data concerning tumor markers in ovarian carcinoma. The problems with several possible cut-off points on the indicator variable are considered.

5431 **STEVEN THOMPSON (Mathematical Sciences, University of Alaska Fairbanks, Fairbanks, Alaska 99701, USA), Adaptive Cluster Sampling.**

In many sampling situations, researchers would like to increase sampling effort adaptively in the vicinity of high observed abundance. This paper describes designs for doing that and obtaining unbiased estimates of the population mean or total. For sampling populations which are sufficiently clustered, such strategies are found to give lower variance than simple random sampling of equivalent sample size.

5432 **HELGI TOMASSON (Kjararannsoknarnefnd, Borgarstuni 22, IS-105 Reykjavik, Iceland) and HRAFN TULINIUS (The Icelandic Cancer Registry), Some Applications of Linking the Genetic Database to Breast Cancer Screening Data: A Case-Control Study.**

In the period 1963 to 1985, about 67,000 women were screened at the Icelandic Cancer Registry. Of these, about 1,000 have developed breast cancer. These 1,000 have been matched with about 6,000 controls, using year of birth as matching criterion. The genetic database is then used to find mothers and sisters of cases and controls. In order to evaluate the impact of family history for the risk of breast cancer, the resulting files are then merged with the Cancer Registry containing about 2,800 cases.

5433 **B. W. R. TORSSELL (Department of Crop Production Science, Swedish University of Agricultural Sciences, S-750 07 Uppsala, Sweden), System Analyses — a Complement to the Analysis of Variance in Agronomic Experimentation.**

This paper first discusses the use of simple deterministic (growth) models as a complement to the analysis of variance in agronomic experimentation. An example is given in which a significant year × genotype interaction, revealed by analysis of variance, is explained in terms of interactions between plant density, growth potential (related to relative growth rate) and a growth index (related to weather), thus integrating the effect of weather. The paper then points out the need for developments in experimental design and statistical methods for estimation of confidence limits for parameters in mechanistic models for agronomic experimentation. This is necessary before deterministic models, commonly used in agricultural research, can be developed into stochastic models for simulation of risks and chances. In stochastic modelling it makes a difference whether the distribution of the driving forces is normal or skewed. Contributions from statisticians with biological competence is required to understand and handle such effects in agronomic-ecological systems.

5434 **HRAFN TULINIUS (The Icelandic Cancer Registry, PO Box 5420, IS-125 Reykjavik, Iceland), Use of a Genetic Database for Epidemiological Research.**

A collaboration between the Icelandic Cancer Registry and the Genetical Committee of the University of Iceland started in 1972 in order to create a genetic resource for cancer research. As a pilot, breast cancer was chosen since that is a common cancer and a considerable body of information existed on familial disposition to breast cancer. All the propositi selected for tracing were chosen on the basis of either year of diagnosis or year of birth. In order to measure accurately by epidemiological methods the increase in risk conferred by having a relative with breast cancer, it was felt necessary first to make descriptive studies of the other known risk factors for breast cancer. These are age, year of birth and reproductive factors. Results of those studies are considered along with the results published in 1982 on the increase in risk of breast cancer among some first- and second-degree relatives.

The following abstracts are of papers read at the 2nd Spanish Biometric Conference, organised by the Spanish Group of the Biometric Society, held in Segovia, Spain, from 20 – 23 September 1989. Some abstracts have incomplete or no postal addresses; inquiries should be directed to the National Secretary of the Spanish Group.

5435 **J. C. ALMARAZ SIMÓN (Sec. Bioestadistica Fac. Medicina, Universidad Complutense, Madrid, Spain), An Algorithm to find the Optimum in Polynomial Programming.**

The present study established an algorithm to find the minimum point in polynomial programming which has a set of linear constraints and where the polynomial objective function is convex in the set of constraints. This algorithm extends and develops Beale's question (1967) about quadratic programming. The procedure consists of obtaining a vertex from the polytope of constraints and continues for as long as possible. When a feasible solution is found that is not a vertex, this solution is transformed to a feasible basic solution of the new applied program in which the above strategies are applied. A rigorous basis is given for the algorithm and this study concludes with an application to menu problem planning.

5436 **C. ARENAS and C. M. CUADRAS (Departament d'Estadística, Universitat de Barcelona, Diagonal 645, 08028 Barcelona, Spain), Some Applications for a Regression Model with Mixed Data.**

A multiple regression method based on distance analysis was proposed and studied in a previous theoretical paper. By using this method we can predict a continuous response variable from several explanatory variables; this is compatible with the general linear model and is found to be useful when the predictor variables are both continuous and categorical. This paper illustrates, with some real data examples, the results obtained.

5437 **J. ARNAU-GRAS and J. GUARDIA-OLMOS (Departamento de Metodologia de Las Ciencias del Comportamiento, Facultad de Psicologia, C/. Adolf Florensá s/n, 08028 Barcelona, Spain), Use of the Longitudinal Panel Design.**

The use of the longitudinal panel design for the study of temporal effect on the relationship between variables seems a valid alternative to obtain empirical evidence about the hypothetical causal relation between variables. However, the traditional analysis of the different correlations has deficiencies, essentially centred on the difficulty of showing the true effects between variables. This communication presents the translation of the different statistical models for the panel design with two waves to the structural equations system. It also discusses the improvements brought about by this kind of analysis.

5438 **M. BASELGA (Depto. de Ciencia Animal. Universidad Politécnica de Valencia, Camino de Vera 14, 46020 Valencia, Spain), and J. CAMACHO (Escuela de Ciencias Agrarias, Universidad Nacional, Heredia, Costa Rica), MIVQUE Estimation of Variance-Covariance Components between Reproductive and Growth Traits in Prolific Animals.**

A bivariate model is proposed to analyse a reproductive trait such as litter size and a growth trait such as growth rate. The aim is to use MIVQUE methodology to estimate variance-covariance components — genetic, maternal and error — concerning both traits. The model includes year-season effect (fixed) for both traits and another fixed effect, different for each one. A repeatability animal model is proposed for the reproductive trait and a sire-and-dam model, including maternal effects, for the growth trait. In order to simplify computations, reproductive followed by growth data are ordered within dams and an equivalent model is proposed, considering the random non-genetic effects as the error. Efforts have been made to save computing time and memory, analysing thoroughly the different steps of the methodology. Consequently, cases involving around 1500 equations can be solved by microcomputers with 640 Kb of RAM and 10 Mb in a fixed disk.

5439 **R. BARTUAL, E. A. CARBONELL and J. I. MARSAL (IVIA, 46113 Moncada (Valencia), Spain), Epistatic Variation for Resistance to *Phytophthora capsici* in Pepper.**

The variability among single and three-way crosses derived from lines of pepper (*Capsicum annum*) selected for resistance to *Phytophthora capsici* was analyzed into statistical-genetics components due to general and specific combining abilities and additive-by-additive epistasis. Indirect evidence of higher order epistasis was also estimated. Epistasis was a principal source of variation for the material studied, indicating that the most appropriate breeding method to be applied for resistance to *Phytophthora* root rot in peppers should be recurrent selection.

5440 **J. M. BATISTA-FOGUET (Departamento de Metodología de las Ciencias del Comportamiento, Facultad de Psicología, Universidad de Barcelona, 08034 Barcelona, Spain), W. SARIS (Universidad de Amsterdam) and X. TORT-MARTORELL (Politécnica de Cataluña).**

Attitudinal data are collected mainly by interviewing people in survey questionnaires. This measurement instrument has many problems, including its length, and the categorical nature of the response scales affects both reliability and validity. Moreover, questionnaires are normally associated with non-experimental designs for data collection and multivariate statistical techniques for data analysis. We propose an alternative to this classical methodology for questionnaire design and data analysis. The topic is job satisfaction, and it aims to evaluate its determinants based on a random sample of Dutch respondents. The questionnaire consists of an implementation of a 2^k factorial design, which should be answered by means of matching procedures. The advantages of using fractional factorial designs are discussed.

5441 **J. BEHAR-ALGRANTI (Departamento Metodologia de las Ciencias del Comportamiento, Facultad de Psicologia, Zona Universitaria de Pedralbes, 08028 Barcelona, Spain), Discriminant Analysis and Cluster Analysis: Comparison of Classifications.**

In order to compare classifications produced by discriminant analysis and cluster analysis, these techniques were applied to the same data, using factorial scores. The sample was composed by two groups of girls of 7th E.G.B. (General Basic Education), pre-pubers and pubers; the total number of girls was 232. In connection with the discriminant analysis, data about classification power, centroids distance and standarized coefficients with more load in the discriminant function were provided. In the cluster analysis, correlation coefficients were used. A strong similarity was observed between the classifications. The homogeneity of variables or factors employed in both calculation processes was considered to be the cause.

5442 **M. J. BOLAÑOS-CARMONA (Cátedra de Bioestadística, Facultad de Medicina, 18071 Granada, Spain), Fuzzy Measures and Fuzzy Integrals in Cluster Analysis.**

An iterative model is proposed for evaluating the relative importance of the variables used in a cluster analysis of cases. The matrix of dissimilarities is obtained at each step by fuzzy integration of standardized differences with respect to a fuzzy measure (bounded and monotone evaluation) defined on the subsets of variables. Two fuzzy integrals can be used, namely Sugeno's integral and 'monotone expectation' based on Choquet's integral, in order to reach two main goals: the determination of clusters and the evaluation of the relative influence of variables. This model allows any classical method of aggregation to be adopted, and it is a flexible tool for incorporating subjective or objective information about the variables concerned.

5443 **A. BOSSI, I. CORTINOVIS and S. MILANI (Istituto di Statistica Medica e Biometria, Università degli Studi di Milano, Via Venzia 1, 20133 Milan, Italy), Construction of Growth Charts for Anthropometric Traits at Birth and in Early Childhood: Methodological Problems and Auxological Aspects.**

We discuss some methodological problems and auxological aspects of the construction of cross-sectional and longitudinal growth standards, and give results of a multicentre obstetric-pediatric survey concerning 45,000 babies born in hospitals of six Italian towns and aimed at evaluating the role of biological, environmental, and social factors on children's health conditions and somatic growth. The construction of longitudinal standards implies two problems: (a) to choose a mathematical function suitable for describing individual growth processes; (b) to estimate the mean growth constants for a homogeneous group of children and the covariance matrix of the vector of observations, so as to compute tolerance limits and draw growth charts. A satisfactory solution to both problems is constituted by two-stage linear models. For example, there are the Potthoff-Roy (1964), Kleinbaum (1973) and Liski (1985) models, which apply to incomplete sets of measurements taken at fixed time points, and the Berkey (1982) and Berkey-Laird (1986) models, which apply to records of measurements taken at variable time-points.

5444 **R. CALVO-HARO, J. L. GONZALEZ-ANDUJAR (Sección de estadística Area de Informática Científica, 28040 Madrid, Spain) and A. GARCIA VALCARCEL (Dep. de Industrias Forestales), A New Asymptotic Model for Weight Loss in Wood Treated with Salts as Combustion Retardants.**

A new asymptotic model which passes through the origin and can have a different number of inflexion points as a function of the parameter values is presented. The model has been very successfully tested in the study of the weight loss of wood previously treated with various salts used in different quantities as combustion retardants, for several forest species.

5445 **M. J. CARABAÑO, R. ALENDA and M. P. VARGAS (Dto. de Produccion Animal, INIA, Carretera de la Coruña Km. 7, 28040 Madrid, Spain), A Study of the Prediction of Milk Production.**

Due to the common practice of predicting total milk production in 305 days from production in the first stages of the lactation period, a study of the genetic and phenotypic correlations between partial and 305 days milk production was deemed necessary. A maximum-likelihood procedure, REML, applied to a two-traits mixed model, was used to estimate the genetic and phenotypic (co)variances needed to obtain the correlations mentioned. REML estimates of variance components were obtained by using an EM algorithm and the computing strategy followed is outlined. Estimates of genetic correlations were high (>0.89), indicating that partial production and 305 days production were regulated by the same genes. Phenotypic correlations were intermediate before 90 days (<0.73) and were increasing up to values close to unity when duration of partial productions increased.

5446 **E. A. CARBONELL (IVIA, Apartado Oficial, 46113 Moncada, Valencia, Spain), A. E. BELL (Purdue University, USA) and J. J. FREY (Pfizer Inc., New York), Non-Additive Genetic Effects in Populations under Different Selection Methods.**

Using the genetic model of Carbonell, Nyquist and Bell (1983, *Biometrics*, **39**, 607–619), the genetic parameters of two quantitative traits in two- and three-way crosses of *Tribolium* populations developed by reciprocal recurrent selection (RRS) and by within-line purebred selection (WLS) were compared each with the other and also with the parameters of the unselected base population. For the heterotic trait Larval Weight, variation due to additive and interline specific effects accounted for over 50% of the total variation. The epistasis contributed another 20% and was followed in importance by the maternal effects. For the more heritable character Pupal Weight, additive variation was the most important. Sex-linked and reciprocal effects were relatively unimportant overall. RRS was more effective in exploiting the interline dominant effects. The epistatic effects were more important in the base population but did not differ between RRS and WLS.

5447 **J. L. CORDERO, P. VARGAS, J. J. JURADO and A. ALONSO (Dto. de Produccion Animal, INIA, Carretera de la Coruña Km. 7, 28040 Madrid, Spain), Extension Coefficients for Milk Records.**

Coefficients were computed for the extension of partial lactations to 305 days for milk and fat records. 91,545 controls corresponding to 15,387 lactations with at least nine controls were used. Linear-models methodology was applied and computer programs were developed in the Animal Production Departament of INIA to overcome the limitations of standard programs (Harvey, LSML76). Extension coefficients are provided for different levels of production, lactation number and seasons.

5448 **C. M. CUADRAS (Departament d'Estadística, Universitat de Barcelona, Diagonal 645, 08028 Barcelona, Spain), Distance Analysis for Studying Non-Linear Regression.**

Distance analysis and metric scaling can be applied to perform a multiple regression of a response variable on several explanatory variables. This method is related to principal component regression and is specially useful when the explanatory variables are both qualitative and quantitative (mixed data). By using a suitable distance function, we prove that this distance approach also seems to be useful to detect and study non-linear regression: defining the model, obtaining a measure of fit, predicting a new observation, etc.

5449 **R. ESTARELLES (Metodología de las Ciencias del Comportamiento, Facultad de Psicología, Universidad de Valencia, Avda. Blasco Ibañez 28, 46010 Valencia, Spain), Multiple-Comparison Procedures: Non-Parametric and Robust Procedures.**

The subject of multiple comparisons forms a part of the broader subject of simultaneous statistical inference. Some of the procedures do not depend on the distributions that generate the sample data (non-parametric multiple comparison procedures). Also, some procedures are resistant to substantial departures from the usual distributional assumption, in particular, robust multiple-comparison procedures. Contributions in this direction were made by Dunnett (1982) and Ringland (1983). We now first restrict attention to departures from normality and presence of heterogeneous error variances. We discuss non-parametric single-step and step-down procedures for one-way layouts, particularly for certain definitions of power.

5450 **A. F. CANCIO (Departamento de Sistemas Forestales, C.I.T. Instituto de Investigaciones Agrarias, Ctra. de la Coruña, Km. 7, E-28040 Madrid, Spain) and J. C. ANTORANZ (UNED, Madrid), Dynamical Systems Theory applied to Epidemics in Animals originated by Microparasites.**

We point out the important role played by the unapparent carriers of viruses and bacteria when these viruses and bacteria are/aren't able to infect, and we show how different solutions can be made to appear in the system by a little change in the relations among the different individual states. We propose a general model where, by means of some simplifications in the interactions between classes, it is possible to obtain analytical solutions like steady states, limit cycles, hysteretic phenomena, and homoclinic and heteroclinic orbits. These models can apply to situations where the individual's recovery time is large (tuberculosis, hepatitis, etc.), and it allows us to propose a mathematical hypothesis on how to produce and reproduce some pandemic cycles with very large period, as with the bubonic plague.

5451 **M. P. GALINDO-VILLARDON, J. L. VICENTE-VILLARDON, I. BARRERA-MELLADO and A. MARTIN CASADO (Biostatistics Unit, School of Medicine, University of Salamanca, Salamanca 37022, Spain), 'HJ-Biplot' for Multivariate Direct Gradient Analysis.**

We propose an alternative to Canonical Correspondence Analysis (ter Braak, 1986) based on biplot methods, which is also a direct method of analysis of the gradient. Let us assume that a researcher has available two sets of variables considered in n experimental groups and wishes to explore and describe the relationships between both sets. The basic idea consists of using the HJ-biplot (Galindo & Cuadras, 1986; Galindo, 1986) as an ordination technique to find the best pattern of variation and then to demonstrate that the variables of the second set can be represented on the same ordination plot. The advantages lie in the fact that the HJ-biplot achieves the same quality of representation for rows and columns; this is much better than that obtained with other representation techniques. The technique is applied to experimental data.

5452 **F. GARCIA, R. ESTARELLES and G. MUSITU (Valencia University, Psychology School, Avda. Blasco Ibañez 28, 46010-Valencia, Spain), Analysis of Internal Consistency from a Questionnaire on Parent-Child Communication.**

This research aims to elaborate a questionnaire to evaluate the perception of parent-child communication. To carry out this objective we have followed theoretical procedures, conceiving the communicative process from the model of punctuation of the general theory system and from Berlo's interactional levels. The communication has been categorised into twelve topics: studies, friends, drugs, television, sexuality, personal projects and family life, testing these topics bidirectionally (father and mother) and in two senses (parent-child and child-parent). The subjects for this study were 764 elementary and high school students, of both sexes, ranging in age from eleven to 17 years. Internal consistency has been studied from the questionnaire by means of the Sperman-Brown, Guttman-Rulon and Alfa coefficients.

5453 **F. GARCIA, R. ESTARELLES and G. MUSITU (Valencia University Psychology School Avda, Blasco Ibañez 28, 46010-Valencia, Spain), Methodological Analysis of the Social Perception of the University.**

This research aims to elaborate a questionnaire to evaluate the perception of the university. To carry out this objective we elaborated a pool of 215 items from the brain-storming technique and from an open-questions questionnaire applied to a pilot sample. The perception of the university was rationally defined by the following categories: information, image, research and formation. This questionnaire was applied to a sample of 461 subjects belonging to the social institutions, private enterprise and the social communication mass-media. The empiric structure of the rational factors was tested by means of factor analysis of the principal components with varimax rotation.

5454 **P. GOMES (Laboratório de Análise de Dados, Faculdade de Economia da Universidade do Porto, Rua do Dr. Roberto Frias, 4200 – Porto, Portugal), A Recent Contribution to Factor Analysis.**

We propose a new factor analysis model which holds for a specified population of variables: for a fixed set of n individuals, data now represent a sample of p variables from this population which has a grouping structure in that it is composed of k subpopulations $P_1, P_2, \ldots, P_K$. It is assumed that all variables belonging to one group have a common probability distribution. We associate to each group a Bingham Distribution $B(u,\xi)$ on the n-sphere where the parameter u is a 'direction parameter' and ξ is a 'concentration parameter'. Then the whole is a mixture of these individual distributions. Cluster analysis methods are used to identify this structure which leads to the estimation of the parameters of our model. Our approach leads to directly interpretable solutions.

5455 **E. GOMEZ-BECERRA (Sección de Estadística, Area de Informática Científica, Apartado 8111, 28080 Madrid, Spain), Circular Plot Surveys: A Study of the Robustness of Buckland's Binomial Estimator of Animal Density Against Failures of two Assumptions of the General Model of Estimation.**

This paper uses simulation to study the robustness of Buckland's binomial estimator of animal density against failures of two assumptions of the general model of estimation, namely: (i) animals are randomly distributed over the study area; (ii) distances are recorded without error. The binomial case was chosen because of its practical advantages since all distances are assigned to one of two categories, according to whether or not they exceed a specified distance. The result is proved that the estimator is robust againt failures of assumption (i), provided observation points are uniformly distributed, but not of assumption (ii). In the case of rounding, which is the most common measurement error, the bias depends on the rounded quantity.

5456 **J. L. GONZALEZ-ANDUJAR, S. PEREZ-BOADA and R. CALVO (Sección de Estadística, INIA, Aptdo. 8111, 28080 Madrid, Spain), and C. FERNANDEZ-QUINTANILLA (Dpto. de Cereales y Leguminosas, Madrid), Comparison of Germination and Emergence Curves of *Avena sterilis* and *Avena fatua*.**

Using the comparison of germination and emergence curves of *Avena fatua* and *A. sterilis* under various temperatures and osmotic potentials, the differences between the two species are determined. The behaviour of each species in terms of germination was different, while in emergence, differences turned up related to temperature but not to osmotic potential.

5457 **V. GONZÁLEZ-ROMÁ, J. L. MELIÁ, M. D. SANCERNI, M. D. BAYARRI and M. ALHAMBRA (Area de Metodología, Facultad de Psicología, Universidad de Valencia, Av. Blasco Ibáñez 21, 46010-Valencia, Spain), Comparison of Two Measures of 'Organizational Boundariness'.**

This paper compares two measures of organizational boundariness. The first is based upon the composition of the focal person's role set and upon the proportion of its members who work in other organizations relative to the proportion for the focal person. The second is based upon a six-item self-reported scale, the organizational boundariness scale. The two measures are significatively correlated, but the second offers better validity levels and its use implies lesser temporal costs.

5458 **V. GONZÁLEZ-ROMÁ, M. D. SANCERNI, J. L. MELIÁ, J. M. TOMÁS and A. OLIVER (Area de Metodología, Facultad de Psicología, Universidad de Valencia, Av Blasco Ibañez 21, 46010 Valencia, Spain), A Scale for Measuring Organizational Boundariness.**

Usually, researchers studying organizational boundary roles have established *a priori* which roles must be considered boundary ones and which not. This prevents consideration of the 'organizational boundariness' of a role as a question of grade. This paper presents an instrument for measuring the 'organizational boundariness' of roles and analyzes its psychometric properties. This is a monofactorial six-item scale which presents an adequate reliability coefficient, and good validity properties. Items ask for the frequency with which persons perform tasks typically associated to boundary roles. Items are responded to on a four-point scale ranging from one (= 'never') to four (= 'many times').

5459 **J. GUARDIA-OLMOS and R. FERRER-PUIG (Dept. de Metodologia de les Ciéncies del Comportament, Facultat de Psicologia, C/. Adolf Florensa s/n, 08028-Barcelona, Spain), Estimation of Serially Related Missing Data.**

Problems arising from missing data on serially related recordings are treated by means of simulation or estimation, strategies being propounded for dealing with them. The investigation is carried out by applying various deletion patterns to a complete sequence of 4800 electrodermal activity data obtained from a single subject during a 20-minute session, and comparing estimated to original data analysis of results.

5460 **I. HERRANZ-TEJEDOR, L. PRIETO-VALIENTE (Dto Bioestadística, Facultad de Medicina, Universidad Complutense, 28040-Madrid, Spain), and A. MARTIN-ANDRES (Cátedra Bioestadística, Granada), 2 × 2 Contingency Tables: Resolution of Cormack's Problems with Unconditioned Tests.**

Traditionally, there has been controversy about which methodology is the more suitable for when two proportions from independent samples are compared: conditioned methods (Fisher, 1935) or unconditioned methods (Barnard, 1947). Conditioned methods are criticized because of their irregular behaviour (as with the two-tailed test) in certain tables. For this reason, the P-value definition in tests of two proportions was substantially altered by some of the supporters of such methods. Cormack (1986) raised five specific problems on working with tests of this type. This study tries to prove that the unconditioned methods are not only consistent but also more powerful than the conditioned ones.

5461 **S. HERRANDO-BORGE (Fac. de Psicología, Depto. de Metodología CC, Zona Universitaria de Pedralbes s/n, 08028 Barcelona, Spain), Computerized Adaptive Testing: A Simple Solution to the Problem of Estimation with Perfect and Zero Scores.**

A classical problem in Item Response Theory is that of estimating parameters with perfect and zero scores. That is why, in the Computerized Adaptive Testing process, there must be at least one error and one correct to produce maximum-likelihood estimators. To avoid the consequent problems, a simple solution is proposed: the inclusion of two dummy items: one extremely easy and the other extremely hard. This artifact doesn't influence the subsequent estimations, its only goal being to allow the application of mathematical formulas for the maximum-likelihood estimations.

5462 **A. MARTÍN-ANDRÉS and J. D. LUNA DEL CASTILLO (Cátedra de Bioestadística, Facultad de Medicina, 18071 Granada, Spain), Pseudo-Bayesian Tests for the Comparison of Two Proportions.**

The comparison of two proportions, using two independent samples, is a well-known

and apparently simple problem, yet one which daily produces ever more disagreement among statisticians. The debate used to be about whether the conditioning principle was obligatory or not, but recently Rice (1988, *Biometrics*, 44, 1 – 22) and Martín and Luna (1987, *Metron*, 45, 81 – 97) have brought a new element into the discussion. They propose eliminating the nuisance parameter p (the value of the common proportion under the null hypothesis) by assigning to it a suitable *a priori* distribution, the former using a conditioned method, and the latter an unconditioned one. Both assume that the distribution is uniform. The present authors propose a new method; they generalise the formulae if a beta distribution is assigned to p, and they discuss the methods proposed.

5463 **A. MARTÍN-ANDRÉS and J. D. LUNA DEL CASTILLO (Cátedra de Bioestadística, Facultad de Medicina, 18071 Granada, Spain), Selection of the Optimal Unconditioned Test for Comparing Two Independent Proportions.**

There are two possible methods of comparing two independent proportions from small samples: conditioned methods (Fisher's exact test) and unconditioned methods (Barnard's test). Various versions of the latter, besides that of Barnard himself, have been put forward; the present authors compare them, together with others which they have elaborated, in order to select the optimal. At the same time, and supposing a known critical region, they give a bound for the size of the test based thereon.

5464 **J. L. MELIÁ (Facultad de Psicología, Universidad de Valencia, Av. Blasco Ibañez 21, 46010 Valencia, Spain), Comparison of Social Positions.**

The discrepancy in positions each person occupies is related to interpersonal behavior and influence, as several wellknown experiments have shown. From the perspective of social psychology, the importance of discrepancy of social positions cannot be exaggerated. However, the lack of a procedure for measuring and comparing social positions makes some results imprecise and ambiguous. This paper presents an approximation to the comparison of social positions and offers some suggestions for future research.

5465 **J. L. MELIÁ (Facultad de Psicología, Universidad de Valencia, Av. Blasco Ibañez 21, 46010 Valencia, Spain), Measuring Social Position.**

A position is a unique point in a social space. Here social space is defined in terms of a social network, a structure of interrelated positions and the pattern of social interactions associated with them. Position is a relational concept, defining one in terms of relationships to other adjacent positions. This paper presents a general procedure for measuring social position. The crucial point of the procedure is that the concept of social position is defined by the relationship structure.

5466 **J. L. MELIÁ and J. F. PRADILLA (Area de Metodología, Facultad de Psicología, Universidad de Valencia. Av. Blasco Ibañez 21, 46010 Valencia, Spain), Quantification of Congruence in Perception of Social Position.**

Each social position in a social system is directly related to certain others (radial subjects). They constitute its radial set. A social position is defined by a pattern of social interactions. Each radial subject develops a conception of the focal position which is inevitably biased by the relationship of his own social position to that of the focal position. This paper presents a procedure for measuring the differences in perception of a focal position.

5467 **J. OCAÑA and C. RUIZ DE VILLA (Dep. d'Estadística, Universitat de Barcelona, Diagonal 645, 08071 Barcelona, Spain), A Monte-Carlo Study of Levene's Index of Sexual Selection and its Jackknife.**

A simulation study has been made of Levene's *Zm* index of sexual selection in multiple-choice mating experiments. The study used the parametric framework given by a generalization of the hypergeometric distribution due to Wallenius. This family of distributions depends on a parameter which can be related directly to the quotient of mating probabilities for each male type. *Zm* strongly underestimates the true mating probabilities ratio, type 1/type 2 (rare), for increasing values of this ratio and for decreasing frequencies of the rare type. Asymptotic tests based on *Zm* are also biased. They will very probably fail in detecting true selection against the rare type if their frequency is low. Some possible alternative estimators and tests, exact and based on the jackknife, are discussed and tested.

5468 **M. PELEGRINA DEL RÍO and F. SALVADOR-BELTRAN (Departamento de Metodología, Laboratorio de Visión, Universidad de Barcelona, 08028-Barcelona, Spain), Relative Operating Characteristic Curves and the Processes of Discrimination and Decision in Memory**

The relative (or receiver) operating characteristic (ROC) permits the representation of the subjects' responses in tests of memory, attention, decision making, and detection (Green and Swets, 1966; Swets, 1986). We propose a predictive mathematical model based on signal detection theory (SDT) and the ROC index. The 'signal', 'stimuli' or 'information' were based on schema theories (Graesser, 1981; Schank, 1979; Pelegrina, 1988; Salvador, 1986). The schema's variables were organized by typical and atypical information. The results confirm the efficiency of the mathematical model and empirical ROC curves in discrimination and decision tasks.

5469 **S. PEREZ-BOADA and J. GALLEGO-DIAZ-FAJARDO (Apdo. 8.111, 28080 Madrid, Spain), Box-Jenkins Models for Annual Precipitation and Temperature Series in Six Spanish Cities.**

Univariate analysis of annual total precipitation and annual mean temperature for six Spanish cities has been performed using Box-Jenkins ARIMA models. For precipitation, two series, Madrid and San Fernando (Cádiz), turned out to be white noise. Two of them were MA(1): Barcelona and La Coruña. The remaining two gave the following results: Badajoz was an AR(1) and Valencia was an AR(3) with only one parameter. For temperature, Badajoz was an AR(2) while Barcelona was an AR(1). The others, Madrid, La Coruña, San Fernando (Cádiz) and Valencia were an ARIMA (0,1,1). Forecasts for the year 1989 were obtained for all series.

5470 **M. D. PERIS-I-PASCUAL (Facultad de Psicología, Universidad de Barcelona, Zona Universitaria Pedralbes, 08028 Barcelona, Spain), The Circumplex in the Measurement of Cognitive Connectionism.**

Multi-dimensional scaling (MDS) is used to analyze a transition matrix which includes multiple associations in a contrabalanced design. Important consequences for the Semantic Networks are elicited from the perfect fit of the Circumplex model to the data. Multiple tests and analytic techniques have been applied modifying codification in order to check the relative usefulness, concluding that MDS was the most interesting.

5471 **M. D. PERIS-I-PASCUAL (Facultad de Psicología, Universidad de Barcelona, Zona Universitaria Pedralbes, 08028 Barcelona, Spain), Correction of Variance Partition in Experimental Designs for the Determination of Intelligence Heritability.**

After reviewing studies about intelligence heritability, we provide the evidence of a confusion effect based on the background of design. Assumptions in the vegetal system are not valid for the human system. It can be shown that the phenotype variance is erroneously considered as genotype variance, and H^2 as h^2. In the model developed in terms of regression, the scores of h^2 were corrected by the addition of environmental effects. The heritability factor of the five series of Raven's 56PM were estimated using the traditional parents-offspring design in 50 families, and alternative multivariate methods of analysis are proposed.

5472 **V. QUERA (Depto. de Metodología de las Ciencias del Comportamiento, Universidad de Barcelona, Zona Universitaria, 08028 Barcelona, Spain), Measuring the Duration of Behavioral States using 'Time Sampling': Distribution Functions and Moments of Measurement Errors.**

'Time sampling' is a well-known technique used to record spontaneous behavior in human and animal subjects. Three types of time sampling exist: 'instantaneous sampling', 'partial-interval sampling', and 'whole-interval sampling'. The observation session is divided into intervals and the observer records which behavioral category is on at the end of the interval ('instantaneous s.'), which categories have been on during the interval ('partial i.s.'), or which category has occupied the entire interval ('whole i.s.'). As the data obtained using these techniques contain biased information on the duration of the behavioral categories, the distribution functions and moments of duration errors provided by them must be known in order to correct for over- and under-estimation. Both general distribution functions and moments of the errors, and some developments made under uniform and exponential assumptions, are presented in this paper.

5473 **M. D. RIBA-I-LLORET (Laboratorio de Psicología Matemática, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain), The Treatment of Dichotomous Responses: Application of Logit Analysis and ANOVA to Factorial Designs in the absence of Variability.**

The behavior of logit analysis applied to factorial designs characterized by the presence of a dichotomous dependent variable and by a not very large number of cases is investigated using the Monte-Carlo method. Different levels of power for the non-null components are considered. When these levels are high, the population parameters are very extreme proportions and some sample cells can be a random set of ones or zeros. The results have been compared with others obtained using the analysis of variance. The size and power of the logit analysis are more influenced than those of ANOVA by the presence of cells with uniform values, the actual power of the second order interaction being the most seriously affected. This fact, in turn, has effects on the rest of the model components.

5474 **M. RIOS, A. VILLARROYA, M. CALVO and A. MIÑARRO (Departamento de Estadística, Universidad de Barcelona, Diagonal 645, 08028 Barcelona, España), A Theoretical Model for the Study of Plasma Glucose and Insulin Concentrations during an Oral Glucose Tolerance Test.**

A new theoretical model is introduced for the study of plasma glucose and insulin concentrations during the realization of an oral glucose tolerance test (OGTT). Once the theoretical model corresponding to the glucemia and insulinemia curves had been obtained, the equations of the model were solved for a sample of 100 children submitted to an OGTT. The results were utilized for the diagnostic of altered OGTT, and the biological meaning of the parameters obtained is discussed.

5475 **M. RUIZ-SOLER (Department of Psychology, University of Malaga, Campus El Ejido, 29071 Malaga, Spain), Are Stochastics Really the Residual Components from the Mathematical Models?**

In recent years, several researchers have discovered that some dynamic systems can produce stochastic behaviour that is also deterministic. In other words, there is order in the chaos. Starting from these ideas, we introduce some suggestions about how structural models from experimental designs can be improved. It is well-known that the efficiency of an experimental design expresses its sensitivity for detecting significance from the factors which we suppose are implicated in the explanation of the phenomena.

Therefore, if we can find a systematic component within the residual one, we shall increase the sensitivity model. For this purpose, we think that the useful topological tool called 'configuration space' must be used to find the underlying chaotic attractors — or fractals — which are probably present under that randomness wrapper that seems to cover a lot of residual components from certain mathematical models.

5476 **L. SALAFRANCA, J. TURBANY and A. SOLANAS (Departament de Metodologia de les Ciències del Comportament, Facultat de Psicologia U.B., c/. Adolf Florensa s/n, 08028 Barcelona, Spain), Bootstrap Confidence Intervals: A Comparative Study of Precision.**

Bootstrap techniques, introduced by Efron (1979), offer various alternatives to the classical elaboration of approximate adjusted confidence intervals and standard error estimation. The more adjusted intervals obtained by applying bootstrap methods increase Type I error rate, in the opinion of Rasmussen (1987). We suggest a comparative study between classical and bootstrap confidence interval elaboration techniques, measuring Type I error rates obtained by each of them. We use different bootstrap methods: the percentile, the bias-corrected and the bias-corrected-accelerated, providing new data for the Rasmussen (1987), Strube (1988), and Efron (1988) polemics.

5477 **M. SALICRU and P. SANCHEZ (Departamento de Estadistica, Universidad de Barcelona, Diagonal 645, 08028 Barcelona, Spain), Measures of Information Associated with *J*-Divergences.**

Two methods for determining informative matrices associated with *J*-divergences are introduced. In the first method, the informative matrices are derived from the metric associated with the tangent space direction (to the density functions space). In the second, the matrices resulting from parameter perturbations are considered. These perturbations are introduced in the directions of the coordinate axes. Algebraic relations between the matrices obtained under both methods are also derived.

5478 **P. SÁNCHEZ-ALGARRA (Departament d'Estadística, Universitat de Barcelona, 08028 Barcelona, Spain), On an Inequality that is Satisfied by the Coefficient of Determination in Multiple Regression.**

It is shown that in multiple regression the sum of squares taken out by regression on many variables simultaneously can be greater than the sum of squares taken out by regression on each variable separately. In other words, we study and discuss situations such that the squared multiple correlation is either greater than, equal to or smaller than the sum of squared single correlations.

5479 **M. D. SÁNCHEZ-MUÑOZ (Facultad de Medicina, Departamento de Bioestadística, 28040 Madrid, Spain) and C. SANTISTEBAN-REQUENA (Madrid), Spectral Study of Short-Term Memory under Different Sound Conditions.**

Techniques of Fourier spectral analysis are applied to the data obtained in experiments which involved the short-term memory task under different sound conditions. Spectral analysis procedures were used for every sound condition (silence, classical music, traffic noise and electric drilling) using the absolute frequencies of the subjects who recalled determined numbers of words in a fixed time. Applying Fourier analysis we obtained the periodic theoretical functions fitted to the data. To plot the corresponding periodograms we determined the average power, calculating previously the coefficients, amplitudes and phases of the functions. The theoretical sample spectrum calculated allowed us, through the Bartlett test, to check the goodness of fit of the data to the theoretical model.

5480 **M. D. SÁNCHEZ-MUÑOZ (Facultad de Medicina, Departamento de Bioestadística, 28040 Madrid, Spain), Z. SANTALLA-PEÑALOZA and C. SANTISTEBAN-REQUENA (Madrid), Mathematical Models for Experiments with an Auditory Signal: Spectral Study.**

The first- and second-order continuous and discrete autoregressive models are analyzed, through the autocovariance and autocorrelation functions, for experiments in which auditory signals are present. The spectrum power, as a Fourier transform of the autocovariance function, shows how the variance process is distributed. To study the sample spectrum fluctuations, the mean, variance and quadratic mean error were calculated from the frequencies of distribution. The conditions in which the spectral estimator obtained is approximately a χ^2 distribution were studied doing a smoothing of the sample spectrum. For that, we used the spectral Bartlett window; previous work (Sánchez-Muñoz, 1989) used the Kolmogoroff test.

5481 **A. SANCHEZ-PLA (Departament d'Estadística, Facultat de Biologia, Diagonal 645, 08028 Barcelona, Spain), A Pascal Program Performing Bootstrap Estimation.**

The bootstrap is a computer-intensive method oriented to measuring the accuracy of an estimator. It is also useful for building confidence intervals for this estimator. We present a user-oriented program, written in Pascal, for a complete bootstrap estimation process: (1) It resamples from a given sample, using the empirical cdf or another distribution function such as the Normal or Uniform law. (2) It calculates bootstrap estimators for a given parameter θ and for its standard error through a routine that the user must provide. (3) It builds bootstrap confidence intervals by different procedures. There is also the possibility of graphical output (histogram) for estimating the bootstrap distribution.

5482 **A. SANCHEZ-PLA and J. OCAÑA-REBULL (Departament d'Estadística, Facultat de Biologia, Diagonal 645, 08028 Barcelona, Spain), A Simulation Study of Two Estimators of Genetic Distance Obtained by Resampling Methods (Jackknife and Bootstrap).**

Two estimators of genetic distance, calculated by resampling methods, are introduced in order to estimate its variance and to build confidence intervals. Due to the nature of the methods, making difficult an analytical validation, a Monte Carlo simulation study has been used to analyze the estimators' efficacy under different circumstances. The jackknife estimator for the distance has proved to work as well as the original estimator. The bootstrap estimator for the distance is more biased than the other two but performs much better than the jackknife one at estimating variance of genetic distance. Non-parametric confidence intervals have been built by the bias corrected percentile method. Though they haven't proved to substantially improve the coverage probability relative to standard confidence intervals, their form measured through the ratio (right/left) is most similar to 'real' confidence intervals (calculated from the Monte Carlo experiment).

5483 **C. SANTISTEBAN-REQUENA and Z. SANTALLA-PEÑALOZA (Departamento de Metodología, Facultad de Psicología, Universidad Complutense, 28023 Madrid, Spain), A Measure of Clustering and Random Configurations in Free Recall.**

In many short-term memory experiments, groups of objects or words, organized according to natural or theoretical criteria, are presented to subjects. In the process of recall, objects or words follow a particular sequence. Data analyses usually take into account the number of items recalled and the total number of repetitions observed. Accordingly, clustering indexes, generally based on that number of repetitions and some other statistics like mean, and the variance, are proposed. But they don't take into account the structure of the runs in every response sequence. Other propositions consider this new aspect in two different ways: The first one corresponds to the subject's short-term memory ability and the second shows how he/she recalled the information. Experimental probabilities and that obtained by the proposed formulas for the total number of runs are compared with theoretical probabilities to see if the configuration appearing in the answer could be attributed to chance.

5484 **A. SILVA-MATO (Dpto. Bioestadística, Facultad de Medicina, Univ. Alcalá de Henares, 28049-Madrid, Spain), F. GAYA-MORENO (ECEMC, Madrid) and J. D. LUNA DEL CASTILLO (Cátedra de Bioestadística, Granada), The McDonald Unconditional Method of Comparing Two Independent Proportions: A New Algorithm in the 'C' Language.**

When Barnard starts developing the unconditional methodology to solve the homogeneity test of two independent proportions, he is raising a test that leads to a serious problem in calculation time. Under the same philosophy, McDonald proposes a new unconditional test by introducing an algorithm in the Fortran 66 language, which saves a lot of process time with a minimal loss of power. There are several studies about this type of test which confirm that it is more powerful than others. Thus, we have developed for this test a new and faster algorithm in the language 'C' (over fifty times faster). We worked on a standard PC.

5485 **A. SATORRA (Department of Statistics & Econometrics, University of Barcelona, Avda. Diagonal 690, 08034-Barcelona, Spain), Asymptotic Robustness of a Normal-Theory Chi-Squared Goodness-of-Fit Statistic in Instrumental Variable (IV) Estimation.**

Fast and inexpensive methods of estimation can play an important role in the practice of covariance structure analysis. One such method is the instrumental variable (IV) approach. Traditionally, one of the limitations of the IV approach is the lack of a chi-squared goodness-of-fit statistic for testing model adequacy. A general type of chi-squared goodness-of-fit statistic, which we use here in conjunction with IV estimation, was proposed by Browne. A normal theory form of Browne's statistic which, by contrast, is not cumbersome to compute was investigated by Satorra and Bentler. In the present paper we investigate the performance of both chi-squared goodness-of-fit statistics when applied to the context of IV estimation.

5486 **A. SOLANAS, L. SALAFRANCA and J. TURBANY (Departament de Metodologia de les Ciències del Comportament, Facultat de Psicologia de la U.B., c/. Adolf Florensa s/n, 08028 Barcelona, Spain), Analysis of the Efficacy of Intervention in Behavioral Designs: The $\hat{\beta}_n$ Statistic.**

Since the assumptions underlying statistical techniques may not hold, the randomization test has been proposed as an alternative to the classical techniques used in behavioural designs. This paper presents a new technique called $\hat{\beta}_n$, to be applied to behavioral designs with only one observation in the baseline. Although many of the inherent methodological problems of the A-B strategy remain unsolved, the efficacy of the clinical treatment can be evaluated by means of the significance of the statistic β_n.

5487 **A. SOLANAS, J. TURBANY and L. SALAFRANCA (Departament de Metodologia de les Ciències del Comportament, Facultat de Psicologia de la U.B., c/. Adolf Florensa s/n, 08028 Barcelona, Spain), STATBETA: A Computer Program for Statistical Analysis of A-B Behavioral Designs.**

The STATBETA program (in BASIC 3.2 and based on the $\hat{\beta}_n$ statistic, see previous abstract 5486) allows evaluation of the efficacy of the treatment (clinical or experimental) in A-B behavioral designs. The main issue of the program is the simplicity and the reduced computional cost to achieve the usual results ($\hat{\beta}_n$ statistic,

autocorrelation analysis, *P*-value, normal approximation, plots, etc.). The program can be used for (a) data entry, (b) data analysis, and (c) visual data analysis.

5488 **A. SORRIBAS (Departament de Ciències Mèdiques Bàsiques, Universitat de Barcelona, Av. Diagonal 640, 08028 Barcelona, Spain), E. O. VOIT, P. F. RUST (Medical University of South Carolina) and J. SENTIS (Barcelona), *S*-Systems: A Useful Representation for Computing Statistical Distributions.**

S-systems are a special set of ordinary differential equations that can be used as a canonical form for studying non-linear differential equations, providing a systematic way of representing a wide class of equations. Having a canonical form allows for relating the original equations, which can include any kind of non-linearity, in a simple way. Also, it allows us to focus the search for solutions, both analytical and numerical, based on the canonical form. The use of the *S*-system is not restricted to the recasting of non-linear differential equations. We show the utility of the *S*-system canonical form for representing statistical distributions by means of differential equations. From this representation, it is easy to compute densities, cumulatives and quantiles, which is a major advantage when it comes to using complicated distributions such as the non-central t, F and χ^2.

5489 **E. UGARTE, R. ALENDA and M. J. CARABAÑO (Dto. de Produccion Animal, INIA, Carretera de la Coruña Km. 7, 28040 Madrid, Spain), Using Mixed Models for Evaluating Sires for Breeding.**

Using mixed models to obtain best linear unbiased predictions of sire's evaluation has desirable properties. Whether a factor is considered as fixed or random has an influence on the mean squared error (MSE) of the prediction of breeding value. Results obtained in this study show that, when working with a simulated population, the MSE of predicted breeding values was smaller when contemporary groups (e.g. herds) were taken as random (as opposed to fixed), with sires randomly distributed in these groups. However, the MSE of predicted breeding values was larger for models that include contemporary groups as random when groups are small (less than four individuals per group) and an association between sires and groups exits.

5490 **M.-M. WU and P. O. DROZ (Institute of Occupational Health Sciences, Rue du Bugnon 19, Ch-1005 Lausanne, Switzerland), Evaluating Mean Exposure from a Lognormal Distribution.**

In assessing the chronic health effect of occupational exposure to toxic chemicals at a work place, mean exposure over time is evaluated from daily measurements. Exposure for an individual worker or group is generally assumed to be adequately described by a lognormal distribution. Due to its close relation with a normal distribution, a lognormal distribution can be completely defined by either one of the two sets of parameters for location and variance. In evaluating the mean exposure against a prespecified standard, the investigator faces choice among various statistics. This paper discusses three approaches: the maximum-likelihood estimate of the mean, the mean of the logarithms, and a test based on the central-limit theorem. An empirical study is used to compare their accuracies for a range of coefficients of variation and sample sizes. Powers of these tests are also evaluated. ■

Travel grants to IBC

Second announcement of support to attend XVth IBC in Budapest

There is limited funding available for travel to the XVth IBC. The funds have been generously contributed by the University of Washington, Seattle, USA. *The funds are specifically earmarked for use by members of the Biometric Society in Third World or developing nations or in countries with severe monetary restrictions.* Grantees will also receive living expenses while in Hungary. Please address your request for consideration to Dr N. A. Goodchild, Chair of Awards Fund Committee, University of Western Australia, School of Agriculture, Nedlands, W.A. 6009 Australia. Applicants will be notified as soon as possible if they have been awarded grants, but they should not make any assumptions about such funding in connection with submission of a contributed paper to the IBC.

Applicants must include a letter of request which includes: amount of travel funding required; other sources of funding that is or may become available; other travel grants awarded in the past three years; your role at the IBC (session chairperson, contributed or invited speaker, etc.); a concise statement outlining why you believe you should participate in this travel grant. In addition, applicants must include a resumé giving: applicants full name, rank, address and institution; highest earned degree; area of biometric specialty; awards; bibliography; positions held; scholarships, fellowships etc.; and any other information the applicant deems pertinent to the selection process. Applicants should make their submissions as soon as possible and not later than a date to ensure delivery in Western Australia by 31 March 1990.