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BOOK ANNOUNCEMENTS

Erhard Godehardt, Graphs as Structural Models: The Application of Graphs and Multigraphs in Cluster Analysis (Vieweg, Braunschweig, 1988) 214 pages

Chapter 1: *Introduction, Basic Concepts.* Modelling in medicine and biology. Graphs as tools in mathematical modelling. The scope of exploratory data analysis. The basic concepts of cluster analysis. *Chapter* 2: *Current Methods of Cluster Analysis An Overiew.* The aim of cluster analysis. The different steps of a cluster analysis (Data sampling and preparation. Measures of similarity or distance. Types of classification. Procedures of classification (Optimization methods. Recursive construction of groups. Analysis of the point density. Linkage methods)). A short review of classification methods. Preparation and presentation of results. *Chapter* 3: *Graph-theoretic Methods of Cluster Analysis.* Classification by graphs (The classification at level d. Single-linkage clusters as components of a graph. Modifications of the cluster definition). Classifications by multigraphs (Undirected, completely labelled multigraphs. Application to classification models: The $(k, \vec{d}^T; s)$-cluster. Discussion of the new cluster definition). An algorithm for the construction of $(k, \vec{d}^T; s)$-clusters. The construction of dendrograms of $(k; s)$-clusters. *Chapter* 4: *Probability Models of Classification.* Current probability models in cluster analysis. Graph-theoretic models of classification (The model of R.F. Ling. A probability model based on random multigraphs). Discussion of the graph-theoretic probability models. *Chapter* 5: *Probability Theory of Completely Labelled Random Multigraphs.* Definitions and notation. A probability model of random multigraphs (Definition of the probability space. Definition of the random variables. Relations to current probability models). Some results for random graphs Γ_{nN} and G_{np}. Limit theorems for random multigraphs. Discussion of the results. Hints for the numerical computation of the expectations and distributions. *Chapter* 6: *Classifications by Multigraphs: Three Examples from Medicine.* Pharmacokinetics of urapidil in patients with normal and impaired renal function (Material and methods. Biometrics: Basic pharmacokinetics of urapidil. Cluster analysis of the urapidil data). Pharmacokinetics of lidocaine in patients with kidney or liver impairments (Material and methods. Biometrics: Basic pharmacokinetics of lidocaine. Cluster analysis of the lidocaine data). Pregnancy-induced hypertension.

P. Kall, J. Kohlas, W. Popp and C.A. Zehnder, eds., Quantitive Methoden in den Wirtschaftswissenschaften (Springer, Berlin, 1989) 240 pages

Chapter I: *Einführung.* 40 Jahre Operations Research: eine Abschiedsvorlesung (F. Weinberg). *Chapter* II: *Mathematische Optimierung.* Lösungsverfahren der stochastischen Programmierung – ein Überblick (P. Kall). Decomposition schemes for finding saddle points of quasi-convex-concave functions (W. Oettli). A characterization of a cone of pseudo-Boolean functions via supermodularity-type inequalities (Y. Crama, P.L. Hammer and R. Holzman). Ein Lösungsverfahren für das Losgrößenproblem mit linearen Restriktionen (K. Kleibohm). *Chapter* III: *Zufall und Ungewißheit.* Numerical solutions for Markovian event systems (W.K. Grassmann). On approximations for stochastic filtering with an application to reliability (W.J. Runggaldier and C.A. Clarotti). Produktformlösungen für geschlossene Warteschlangennetzwerke (H. Tzschach). Modellierung der Ungewißheit mit unsicheren Mengen (J. Kohlas). O.R. and M.S. revisited in the case of uncertain and subjective data (A. Kaufmann). *Chapter* IV: *Mathematische Modelle in der Volkswirtschaftslehre.* Mathematische Modelle als Hilfsmittel für die

Wirtschaftspolitik (W. Krelle und H. Sarrazin). Die Stochastische Lebenszyklushypothese und Neutralität der Fiskalpolitik (R. Henn und G. Nakhaeizadeh). Einsatz und Bewertung der quantitativen Methoden in der Agrarwirtschaft der Schweiz (D. Onigkeit). *Chapter* V: *Mathematische Modelle in der Betriebswirtschaftslehre.* Operations Research in der Unternehmenskrise (H. Albach). Strom und Bestandskontrolle in Organisationen (M.J. Beckmann). F&E-Management unter Berücksichtigung des Risikos (W. Popp). *Chapter* VI: *Informatik.* Datenföderalismus (C.A. Zehnder). Verzeichnis der Schriften von Hans Paul Künzi.

P.Y. Papalambros and D.J. Wilde, Principles of Optimal Design (Cambridge University Press, Cambridge, 1988) 416 pages

Chapter 1: *Optimization Models.* Mathematical modeling (The system concept. Hierarchical levels. Mathematical models. Elements of models. Analysis models and design models. Decision making). Design optimization (The optimal design concept. Formal optimization models. The question of design configuration. Systems and components). Feasibility and boundedness (Feasible domain. Boundedness. Activity). Topography of the design space (Interior and boundary optima. Local and global optima. Constraint interaction). Modeling data (Graphical and tabular data. Families of curves. Numerically generated data. Best fit curves and least squares). Solution and computation (Interplay of modeling and computation. Global and local knowledge). Design projects. Summary. *Chapter* 2: *Model Boundedness.* Bounds, extrema, and optima (Well-bounded functions. Nonminimizing lower bound. Multivariable extension). Constrained optimum (Partial minimization. Constraint activity. Activity theorem. Cases). Underconstrained models (Monotonicity. First monotonicity principle. Criticality. Optimizing a variable out). Making a model well bounded (Adding constraints. Constraint-bound models. Problem simplification. Trading off). Recognizing monotonicity (Simple and composite functions. Integrals). Inequalities (Constraint bifurcation. Conditional criticality. Multiple criticality. Dominance. Relaxation. Uncriticality). Equality constraints (Equality and activity. Replacing equalities by inequalities. Directing an equality. Regional monotonicity). Variables not in the objective (Relevance. Substitution. Second monotonicity principle. Nonobjective conditional criticality). Model preparation procedure. Summary. *Chapter* 3: *Interior Optima.* Existence (The Weierstrass theorem. Sufficiency). Local approximation (Taylor series. Quadratic functions. Vector functions). Optimality (First-order necessity. Second-order sufficiency. Nature of stationary points). Convexity (Convex sets and functions. Differentiable functions). Local exploration (Gradient descent. Newton's method). Searching along a line (Gradient method. Modified Newton's method). Stabilization (Modified Cholesky Factorization). Summary. *Chapter* 4: *Boundary optima.* Feasibile directions. Describing the constraint surface (Regularity. Tangent and normal hyperplanes). Equality constraints (Reduced (constrained) gradient. Lagrange multipliers). Curvature at the boundary (Constrained Hessian. Second-order sufficiency. Bordered Hessians). Feasible iterations (Generalized reduced gradient method. Gradient projection method). Inequality constraints (Karush-Kuhn-Tucker conditions. Lagrangian standard forms). Geometry of boundary optima (Interpretation of KKT conditions. Interpretation of sufficiency conditions). Linear programming (Optimality conditions. Basic LP algorithm). Sensitivity (Sensitivity coefficients). Summary. *Chapter* 5: *Model Reduction.* Parametric solution (Particular optimum and parametric procedure. Branching. Graphical interpretation. Parametric tests). The Monotonicity table (Setting up. First analysis cycle. Final cycle). Hidden monotonicity (Change of variable. Nuisance terms. A fleet design example. Monotonicity transformation). The activity map. Overconstrained models (Degrees of freedom. Maximal degrees of freedom. The symmetry principle. Maximal active sets. Maximal activity principle). Finding the optimal case (Feasibility and optimality testing. Starting case. Infeasibility. Nonoptimality). Starting case selection (Constraint coincidence. Parametric screening. Simple bounds. Other considerations. Consistent restriction). Discrete variables. Summary. *Chapter* 6: *Global Bound Construction.* Lower bounds (Power function derivatives. Posynomials. Simple lower bounds).

Geometric inequality (Geometric lower-bounding function. Geometric lower-bounding constant. Satisfactory designs). Unconstrained geometric programming (Zero degrees of difficulty: The gravel box. Degrees of difficulty: Condensation. Dual geometric programming). Standard sizes (Branching. Bounding). Constrained geometric programming (Constrained gravel box. Geometric programming theory). Normal posynomial form. Solving constraints. Orthogonality analysis. Summary. *Chapter* 7: *Local Computation.* Numerical algorithms (Local and global convergence. Termination criteria). Single variable minimization (Bracketing, sectioning, and interpolation. The Davies, Swann, and Campey method. Inexact line search). Quasi-Newton methods (Hessian matrix updates. The DFP and BFGS formulas). Finite differences and scaling (Finite differences. Scaling). Active set strategies (Adding and deleting constraints. Lagrange multiplier estimates). Moving along the boundary. Penalties and barriers (Barrier functions. Penalty functions. Augmented Lagrangian (Multiplier) methods). Sequential quadratic programming (The Lagrange–Newton equations. Enhancements of the basic algorithm. Solving the quadratic subproblem). Summary. *Chapter* 8: *Principles and Practice.* Modeling considerations for local computation (Modeling the constraint set. Modeling the functions. Modeling the objective. Degeneracy). Modeling considerations prior to computation (Natural and practical constraints. Asymptotic substitution. Feasible domain reduction). Optimization checklist (Problem identification. Initial problem statement. Analysis models. Optimal design models. Model transformation. Power function models. Local iterative techniques. Final review). Concepts, rules, and principles (Model simplifying. Local searching. Global bounding). Summary.

R. Mead, The Design of Experiments (Cambridge University Press, Cambridge, 1988) 620 pages

PART I: OVERTURE. *Chapter* 1: *Introduction.* Why a statistical theory of design?. History, computers and mathematics. The influence of analysis on design. Separate consideration of units and treatments. *Chapter* 2: *Elementary Ideas of Blocking: The Randomised Block Design.* Controlling variation in experimental units. The analysis of variance identity. Estimation of variance and the comparison of treatment means. Residuals and the meaning of error. The random allocation of treatment to units. Practical choices of blocking patterns. *Chapter* 3: *Elementary Ideas of Treatment Structure.* Choice of treatments. Factorial structure. Models for main effects and interactions. The analysis of variance identity. Interpretation of main effects and interactions. Advantages of factorial structures. *Chapter* 4: *General Principles of Linear Models for the Analysis of Experimental Data.* Introduction and some examples. The principle of least squares and least squares estimators. Properties of least squares estimators. Overparameterisation, constraints and practical solution of least squares equations. Subdividing the parameters and the extra sum of squares. Distributional assumptions and inferences. Contrasts, treatment comparisons and component sums of squares. Least squares estimators for linear models. Properties of least squares estimators. Overparameterisation and constraints. Partitioning the parameter vector and the extra SS principle. Distributional assumptions and inferences. Treatment comparisons and component sums of squares. *Chapter* 5: *Computers for Analysing Experimental Data.* Introduction. How general, how friendly. Requirements of packages for the analysis of experimental data. The factor philosophy of analysis programs. The regression model for analysis programs. Implications for design. PART II: FIRST SUBJECT. *Chapter* 6: *Replication.* Preliminary example. The need for replication. The completely randomised design. Different levels of variation. Identifying and allowing for different levels of variation. Sampling and components of variation. How much replication?. *Chapter* 7: *Blocking.* Preliminary examples. Design and analysis for very simple blocked experiments. Design principles in blocked experiments. The analysis of block-treatment designs. Balanced incomplete block designs and classes of less balanced des. Orthogonality, balance and the practical choice of design. The analysis of within block and inter-block information. *Chapter* 8: *Multiple Blocking Systems and Cross-over Designs.* Preliminary examples. Latin square designs and Latin rectangles. Multiple orthogonal classifications and sequences of experiments. Non-orthogonal row and column design. The practical choice of row and column design. Cross-over designs - time as a blocking factor. Cross-over designs for residual or interaction effects. *Chapter* 9: *Randomisation.* What is the population?. Random treatment allocation. Randomisation tests. Randomisation theory of the analysis of experimental data. Practical implications of the two theories for the analysis of experimental data. Practical randomisation. Sequential allocation of treatments in clinical trials. *Chapter* 10: *Covariance - Extension of Linear Models.* Preliminary examples. The use of additional information. The general theory of covariance analysis. Covariance analysis for a randomised block design. Examples of the use of covariance analysis. Assumptions and implications of covariance analysis. Blocking or covariance. Spatial covariance and nearest neighbour analysis. *Chapter* 11: *Model Assumptions and More General Models.* Preliminary examples. The model assumed for general linear model analysis. Examining residuals and testing assumptions. Transformations. More general statistical models for analysis of experimental data. Missing values and outliers. The separation of quantitative and qualitative information. PART III: SECOND SUBJECT. *Chapter* 12: *Experimental Objectives, Treatments and Treatment Structures.* Preliminary examples. Different categories of treatment. Comparisons between treatments. Presentation of results. Qualitative or quantitative factors. Treatment structures. Incomplete structures and varying replication. Treatments as a sample. Screening and selection experiments. *Chapter* 13: *Factorial Structure and Particular forms of Effects.* Preliminary example. Factors with two levels only. Improved yield comparisons in terms of effects. Analysis by considering sums and differences. Factors with three or more levels. The use of only a single replicate. The use of a fraction of a complete factorial experiment. *Chapter* 14: *Split Unit Designs and Repeated Measurements.* Preliminary examples. The practical need for split units. Advantages and disadvantages of split unit designs. Extensions of the split unit idea. Identification of multiple strata designs. Time as a split unit factor and repeated measurements. Systematic treatment variation within main units. *Chapter* 15: *Incomplete Block Size for Factorial Experiments.* Preliminary examples. Small blocks and many factorial combinations. Factors with a common number of levels. Incompletely confounded effects. Partial confounding. The split unit design as an example of confounding. Confounding for general block size and factor levels. *Chapter* 16: *Some Mathematical Theory for Confounding and Fractional Replication.* Preliminary examples. The negative approach to confounding. Confounding theory for 2^n factorial structures. Confounding theory for other factorial structure; dummy factors. Confounding for 3^n. Fractional replication. Confounding in fractional replicates. Confounding in row and column designs. *Chapter* 17: *Quantitative Factors and Response Functions.* Preliminary examples. The use of response functions in the analysis of data. Design objectives. Specific parameter estimation. Optimal design theory. Discrimination. Designs for competing criteria. Systematic designs. *Chapter* 18: *Response Surface Exploration.* Preliminary examples. General estimation objectives. Some response surface designs based on factorial treatment structures. Prediction, rotatability and testing fit. Blocking and orthogonality. Sequential experimentation. Analysis of response surface experimental data. Experiments with mixtures. PART IV: CODA. *Chapter* 0: *Designing Useful Experiments.* Some more real problems. Design principles or practical design. Resources and experimental units. Treatments and detailed objectives. The resource equation. The marriage of resources and treatments. Three particular problems. The relevance of experimental results. Block $\times$ treatment and experiment $\times$ treatment interactions.

Robert M. Miura, ed., Some Mathematical Questions in Biology: DNA Sequence Analysis (The American Mathematical Society, Rhode Island, 1986) 124 pages

Preface (Robert M. Miura). *Unresolved Problems in DNA Sequence Analysis* (Walter M. Fitch). *Pattern Recognition in DNA* (Peter H. Sellers). *Probability Distribution for DNA Sequence Comparisons* (Michael S. Waterman). *Some Probabilistic and Statistical Problems in the Analysis of DNA Sequences* (Simon Tavaré). *RNA Folding Prediction: The Continued Need for Interaction between Biologists and Mathematicians* (Michael Zuker).