

# IMS LECTURE NOTES — MONOGRAPH SERIES

This series provides an avenue for the rapid, but carefully refereed, publication of important research results in comprehensive form and expository style. These volumes should be of great value to researchers and advanced students in statistics, probability, and related fields. The series editor is Shanti S. Gupta, Purdue University.

---

## 7 APPROXIMATE COMPUTATION OF EXPECTATIONS

by Charles Stein

An abstract approach to the approximate computation of expectations.

One aim of the theory of probability is the effective computation of probabilities that are given in principle.

This volume presents an abstract approach to this issue keeping in mind the interaction of theoretical ideas and concrete problems.

164 Pages  
List Price \$20  
IMS members \$12

## 8 ADAPTIVE STATISTICAL PROCEDURES AND RELATED TOPICS

edited by John Van Ryzin

Proceedings of the Symposium on Adaptive Statistical Procedures and Related Topics, Brookhaven National Laboratory, June 1985.

This symposium was held in honor of the 70th birthday of Herbert Robbins and covers the broad range of topics to which he has made fundamental contributions including stochastic approximation, empirical Bayes and sequential analysis. This volume contains 36 papers (five in abstract form) by students and/or colleagues of Robbins.

476 Pages  
List price \$40  
IMS members \$24

## 9 FUNDAMENTALS OF STATISTICAL EXPONENTIAL FAMILIES WITH APPLICATIONS IN STATISTICAL DECISION THEORY

by Lawrence D. Brown

A systematic treatment of the analytical and probabilistic properties of exponential families.

Many if not most of the successful mathematical formulations of statistical questions involve specific exponential families of distributions. This volume examines these mathematical formulations from the perspective of general exponential families with a variety of statistical applications in mind.

283 pages  
List price \$25  
IMS members \$15

## & ADDITIONAL TITLES

Previously published: Volume 1, *Essays on the Prediction Process* by Frank Knight (\$15/members \$9); Volume 2, *Survival Analysis* edited by John Crowley and Richard A. Johnson (\$25/members \$15); Volume 3, *Empirical Processes* by Peter Gaenssler (\$20/members \$12); Volume 4, *Zonal Polynomials* by Akimichi Takemura (\$15/members \$9); Volume 5, *Inequalities in Statistics and Probability* edited by Y. L. Tong (\$25/members \$15); Volume 6, *The Likelihood Principle* by James Berger and Robert Wolpert (\$25/members \$15). Forthcoming: *Differential Geometry in Statistical Inference* by S. Amari, O. Barndorff-Nielsen, R. Kass, S. Lauritzen, and C. R. Rao; *Group Theory in Statistics* by P. Diaconis.

---

Prepaid orders for individual volumes and requests for standing order enrollment (eligible for 20% prepublication discounts from list prices) should be sent to

Institute of Mathematical Statistics  
3401 Investment Boulevard #7  
Hayward, California 94545 (USA)



**“When we read what their college will cost...we bought the maximum life insurance available in the IMS Members’ Insurance Program...”**

“...Oh, we expect to be there—proud as can be—when they enter college. But, just in case one of us isn’t...the insurance coverage will be.”

If a breadwinner is no longer around to provide for family shelter and the children’s college education...life insurance had better be.

Our group term life insurance can supplement your insurance portfolio so that your family has the protection it needs now—and for the future.

As a member, you can fill your insurance needs at low group rates. You can get family coverage, too. And if you change jobs, your group insurance automatically goes with you, so there’s no lapse in your insurance coverage.

Check *your* insurance portfolio. Will it meet your family’s future needs? If not, call or write the Administrator.

**UP TO \$240,000 IN  
TERM LIFE INSURANCE PROTECTION  
IS AVAILABLE TO IMS MEMBERS.**

**Contact Administrator,  
IMS Group Insurance Program**  
Smith-Sternau Organization, Inc  
1255 23rd Street, N.W.  
Washington, D.C. 20037  
**800 424-9883 Toll Free**  
in Washington, D.C. area. 202 296-8030

# Probability Theory and Related Fields

Continuation of  
Zeitschrift für Wahrscheinlichkeitstheorie

## Volume 72 Number 3 1986

- 319 **P.J. Fitzsimmons, B. Maisonneuve:** Excessive Measures and Markov Processes with Random Birth and Death
- 337 **D.C. Weiner:** A law of the Iterated Logarithm for Distributions in the Generalized Domain of Attraction of a Nondegenerate Gaussian Law
- 359 **F. Hofbauer:** Piecewise Invertible Dynamical Systems
- 387 **R.H. Schonmann, M.E. Vares:** The Survival of the Large Dimensional Basic Contact Process
- 395 **A.F. Karr, A.O. Pittenger:** Structural Properties of Randomized Times
- 417 **D. Bell:** On the Relationship Between Differentiability and Absolute Continuity of Measures on  $\mathbb{R}^n$
- 425 **M. Scheutzw:** Periodic Behavior of the Stochastic Brusselator in the Mean-Field Limit
- 463 **J.B. Mitro:** A Discontinuous Time Change for Natural Additive Functionals Which Preserves Duality
- 471 **S.J. Eigen:** A Counter-Example to Dye's Theorem for All Non-Separable Measure Algebras

## Volume 72 Number 4 1986 (Last issue of this volume)

- 477 **L. de Haan, J. Pickands III:** Stationary  $M_{\alpha,1}$ -Stable Stochastic Processes
- 493 **K.B. Erickson:** A Ratio Ergodic Theorem for Increasing Additive Functionals
- 505 **R.Y. Liu, J. Van Ryzin:** The Limiting Distribution of the Maximal Deviation of a Density Estimate and a Hazard Rate Estimate
- 517 **V. Losert, R.F. Tichy:** On Uniform Distribution of Subsequences
- 529 **D.B.H. Cline:** Convolution Tails, Product Tails and Domains of Attraction
- 559 **D.J. Aldous:** Self-Intersections of 1-Dimensional Random Walks
- 589 **H. Tsaknakis, D. Kazakos, P. Papantoni-Kazakos:** Robust Prediction and Interpolation for Vector Stationary Processes
- 603 **A. Krámlí, N. Simányi, D. Szász:** Random Walks with Internal Degrees of Freedom. III. Stationary Probabilities
- 619 **L. Carraro:** Problèmes de prediction pour le processus de Wiener a deux parametres

## Volume 73 Number 1 1986

- 1 **R. Wittmann:** Natural Densities of Markov Transition Probabilities
- 11 **G.J. Morrow, W. Philipp:** Invariance Principles for Partial Sum Processes and Empirical Processes Indexed by Sets
- 43 **Z. Sasvári:** Characterizing the Distributions of the Random Variables  $X_1, X_2, X_3$  by the Distribution of  $(X_1 - X_3, X_2 - X_3)$
- 51 **P.H. Baxendale:** Asymptotic Behaviour of Stochastic Flows of Diffeomorphisms: Two Case Studies
- 87 **T. Shiga, K. Uchiyama:** Stationary States and their Stability of the Stepping Stone Model Involving Mutation and Selection
- 119 **P. Imkeller:** A Note on the Localization of Two-Parameter Processes
- 127 **E.D. Andjel:** Convergence to a Non Extremal Equilibrium Measure in the Exclusion Process
- 135 **S. Weinryb:** Etude Asymptotique par des mesures de  $\mathbb{R}^3$  de saucisses de Wiener localisées
- 149 **A. Buja:** On the Huber-Strassen Theorem
- 153 **K.S. Chan, H. Tong:** A Note on Certain Integral Equations Associated with Non-linear Time Series Analysis

# Probability Theory and Related Fields

Continuation of  
Zeitschrift für Wahrscheinlichkeitstheorie

## Volume 73 Number 2 1986

- 159 **W.J.R. Eplitt:** Approximation Theory for the Simulation of Continuous Gaussian Processes
- 183 **K.D. Stroyan:** Previsible Sets for Hyperfinite Filtrations
- 197 **B.R. Clarke:** Nonsmooth Analysis and Fréchet Differentiability of  $M$ -Functionals
- 211 **M. Csörgö, P. Révész:** Mesure du Voisinage and Occupation Density
- 227 **T. Bojdecki, L.G. Gorostiza:** Langevin Equations for  $\mathcal{S}^p$ -Valued Gaussian Processes and Fluctuation Limits of Infinite Particle Systems
- 245 **J. Chen, B. Davis, H. Rubin:** How Non-Uniform Can a Uniform Sample Be: a Histogram Approach
- 255 **D. Nualart, M. Zakai:** Generalized Stochastic Integrals and the Malliavin Calculus
- 281 **T. Norberg:** Random Capacities and Their Distributions
- 299 **L.V. Rozovsky:** Asymptotic Expansions for Probabilities of Large Deviations

## Volume 73 Number 3 1986

- 319 **T.S. Salisbury:** On the Itô Excursion Process
- 351 **T.S. Salisbury:** Construction of Right Processes from Excursions
- 369 **H. Kesten:** The Incipient Infinite Cluster in Two-Dimensional Percolation
- 395 **I. Berkes, E. Péter:** Exchangeable Random Variables and the Subsequence Principle
- 415 **R.K. Gettoor, J. Steffens:** Capacity Theory Without Duality
- 447 **R.Z. Hasminskii, I.A. Ibragimov:** Asymptotically Efficient Nonparametric Estimation of Functionals of a Spectral Density Function
- 463 **R. Berthuet:** Étude de processus généralisant l'Aire de Lévy

## Volume 73 Number 4 1986 (Last issue of this volume)

- 481 **M. Bramson:** Location of the Travelling Wave for the Kolmogorov Equation
- 517 **B.R. Ebanks:** Measures of Inset Information on Open Domains-II: Additive Inset Entropies with Measurable Sum Property
- 529 **A.L. Rukhin:** Adaptive Tests in Statistical Problems with Finite Nuisance Parameter
- 539 **Z.D. Bai:** Limiting Properties of Large System of Random Linear Equations
- 555 **Z.D. Bai, Y.Q. Yin:** Limiting Behavior of the Norm of Products of Random Matrices and Two Problems of Geman-Hwang
- 571 **S. Portnoy:** On the Central Limit Theorem in  $R^p$  when  $p \rightarrow \infty$
- 585 **E.V. Khmaladze, A.M. Parjanadze:** Functional Limit Theorems for Linear Statistics from Sequential Ranks
- 597 **Y. Higuchi:** A Percolation Problem for  $\{\pm 1\}$ -Valued Strongly Mixing Random Fields on  $\mathbb{Z}^d$
- 613 **M. Bramson, J.T. Cox, D. Griffeath:** Consolidation Rates for two Interacting Systems in the Plane
- 627 **N.E. Heckman:** Repeated Significance Tests with Biased Coin Allocation Schemes

# STATISTICAL SCIENCE

a review journal of the institute of mathematical statistics

EXECUTIVE EDITOR: **Morris H. DeGroot**, *Carnegie-Mellon University*

EDITORS: **David R. Brillinger**, *University of California, Berkeley*

**J. A. Hartigan**, *Yale University*

**Ingram Olkin**, *Stanford University*

IMS continues publication of *Statistical Science*, its successful quarterly review journal in statistics and probability, in 1987. *Statistical Science* presents the full range of contemporary statistical thought at a modest technical level accessible to the broad community of practitioners, teachers, researchers, and students in statistics and probability. *Statistical Science* has been enthusiastically received by the statistical and probabilistic community.

"...a joy to read...clear and insightful."

Peter Enis, *Buffalo*

"...beautiful...an attractive and exciting product."

Judith Tanur, *Stony Brook*

"...most refreshing...I enjoyed page after page."

Frederick Mosteller, *Harvard*

"...a welcome draught of fresh air."

Samuel Kotz, *Maryland*

"...very attractive...extremely interesting."

Peter Armitage, *Oxford*

"...a great success."

I. Richard Savage, *Yale*

"*Statistical Science* is a gem."

Jonas H. Ellenberg, *National Institutes of Health*

"...marvelous...a wonderful service!"

Michael D. Perlman, *Washington*

"...read from cover to cover, and I enjoyed every bit of it."

Robert F. Ling, *Clemson*

"...an enormous delight!"

Edward R. Tufte, *Yale*

## Featuring in Volume 1 (1986)

Articles by Freedman & Navidi on "Models for Adjusting the Census"; Efron & Tibshirani on "The Bootstrap"; Le Cam on "The Central Limit Theorem Around 1935"; Geisser on "The Collected Works of George E. P. Box"; Genest & Zidek on "Combining Probability Distributions"; Good on "Statistical Applications of Poisson's Work"; Bookstein on "Morphometrics"; Thisted on "Computing Environments"; Lai & Siegmund on "The Contributions of Herbert Robbins"; Hastie & Tibshirani on "Generalized Additive Models"; Fishburn on "The Axioms of Subjective Probability"; Stigler on "Laplace's Memoir on Inverse Probability"; Chatterjee & Hadi on "Influential Observations"; Shafer on "Savage Revisited"; Wegman on "Harald Cramér's Personal Recollections"; O'Sullivan on "Ill-Posed Inverse Problems". *Conversations* with T. W. Anderson, D. Blackwell, P. Diaconis, E. L. Lehmann, and C. Stein.

*Statistical Science* is included as a privilege of membership in the Institute (\$30 for individuals). Nonmember subscriptions are available to individuals (\$25) and organizations (\$40). All subscriptions to *The Annals of Statistics* and *The Annals of Probability* include a subscription to *Statistical Science* in 1987. For additional information on how to receive *Statistical Science*, please write to the IMS Business Office, 3401 Investment Boulevard #7, Hayward, California 94545 (USA).

# The Annals of Probability

Vol. 15

April 1987

No. 2

## Special Invited Paper

- Critical phenomena and universal exponents in statistical physics.  
On Dyson's hierarchical model . . . . . P. M. BLEHER AND P. MAJOR

## Articles

- Gradient dynamics of infinite point systems . . . . . J. FRITZ  
The infinitely-many-sites model as a measure-valued diffusion  
S. N. ETHIER AND R. C. GRIFFITHS  
Hydrodynamical limit for the asymmetric simple exclusion process  
ALBERT BENASSI AND JEAN-PIERRE FOUQUE  
Markov additive processes I. Eigenvalue properties and limit theorems  
P. NEY AND E. NUMMELIN  
Markov additive processes II. Large deviations . . . . . P. NEY AND E. NUMMELIN  
Large deviations for processes with independent increments  
JAMES LYNCH AND JAYARAM SETHURAMAN  
Limit theorems in the area of large deviations for some dependent random  
variables . . . . . NARASINGA RAO CHAGANTY AND JAYARAM SETHURAMAN  
A large deviations principle for small perturbations of random evolution  
equations . . . . . CAROL BEZUIDENHOUT  
Joint continuity of the intersection local times of Markov processes . . . . . JAY ROSEN  
Brownian excursions and minimal thinness. I . . . . . KRZYSZTOF BURDZY  
Recurrence and invariant measures for degenerate diffusions . . . . . WOLFGANG KLIEMANN  
An ideal metric and the rate of convergence to a self-similar process  
MAKOTO MAEJIMA AND SVETLOZAR T. RACHEV  
A ratio limit theorem for the tails of weighted sums . . . . . HOLGER ROOTZÉN  
Asymptotic expansions in the Poisson limit theorem . . . . . A. D. BARBOUR  
Noncentral limit theorems and Appell polynomials  
FLORIN AVRAM AND MURAD S. TAQQU  
Nonuniform estimates in the conditional central limit theorem  
DIETER LANDERS AND LOTHAR ROGGE  
Continuous lower probability-based models for stationary processes with bounded  
and divergent time averages . . . . . YVES L. GRIZE AND TERRENCE L. FINE  
Partitioning general probability measures . . . . . THEODORE P. HILL  
A second-order asymptotic distributional representation of  $M$ -estimators with  
discontinuous score functions . . . . . JANA JUREČKOVÁ AND PRANAB KUMAR SEN  
A unified approach to a class of optimal selection problems with an unknown  
number of options . . . . . F. THOMAS BRUSS AND STEPHEN M. SAMUELS  
On the existence of the ergodic Hilbert transform . . . . . R. JAJTE

*contents (continued)*

An alternative regularity condition for Hájek's representation theorem . . .	LUKE TIERNEY	427
Minimax estimation of the mean of a general distribution when the parameter space is restricted . . . . .	AVRAHAM A. MELKMAN AND YA'ACOV RITOV	432
The penalty for assuming that a monotone regression is linear DAVID FAIRLEY, DENNIS K. PEARL AND JOSEPH S. VERDUCCI		443
Extended-Paulson sequential selection . . . . .	DON EDWARDS	449
Is the selected population the best? . . . . .	SAM GUTMANN AND ZAKHAR MAYMIN	456
A characterization of the Fieller solution . . . . .	MARTIN A. KOSCHAT	462

**Corrections**

Order restricted statistical tests on multinomial and Poisson parameters: The starshaped restriction . . . . .	RICHARD L. DYKSTRA AND TIM ROBERTSON	469
Bootstrap tests and confidence regions for functions of a covariance matrix RUDOLF BERAN AND MUNI S. SRIVASTAVA		470