

THE ANNALS
of
STATISTICS

AN OFFICIAL JOURNAL OF THE INSTITUTE OF
MATHEMATICAL STATISTICS

VOLUME 3

1975

CONTENTS OF VOLUME 3

ARTICLES AND SHORT COMMUNICATIONS

ADENSTEDT, ROLF K. Asymptotically efficient estimators for a constant regression with vector-valued stationary residuals	1109-1121
ADICHIE, J. N. On the use of ranks for testing the coincidence of several regression lines	521-527
AFSARINEJAD, K. AND HEDAYAT, A. Some contributions to the theory of multistage Youden design	707-711
AKAHIRA, MASAFUMI AND TAKEUCHI, KEI. Characterizations of prediction sufficiency (adequacy) in terms of risk functions	1018-1024
ANDERSON, T. W. Maximum likelihood estimation of parameters of autoregressive processes with moving average residuals and other covariance matrices with linear structure	1283-1304
ANDERSSON, STEEN. Invariant normal models	132-154
ARNOLD, BARRY C. AND MEEDEN, GLEN. Characterization of distributions by sets of moments of order statistics	754-758
ARVESEN, JAMES N. AND LAYARD, MAXWELL W. J. Asymptotically robust tests in unbalanced variance component models	1122-1134
BAI, DO SUN. Efficient estimation of transition probabilities in a Markov chain	1305-1317
BANCROFT, T. A., HAN, CHIEN-PAI AND MEAD, RONALD. Power of analysis of variance test procedures for incompletely specified models	797-808
BEHNEN, K. AND NEUHAUS, G. A central limit theorem under contiguous alternatives	1349-1353
BERAN, RUDOLF. Local asymptotic power of quadratic rank tests for trend	401-412
BERAN, RUDOLF. Tail probabilities of noncentral quadratic forms	969-974
BERGER, JAMES. Minimax estimation of location vectors for a wide class of densities	1318-1328
BERK, ROBERT H. Comparing sequential and nonsequential tests	991-998
BERK, ROBERT H. Locally most powerful sequential tests	373-381
BICKEL, P. J. AND LEHMANN, E. L. Descriptive statistics for nonparametric models.	
I. Introduction	1038-1044
II. Location	1045-1069
BOCK, M. E. Minimax estimators of the mean of a multivariate normal distribution	209-218
BONDESSON, LENNART. Uniformly minimum variance estimation in location parameter families	637-660
BROWN, L. On a theorem of Morimoto concerning sufficiency for discrete distributions	1180-1182

CAINES, P. E. A note on the consistency of maximum likelihood estimates for finite families of stochastic processes.....	539-546
CAUSEY, B. Upper confidence and fiducial limits to the range of several means.....	473-477
CHIKUSE, Y. AND MUIRHEAD, R. J. Asymptotic expansions for the joint and marginal distributions of the latent roots of the covariance matrix.....	1011-1017
COBB, E. BENTON. A note on sampling with replacement.....	500-503
COBERLY, W. A., LEWIS, T. O. AND GRAY, H. L. On Edgeworth expansions with unknown cumulants.....	741-746
COHEN, ARTHUR AND SACKROWITZ, H. B. Unbiasedness of the chi-square, likelihood ratio, and other goodness of fit tests for the equal cell case.....	959-964
COVER, THOMAS M. AND HIRSCHLER, PATRICK. A finite memory test of the irrationality of the parameter of a coin.....	939-946
CRAIN, BRADFORD R. AND MORGAN, RONNIE L. Asymptotic normality of the posterior distribution for exponential models.....	223-227
DAVIS, KATHRYN BULLOCK. Mean square error properties of density estimates.....	1025-1030
DE MONTRICHER, G. F., TAPIA, R. A., AND THOMPSON, J. R. Nonparametric maximum likelihood estimation of probability densities by penalty function methods.....	1329-1348
DION, JEAN-PIERRE. Estimation of the variance of a branching process.....	1183-1187
EFRON, BRADLEY. Defining the curvature of a statistical problem (with applications to second order efficiency). Discussion by D. R. Cox, A. P. Dawid, J. K. Ghosh, N. Keiding, L. Le Cam, D. V. Lindley, J. Pfanzagl, D. A. Pierce, C. R. Rao, J. Reeds.....	1189-1242
FEDER, PAUL I. The log likelihood ratio in segmented regression.....	84-97
FEDER, PAUL I. On asymptotic distribution theory in segmented regression problems—identified case.....	49-83
FEDERER, W. T. AND HEDAYAT, A. On the nonexistence of Knut Vik designs for all even orders.....	445-447
FEDERER, W. T. and RAGHAVARAO, D. On connectedness in two-way elimination of heterogeneity designs.....	730-735
FISHBURN, PETER C. Unbounded expected utility.....	884-896
FLUECK, JOHN A. AND KORSH, JAMES F. A generalized approach to maximum likelihood paired comparison ranking.....	846-861
FRASER, D. A. S. AND MACKAY, JOCK. Parameter, factorization and inference based on significance, likelihood, and objective posterior.....	559-572
FU, JAMES C. The rate of convergence of consistent point estimators..	234-240
GASTWIRTH, JOSEPH L. AND RUBIN, HERMAN. The asymptotic distribution theory of the empiric cdf for mixing processes.....	809-824
GASTWIRTH, JOSEPH L. AND RUBIN, HERMAN. The behavior of robust estimators on dependent data.....	1070-1100

GINÉ M., EVARIST. Invariant tests for uniformity on compact Riemannian manifolds based on Sobolev norms	1243-1266
GOEL, PREM K. On re-pairing observations in a broken random sample	1364-1369
GOLDSTEIN, M. Approximate Bayes solutions to some nonparametric problems	512-517
GOLDSTEIN, MICHAEL. A note on some Bayesian nonparametric estimates	736-740
GOOD, I. J. The Bayes factor against equiprobability of a multinomial population assuming a symmetric Dirichlet prior	246-250
GRAY, H. L., COBERLY, W. A., AND LEWIS, T. O. On Edgeworth expansions with unknown cumulants	741-746
GUSEMAN, L. F., JR., PETERS, B. CHARLES, JR. AND WALKER, HOMER F. On minimizing the probability of misclassification for linear feature selection	661-668
HABERMAN, SHELBY J. Direct products and linear models for complete factorial tables	314-333
HABERMAN, SHELBY J. How much do Gauss-Markov and least squares estimates differ? A coordinate-free approach	982-990
HAMADA, NOBORU AND TAMARI, FUMIKAZU. Duals of BIB block designs from an affine geometry	926-938
HAN, CHIEN-PAI, MEAD, RONALD, AND BANCROFT, T. A. Power of analysis of variance test procedures for incompletely specified fixed models	797-808
HANNAN, E. J. The estimation of ARMA models	975-981
HARTIGAN, J. A. Necessary and sufficient conditions for asymptotic joint normality of a statistic and its subsample values	573-580
HASMINSKII, R. Z. AND IBRAGIMOV, I. A. On a lower bound for moments of point estimators	228-233
HEDAYAT, A. AND AFSARINEJAD, K. Some contributions to the theory of multistage Youden design	707-711
HEDAYAT, A. AND FEDERER, W. T. On the nonexistence of Knut Vik designs for all even orders	445-447
HEDAYAT, A., RAGHAVARAO, D. AND SEIDEN, E. Further contributions to the theory of F -squares design	712-716
HILL, BRUCE M. A simple general approach to inference about the tail of a distribution	1163-1174
HIPP, C. Note on the paper "Transformation groups and sufficient statistics" by J. Pfanzagl	478-482
HIRSCHLER, PATRICK AND COVER, THOMAS M. A finite memory test of the irrationality of the parameter of a coin	939-946
HOKE, ALBERT T. The characteristic polynomial of the information matrix for second-order models	780-786
HORDIJK, ARIE AND TIJMS, HENK. A modified form of the iterative method of undiscounted dynamic programming	203-208

HORN, SUSAN D. On the optimality criterion in compound decision problems	767-772
HOYLE, M. H. Estimating generating functions	1361-1363
HWANG, T. Y. AND KLOTZ, J. H. Bahadur efficiency of linear rank statistics for scale alternatives	947-954
IBRAGIMOV, I. A. AND HASMINSKII, R. Z. On a lower bound for moments of point estimators	228-233
JAQUETTE, STRATTON C. Markov decision processes with a new optimality criterion: Continuous time	547-553
JENSEN, D. R. AND MAYER, L. S. Normal-theory approximations to tests for linear hypotheses	429-444
JOHN, PETER W. M. Isomorphic $L_2(7)$ designs	728-729
JOHNSON, BRUCE MCK. Bounds on the variance of the U -statistics for symmetric distributions with shift alternatives	955-958
JOSHI, V. M. A conjecture of Berry regarding a Bernoulli two-armed bandit	189-202
JOSHI, V. M. On the minimax estimation of a random probability with known first N moments	680-687
JOSHI, V. M. Strong admissibility of a set of confidence intervals for the mean of a finite population	483-488
KEIDING, NIELS. Maximum likelihood estimation in the birth-and-death process	363-372
KIEFER, J. Balanced block designs and generalized Youden designs, I. Construction (patchwork)	109-118
KIMELDORF, GEORGE AND SMITH, FURMAN. Discrete sequential search for one of many objects	906-915
KLEYLE, ROBERT. Upper and lower posterior probabilities for discrete distributions	504-511
KLOTZ, J. H. AND HWANG, T. Y. Bahadur efficiency of linear rank statistics for scale alternatives	947-954
KORSH, JAMES F. AND FLUECK, JOHN A. A generalized approach to maximum likelihood paired comparison ranking	846-861
LAI, TZE LEUNG. A note on first exit times with applications to sequential analysis	999-1005
LAI, TZE LEUNG. On Chernoff-Savage statistics and sequential rank tests	825-845
LAI, TZE LEUNG. Termination, moments and exponential boundedness of the stopping rule for certain invariant sequential probability ratio tests	581-598
LAWRENCE, M. J. Inequalities of s -ordered distributions	413-428
LAYARD, MAXWELL W. J. AND ARVESEN, JAMES N. Asymptotically robust tests in unbalanced variance component models	1122-1134
LEHMANN, E. L. AND BICKEL, P. J. Descriptive statistics for nonparametric models.	

I. Introduction	1038-1044
II. Location	1045-1069
LEWIS, T. O., GRAY, H. L. AND COBERLY, W. A. On Edgeworth expansions with unknown cumulants	741-746
LIN, PI-ERH. Rates of convergence in empirical Bayes estimation problems: Continuous case	155-164
LITTELL, RAMON C., RAO, P. V. AND SCHUSTER, EUGENE F. Estimation of shift and center of symmetry based on Kolmogorov-Smirnov statistics	862-873
MACKAY, JOCK AND FRASER, D. A. S. Parameter, factorization and inference based on significance, likelihood and objective posterior	559-572
MAURER, WILLI. On most effective tournament plans with fewer games than competitors	717-727
MAYER, L. S. AND JENSEN, D. R. Normal-theory approximations to tests for linear hypotheses	429-444
MCDONALD, LYMAN. Tests for the general linear hypothesis under the multiple design multivariate linear model	461-466
MEAD, RONALD, BANCROFT, T. A. AND HAN, CHIEN-PAI. Power of analysis of variance test procedures for incompletely specified fixed models	797-808
MEEDEN, GLEN AND ARNOLD, BARRY C. Characterization of distributions by sets of moments of order statistics	754-758
MEHRA, K. L. AND RAO, M. SUDHAKARA. On functions of order statistics for mixing processes	874-883
MEHRAN, FARHAD. Relationships between the UMVU estimators of the mean and median of a function of a normal distribution	457-460
MOORE, DAVID S. AND SPRUILL, M. C. Unified large-sample theory of general chi-squared statistics for tests of fit	599-616
MORGAN, RONNIE L. AND CRAIN, BRADFORD R. Asymptotic normality of the posterior distribution for exponential models	223-227
MORRIS, CARL. Central limit theorems for multinomial sums	165-188
MOST, BERNARD M. Resistance of balanced incomplete block designs	1149-1162
MUIRHEAD, R. J. AND CHIKUSE, Y. Asymptotic expansions for the joint and marginal distributions of the latent roots of the covariance matrix	1011-1017
NEUHAUS, GEORG. Convergence of the reduced empirical process for non-i.i.d. random vectors	528-531
NEUHAUS, G. AND BEHNEN, K. A central limit theorem under contiguous alternatives	1349-1353
ODÉN, ANDERS AND WEDEL, HANS. Arguments for Fisher's permutation test	518-520
O'REILLY, FEDERICO J. On a criterion for extrapolation in normal regression	219-222

PARANJAPE, S. R. AND RUBIN, HERMAN. Special case of the distribution of the median	251-256
PERLMAN, MICHAEL D. AND WICHURA, MICHAEL J. A note on substitution in conditional distribution	1175-1179
PETERS, B. CHARLES, JR., WALKER, HOMER F. AND GUSEMAN, L. F., JR. On minimizing the probability of misclassification for linear feature selection	661-668
PICKANDS, JAMES III. Statistical inference using extreme order statistics	119-131
PIERCE, DAVID A. Noninvertible transfer functions and their forecasts	1354-1360
PILLAI, K. C. S. The distribution of the characteristic roots of $S_1 S_2^{-1}$ under violations	773-779
PILLAI, K. C. S. AND SUDJANA. Exact robustness studies of tests of two multivariate hypotheses based on four criteria and their distribution problems under violations	617-636
POLLAK, M. AND SIEGMUND, D. Approximations to the expected sample size of certain sequential tests	1267-1282
PORTNOY, STEPHEN L. Admissibility of the best invariant estimator of one coordinate of a location vector	448-450
RAGHAVARAO, D. AND FEDERER, W. T. On connectedness in two-way elimination of heterogeneity designs	730-735
RAGHAVARAO, D., SEIDEN, E. AND HEDAYAT, A. Further contributions to the theory of F -squares design	712-716
RAMAKRISHNAN, M. K. Choice of an optimum sampling strategy—I	669-679
RAO, J. S. AND SETHURAMAN, J. Weak convergence of empirical distribution functions of random variables subject to perturbations and scale factors	299-313
RAO, M. SUDHAKARA AND MEHRA, K. L. On functions of order statistics for mixing processes	874-883
RAO, P. V., SCHUSTER, EUGENE F. AND LITTELL, RAMON C. Estimation of shift and center of symmetry based on Kolmogorov-Smirnov statistics	862-873
RECHTSCHAFFEN, R. Weak convergence of the empiric processes for independent random variables	787-792
REYNOLDS, MARION R., JR. A sequential signed-rank test for symmetry	382-400
ROBERTSON, TIM AND WRIGHT, F. T. Consistency in generalized isotonic regression	350-362
ROBINSON, P. M. Continuous time regressions with discrete data	688-697
ROSENBLATT, M. A quadratic measure of deviation of two-dimensional density estimates and a test of independence	1-14
ROSS, SHELDON M. A note on optimal stopping for success runs	793-795
RUBIN, HERMAN AND GASTWIRTH, JOSEPH L. The asymptotic distribution theory of the empiric cdf for mixing processes	809-824

RUBIN, HERMAN AND GASTWIRTH, JOSEPH L. The behavior of robust estimators on dependent data.....	1070-1100
RUBIN, HERMAN AND PARANJPE, S. R. Special case of the distribution of the median.....	251-256
RUYMGAART, F. H. A note on chi-square statistics with random cell boundaries.....	965-968
SACKROWITZ, H. B. AND COHEN, ARTHUR. Unbiasedness of the chi-square, likelihood ratio, and other goodness of fit tests for the equal cell case.....	959-964
SACKS, JEROME. An asymptotically efficient sequence of estimators of a location parameter.....	285-298
SAGER, THOMAS W. Consistency in nonparametric estimation of the mode.....	698-706
SAMPSON, ALLAN R. Characterizing exponential family distributions by moment generating functions.....	747-753
SANTNER, THOMAS J. A restricted subset selection approach to ranking and selection problems.....	334-349
SCHUSTER, EUGENE F., LITTELL, RAMON C. AND RAO, P. V. Estimation of shift and center of symmetry based on Kolmogorov-Smirnov statistics.....	862-873
SCHWALLER, RICHARD L. AND TIAHRT, KENNETH J. A method of constrained randomization for $p_1^{n_1} p_2^{n_2} \cdots p_k^{n_k}$ factorials.....	1135-1148
SCOTT, A. J. On admissibility and uniform admissibility in finite population sampling.....	489-491
SEIDEN, E., HEDAYAT, A. AND RAGHAVARAO, D. Further contributions to the theory of F -squares design.....	712-716
SEKKAPPAN, RM. AND THOMPSON, M. E. On a class of uniformly admissible estimators for finite populations.....	492-499
SEN, ASHISH AND SRIVASTAVA, MUNI S. On tests for detecting change in mean.....	98-108
SENGUPTA, SAILES K. Lower semicontinuous stochastic games with imperfect information.....	554-558
SETHURAMAN, J. AND RAO, J. S. Weak convergence of empirical distribution functions of random variables subject to perturbations and scale factors.....	299-313
SHAMAN, PAUL. An approximate inverse for the covariance matrix of moving average and autoregressive processes.....	532-538
SHIRAHATA, SHINGO. Locally most powerful rank tests for independence with censored data.....	241-245
SIEGMUND, D. AND POLLAK, M. Approximations to the expected sample size of certain sequential tests.....	1267-1282
SIEVERS, GERALD L. Multivariate probabilities of large deviations....	897-905
SPRUILL, M. C. AND MOORE, DAVID S. Unified large-sample theory of general chi-squared statistics for tests of fit.....	599-616

SMITH, FURMAN AND KIMELDORF, GEORGE. Discrete sequential search for one of many objects	906-915
SRIVASTAVA, MUNI S. AND SEN, ASHISH. On tests for detecting change in mean	98-108
STONE, CHARLES J. Adaptive maximum likelihood estimators of a location parameter	267-284
SUBRAHMANIAM, KOCHERLAKOTA. On the asymptotic distributions of some statistics used for testing $\Sigma_1 = \Sigma_2$	916-925
SUDJANA AND PILLAI, K. J. S. Exact robustness studies of tests of two multivariate hypotheses based on four criteria and their distribution problems under violations	617-636
TAKEUCHI, KEI AND AKAHIRA, MASAFUMI. Characterizations of prediction sufficiency (adequacy) in terms of risk functions	1018-1024
TAMARI, FUMIKAZU AND HAMADA, NOBORU. Duals of BIB block designs derived from an affine geometry	926-938
TAPIA, R. A., THOMPSON, J. R. AND DE MONTRICHER, G. F. Nonparametric maximum likelihood estimation of probability densities by penalty function methods	1329-1348
THOMSEN, IB. Testing hypotheses in unbalanced variance components models for two-way layouts	257-265
THOMPSON, J. R., DE MONTRICHER, G. F. AND TAPIA, R. A. Nonparametric maximum likelihood estimation of probability densities by penalty function methods	1329-1348
THOMPSON, M. E. AND SEKKAPPAN, RM. On a class of uniformly admissible estimators for finite populations	492-499
TIAHRT, KENNETH J. AND SCHWALLER, RICHARD L. A method of constrained randomization for $p_1^{n_1} p_2^{n_2} \cdots p_k^{n_k}$ factorials	1135-1148
TIJMS, HENK and HORDIJK, ARIE. A modified form of the iterative method of undiscounted dynamic programming	203-208
TRETTER, MARIETTA J. AND WALSTER, G. WILLIAM. Central and non-central distributions of Wilks' statistic in MANOVA as mixtures of incomplete beta functions	467-472
WAHBA, GRACE. Interpolating spline methods for density estimation. I. Equi-spaced knots	30-48
WAHBA, GRACE. Optimal convergence properties of variable knot, kernel, and orthogonal series methods for density estimation	15-29
WALKER, HOMER F., GUSEMAN, L. F., JR. AND PETERS, B. CHARLES, JR. On minimizing the probability of misclassification for linear feature selection	661-668
WALSTER, G. WILLIAM AND TRETTER, MARIETTA J. Central and non-central distributions of Wilks' statistic in MANOVA as mixtures of incomplete beta functions	467-472
WEDEL, HANS AND ODÉN, ANDERS. Arguments for Fisher's permutation test	518-520

WICHURA, MICHAEL J. AND PERLMAN, MICHAEL D. A note on substitution in conditional distribution	1175-1179
WIJSMAN, R. A. Exponentially bounded stopping time of the sequential t -test	1006-1010
WINTER, B. B. Rate of strong consistency of two nonparametric density estimators	759-766
WITHERS, C. S. Convergence of empirical processes of mixing rv's on $[0, 1]$	1101-1108
WRIGHT, F. T. AND ROBERTSON, TIM. Consistency in generalized isotonic regression	350-362
ZEHNWIRTH, BENJAMIN. Minimax interval estimators of location parameters	451-456

NOTES

BICKEL, P. J. AND ROSENBLATT, M. Corrections to "On some global measures of the deviations of density function estimates"	1370
CAUSEY, B. Correction to "Upper confidence and fiducial limits to the range of several means"	1188
HASEGAWA, MINORU AND PERLMAN, MICHAEL D. Correction to "On the existence of a minimal sufficient subfield"	1371-1372
PERLMAN, MICHAEL D. AND HASEGAWA, MINORU. Correction to "On the existence of a minimal sufficient subfield"	1371-1372
PIRIE, WALTER R. Correction to "Comparing rank tests for ordered alternatives in randomized blocks"	796
ROSENBLATT, M. AND BICKEL, P. J. Corrections to "On some global measures of the deviations of density function estimates"	1370
WIJSMAN, ROBERT A. Correction to "A monotonicity property of the sequential probability ratio test"	796

OBITUARY

DUPAČ, VÁCLAV. Jaroslav Hájek, 1926-1974	1031-1037
--	-----------