PROCEEDINGS

OF THE

AMERICAN MATHEMATICAL SOCIETY

EDITED BY

FRED G. BRAUER
GLEN E. BREDON
W. WISTAR COMFORT
JACOB FELDMAN
JOSEPH J. ROTMAN
LEE A. RUBEL
GEORGE B. SELIGMAN

WITH THE COOPERATION OF

JAMES D. KUELBS
ALLEN L. SHIELDS
ROBERT I. SOARE

Coden: PAMYAR
VOLUME 32
NUMBER 2
PAGES 333–647
APRIL 1972
WHOLE No. 154

Published by the
AMERICAN MATHEMATICAL SOCIETY
PROVIDENCE, RHODE ISLAND

Proceedings of the American Mathematical Society

THIS JOURNAL is devoted entirely to research in pure and applied mathematics, and the publication of original papers of moderate length. The maximum length of an acceptable paper is about 8 printed pages. Since a page of the PROCEEDINGS contains about 400 words, a rule of thumb is that under 10 typed pages is probably within the limit, but that over 12 typed pages is probably too long.

SHORTER NOTES. Very short notes not to exceed 1 printed page of an unusual nature are also accepted, and appear under the heading SHORTER NOTES. Items deemed suitable include an elegant new proof of an important and well-known theorem, an illuminating example or counterexample, or a new viewpoint on familiar results. New results, if of a brief and striking character, might also be acceptable, though in general a paper which is merely very short will not be suitable for the SHORTER NOTES department.

PREPARATION OF THE MANUSCRIPT. Articles for insertion should be typewritten and double spaced. Ditto is not generally satisfactory, although other modes of multiple reproduction may be. The *Manual for Authors*, available from the Society, should be consulted for symbols and style conventions. Authors should take the greatest possible care in preparing the original manuscript. Hand drawn symbols are satisfactory, if clearly done; directions to the printer should be included where necessary on a separate sheet, not in the accompanying letter. Authors must keep a complete copy of their manuscript, and editors will acknowledge receipt; manuscripts can therefore be sent by ordinary mail and any other kind (registered, certified) is entirely unnecessary. Submission of two copies of the manuscript is helpful, but by no means necessary.

FORM OF MANUSCRIPT. The first page should consist of a *descriptive title*, followed by an *abstract* which summarizes the article in language suitable for workers in the general field (algebra, analysis, etc.). The *descriptive title* should be short, but informative; useless or vague phrases such as "some remarks about" or "concerning" should be avoided. Also avoid proper names unless mathematical usage associates them with the work. The *abstract* should be at least one complete sentence, and at most 150 words. Included with the footnotes to your paper, but placed before the first footnote, there should be first the AMS (MOS) *subject classification numbers* representing the primary and secondary subjects of the article. This may be followed by a list of *key words and phrases* describing the subject matter of the article and taken from it. The AMS (MOS) Subject Classification Scheme (1970) with instructions for its use can be found as an appendix to Mathematical Reviews, Index to Volume 39 (June 1970). See the June 1970 Notices for more details, as well as illustrative examples.

SUBMISSION OF MANUSCRIPTS, REPRINTS AND ADDRESS CHANGES. See the last page of this issue.

SUBSCRIPTION INFORMATION. Five volumes are planned for 1972; the subscription price is $100. Back number prices are as follows: Volumes 1–16, $14 per volume; Volumes 17–19, $18 per volume; Volumes 20–26, $30 per volume; Volumes 27–32, $27 per volume.

THE PROCEEDINGS OF THE AMERICAN MATHEMATICAL SOCIETY is published monthly. Subscriptions, orders for back numbers and inquiries in regard to nondelivery of current numbers should be addressed to the American Mathematical Society, P.O. Box 6248, Providence, R.I. 02904.
Second-class postage paid at Providence, Rhode Island, and additional mailing offices.

Copyright © American Mathematical Society 1972
Printed in the United States of America

AMS (MOS) MAJOR SUBJECT HEADINGS (1970)

The letters in parentheses indicate groupings which are used in the table of contents of each issue and in the volume index.

00 (H) General
01 (H) History and Biography
02 (E) Logic and Foundations
04 (E) Set Theory
05 (A) Combinatorics
06 (A) Order, Lattices, Ordered Algebraic Structures
08 (A) General Mathematical Systems
10 (A) Number Theory
12 (A) Algebraic Number Theory, Field Theory and Polynomials
13 (A) Commutative Rings and Algebras
14 (A) Algebraic Geometry
15 (A) Linear and Multilinear Algebra, Matrix Theory (finite and infinite)
16 (A) Associative Rings and Algebras
17 (A) Nonassociative Rings and Algebras
18 (A) Category Theory, Homological Algebra
20 (A) Group Theory and Generalizations
22 (G) Topological Groups, Lie Groups
26 (B) Real Functions
28 (B) Measure and Integration
30 (B) Functions of a Complex Variable
31 (B) Potential Theory
32 (B) Several Complex Variables and Analytic Spaces
33 (B) Special Functions
34 (B) Ordinary Differential Equations
35 (B) Partial Differential Equations
39 (B) Finite Differences and Functional Equations
40 (B) Sequences, Series, Summability
41 (B) Approximations and Expansions
42 (B) Fourier Analysis
43 (B) Abstract Harmonic Analysis
44 (B) Integral Transforms, Operational Calculus
45 (B) Integral Equations
46 (B) Functional Analysis
47 (B) Operator Theory
49 (B) Calculus of Variations and Optimal Control
50 (D) Geometry
52 (D) Convex Sets and Geometric Inequalities
53 (D) Differential Geometry
54 (G) General Topology
55 (G) Algebraic Topology
57 (G) Manifolds and Cell Complexes
58 (G) Global Analysis, Analysis on Manifolds
60 (F) Probability Theory and Stochastic Processes
62 (F) Statistics
65 (C) Numerical Analysis
68 (C) Computer Science
70 (C) Mechanics of Particles and Systems
73 (C) Mechanics of Solids
76 (C) Fluid Mechanics
78 (C) Optics, Electromagnetic Theory
80 (C) Classical Thermodynamics, Heat Transfer
81 (C) Quantum Mechanics
82 (C) Statistical Physics, Structure of Matter
83 (C) Relativity
85 (C) Astronomy and Astrophysics
86 (C) Geophysics
90 (C) Economics, Operations Research, Programming, Games
92 (C) Biology and Behavioral Sciences
93 (C) Systems, Control
94 (C) Information and Communication, Circuits, Automata
96 (H) Mathematical Education, Elementary
97 (H) Mathematical Education, Secondary
98 (H) Mathematical Education, Collegiate

INDEX TO VOLUME 32

SUBJECT INDEX

*Starred items are "Shorter Notes"

A. Algebra and Number Theory

05. Combinatorics

Carlitz, L. and Subbarao, M. V. *A simple proof of the quintuple product identity*, 42.

Chartrand, Gary, Kaugars, Agnis and Lick, Don R. *Critically n-connected graphs*, 63.

Chvátal, Václav and Harary, Frank. *Generalized Ramsey theory for graphs. II. Small diagonal numbers*, 389.

Doyen, Jean. *Constructions of disjoint Steiner triple systems*, 409.

Spence, Edward. *Hadamard designs*, 29.

06. Order, Lattices, Ordered Algebraic Structures

Bernau, S. J. *The Boolean ring generated by a distributive lattice*, 423.

08. General Mathematical Systems

Davis, Robert C. *Multivalued operations and universal coalgebra*, 385.

Iskander, A. A. *On subalgebra lattices of universal algebras*, 32.

10. Number Theory

Berndt, Bruce C. *Two new proofs of Lerch's functional equation*, 403.

Hagis, Peter, Jr. and McDaniel, Wayne L. *A new result concerning the structure of odd perfect numbers*, 13.

Williams, Kenneth S. *Representation of a binary quadratic form as a sum of two squares*, 368.

12. Algebraic Number Theory, Field Theory and Polynomials

Lando, Barbara A. *Jacobi's bound for first order difference equations*, 8.

Mordeson, J. N. and Vinograde, B. *On high order derivations of fields*, 421.

13. Commutative Rings and Algebras

Eakin, Paul and Kubota, K. K. *A note on the uniqueness of rings of coefficients in polynomial rings*, 333.

Hinohara, Yukitoshi. *On semilocal OP-rings*, 16.

Levitz, Kathleen B. *A characterization of general Z.P.I.-rings*, 376.

Reiten, Idun. *The converse to a theorem of Sharp on Gorenstein modules*, 417.

Roberts, Leslie G. *K_1 of a commutative von Neumann regular ring*, 425.

Wehlen, Joseph A. *Cohomological dimension and global dimension of algebras*, 75.

14. Algebraic Geometry

Bresinsky, H. *Semigroups corresponding to algebroid branches in the plane*, 381.

Eakin, Paul and Kubota, K. K. *A note on the uniqueness of rings of coefficients in polynomial rings*, 333.

15. Linear and Multilinear Algebra, Matrix Theory (finite and infinite)

Amir-Moéz, A. R. and Perry, C. R. *Positive transformations restricted to subspaces and inequalities among their proper values*, 363.

Kodama, Tetsuo. *On the group indices of parasymplectic group of level F*, 349.

Markham, T. L. *Factorizations of nonnegative matrices*, 45.

Sinkhorn, Richard. *Continuous dependence on A in the D_1AD_2 theorems*, 395.

16. Associative Rings and Algebras

Fein, Burton. *Embedding rational division algebras*, 427.

Fieldhouse, David J. *Regular modules*, 49.

Mason, G. R. *On self-injective group rings*, 85.

Putcha, Mohan S., Wilson, Robert S. and Yaqub, Adil. *Structure of rings satisfying certain identities on commutators*, 57.

Putcha, Mohan S. and Yaqub, Adil. *Rings satisfying monomial identities*, 52.

Rant, William H. *Left perfect rings that are right perfect and a characterization of Steinitz rings*, 81.

Wehlen, Joseph A. *Cohomological dimension and global dimension of algebras*, 75.

17. Nonassociative Rings and Algebras

Wilson, Robert Lee. *A characterization of p-reductive Lie algebras*, 89.

18. Category Theory, Homological Algebra

Hinohara, Yukitoshi. *On semilocal OP-rings*, 16.

Peake, E. James and Peters, Galen R. *Extension of algebraic theories*, 358.

Roberts, Leslie G. *K_1 of a commutative von Neumann regular ring*, 425.

Wehlen, Joseph A. *Cohomological dimension and global dimension of algebras*, 75.

20. Group Theory and Generalizations

Alperin, J. L. and Gorenstein, Daniel. *A vanishing theorem for cohomology*, 87.

Cohn, J. H. E. *A condition for a finite group to be cyclic*, 48.

Djoković, D. Ž. and Tang, C. Y. *On the Frattini subgroup of the generalized free product with amalgamation*, 21.

Hempel, John. *Residual finiteness of surface groups*, 323.

Hill, Paul. *The number of isotype and l-pure subgroups of an abelian p-group*, 69.

Hogan, Guy T. *Elements of maximal order in finite p-groups*, 37.

Johnson, C. S., Jr. and McMorris, F. R. *Injective hulls of certain S-systems over a semilattice*, 371.

Kodama, Tetsuo. *On the group indices of parasymplectic group of level F*, 349.

Mukherjee, N. P. *The hyperquasicenter of a finite group*. II, 24.

Searby, D. G. and Wamsley, J. W. *Minimal presentations for certain metabelian groups*, 342.

Sidki, Said. *Automorphism of a finite group scalar on the cosets of a subgroup*, 399.

Stebe, Peter F. *Conjugacy separability of groups of integer matrices*, 1.

B. ANALYSIS

26. Real Functions

Vasudeva, Harkrishan. *On a characterisation of matrix functions which are differences of two monotone matrix functions*, 531.

28. Measure and Integration

Akcoglu, M. A. and Chacon, R. V. *Approximation of commuting transformations*, 111.

Kuelbs, J. and Mandrekar, V. *The Wiener closure theorems for abstract Wiener spaces*, 169.

Lewis, D. R. *A vector measure with no derivative*, 535.

Mukherjea, A. *On the convolution equation $P=P*Q$ of Choquet and Deny for probability measures on semigroups*, 457.

Pachl, Jan. *An elementary proof of a Radon-Nikodým theorem for finitely additive set functions*, 225.

Zander, Vernon. *Fubini theorems for Orlicz spaces of Lebesgue-Bochner measurable functions*, 102.

30. Functions of a Complex Variable

Bajpai, S. K. and Srivastava, R. S. L. *On the radius of convexity and starlikeness of univalent functions*, 153.

Barth, K. F. and Schneider, W. J. *On a problem of Erdös concerning the zeros of the derivatives of an entire function*, 229.

Davie, A. M. *Bounded limits of analytic functions*, 127.

Hag, Kari. *A convergence theorem for limitärperiodisch T-fractions of rational functions*, 491.

Hahn, Liang-Shin. *On the Bloch-Nevanlinna problem*, 221.

Metzger, T. A. and Rajeswara Rao, K. V. *On integrable and bounded automorphic forms.* II, 201.

Noonan, J. W. *On functions of bounded rotation*, 91.

O'Malla, Heppé. *Dirichlet finite biharmonic functions on the unit disk with distorted metrics*, 521.

31. Potential Theory

Newman, James M. *Coercive inequalities for certain classes of bounded regions*, 120.

O'Malla, Heppé. *Dirichlet finite biharmonic functions on the unit disk with distorted metrics*, 521.

Singer, Ivan J. *Dirichlet finite solutions of* $\Delta u = Pu$, 464.

32. Several Complex Variables and Analytic Spaces

Range, R. M. *A small boundary for* H^∞ *on the polydisc*, 253.

33. Special Functions

Gasper, George. *An inequality of Turán type for Jacobi polynomials*, 435.

Khan, I. A. *Generating functions for Jacobi and related polynomials*, 179.

Rowe, Paul P. *Partially-orthogonal polynomials*, 215.

34. Ordinary Differential Equations

Grimmer, R. *Stability of a scalar differential equation*, 452.

Hartman, Philip. *On invariant sets and on a theorem of Ważewski*, 511.

Hinton, Don. *Solutions of* $(ry^{(n)})^{(n)} + qy = 0$ *of class* $\mathscr{L}_p[0, \infty)$, 134.

Schrader, Keith. *Second and third order boundary value problems*, 247.

Sharma, R. R. *An abstract measure differential equation*, 503.

Teufel, Hugo, Jr. *On the behavior of solutions of sublinear second order differential equations*, 445.

35. Partial Differential Equations

Arena, O. *A strong maximum principle for quasilinear parabolic differential inequalities*, 497.

Kazdan, Jerry L. and Warner, Frank W. *Surfaces of revolution with monotonic increasing curvature and an application to the equation* $\Delta u = 1 - Ke^{2u}$ *on* S^2, 139.

Rosencrans, S. I. *Derivation of the Hopf-Cole solution to Burgers' equation by stochastic integrals*, 147.

Widder, D. V. *Time-variable singularities for solutions of the heat equation*, 209.

40. Sequences, Series, Summability

Isaacs, Godfrey L. *The abscissa of absolute summability of Laplace integrals*, 142.

Mazhar, S. M. *On the absolute Nörlund summability factors of infinite series*, 233.

41. Approximations and Expansions

Gregory, John. *An approximation theory for focal points and focal intervals*, 477.

Lambert, Joseph M. *Simultaneous approximation and interpolation in* l_1, 150.

Saff, E. B. *The convergence of rational functions of best approximation to the exponential function.* II, 187.

42. Fourier Analysis

Burnham, J. T. *Closed ideals in subalgebras of Banach algebras.* I, 551.

Gasper, George. *An inequality of Turán type for Jacobi polynomials*, 435.

Kaufman, R. *Sets of multiplicity and differentiable functions*, 472.

43. Abstract Harmonic Analysis

Blozinski, Anthony P. *Convolution of $L(p, q)$ functions*, 237.

Dunkl, Charles F. and Ramirez, Donald E. *Existence and nonuniqueness of invariant means on $\mathscr{L}^\infty(\hat{G})$*, 525.

Ragozin, David L. and Rothschild, Linda Preiss. *Central measures on semisimple Lie groups have essentially compact support*, 585.

Renaud, P. F. *Centralizers of the Fourier algebra of an amenable group*, 539.

44. Integral Transforms, Operational Calculus

Widder, D. V. *Time-variable singularities for solutions of the heat equation*, 209.

46. Functional Analysis

Blumenthal, Robert G. *The closed ideals of some Dirichlet and hypo-Dirichlet algebras*, 469.

Bunce, John. *Representations of strongly amenable C*-algebras*, 241.

Burnham, J. T. *Closed ideals in subalgebras of Banach algebras.* I, 551.

Conway, John B. *The compact operators are not complemented in $\mathscr{B}(\mathscr{H})$*, 549.

Eifler, Larry Q. *Peano curves in function algebras*, 537.

Gregory, John. *An approximation theory for focal points and focal intervals*, 477.

Kaufman, R. *Sets of multiplicity and differentiable functions*, 472.

Kelly, E. P., Jr. and Hogan, D. A. *Bounded, conservative, linear operators and the maximal group*, 195.

Lewis, D. R. *A vector measure with no derivative*, 535.

Range, R. M. *A small boundary for H^∞ on the polydisc*, 253.

Roth, B. *Submodules of $C(X) \times \cdots \times C(X)$*, 543.

Zander, Vernon. *Fubini theorems for Orlicz spaces of Lebesgue-Bochner measurable functions*, 102.

47. Operator Theory

Akcoglu, M. A. and Chacon, R. V. *Approximation of commuting transformations*, 111.

Conway, John B. *The compact operators are not complemented in $\mathscr{B}(\mathscr{H})$*, 549.

* Deddens, James A. *A necessary condition for quasitriangularity*, 630.

Dowson, H. R. and Spain, P. G. *An example in the theory of well-bounded operators*, 205.

* Embry, Mary R. *An invariant subspace theorem*, 331.

Kelly, E. P., Jr. and Hogan, D. A. *Bounded, conservative, linear operators and the maximal group*, 195.

Kritt, Brian. *A theory of unbounded generalized scalar operators*, 484.

McIntosh, Alan. *On the comparability of $A^{1/2}$ and $A^{*1/2}$*, 430.

Martin, R. H., Jr. *Strongly dissipative operators and nonlinear equations in a Fréchet space*, 161.

Masuda, Kyuya. *On the existence of invariant subspaces in spaces with indefinite metric*, 440.

* Ruston, Anthony F. *On operators with rational resolvent*, 329.

Simon, Barry. *A remark on groups with the fixed point property*, 623.

C. Applied Mathematics

94. Information and Communication, Circuits, Automata

Roberson, Fred A. *Recurrence and almost periodicity in a generative transformation group*, 596.

D. Geometry

50. Geometry

Narayana Rao, M. L. *A flag transitive plane of order* 49, 256.

53. Differential Geometry

Chen, Bang-yen and Ludden, Gerald D. *Riemann surfaces in complex projective spaces*, 561.

Grossman, Nathaniel. *On characterization of Riemannian manifolds by growth of tubular neighborhoods*, 556.

Kazdan, Jerry L. and Warner, Frank W. *Surfaces of revolution with monotonic increasing curvature and an application to the equation* $\Delta u = 1 - Ke^{2u}$ *on* S^2, 39.

Vilms, Jaak. *Submanifolds of Euclidean space with parallel second fundamental form*, 263.

F. Statistics and Probability

60. Probability Theory and Stochastic Processes

Brown, B. M. *Erratum to "A general three-series theorem"*, 634.

LePage, Raoul D. *Note relating Bochner integrals and reproducing kernels to series expansions on a Gaussian Banach space*, 285.

Mandrekar, V. *A characterization of oscillatory processes and their prediction*, 280.

Mukherjea, A. *On the convolution equation* $P = P * Q$ *of Choquet and Deny for probability measures on semigroups*, 457.

Park, W. J. *On the equivalence of Gaussian processes with factorable covariance functions*, 275.

Tomkins, R. J. *A generalization of Kolmogorov's law of the iterated logarithm*, 268.

Wilkins, J. Ernest., Jr. *The bold strategy in presence of house limit*, 567.

G. Topology

22. Topological Groups, Lie Groups

* Ragozin, David L. *A normal subgroup of a semisimple Lie group is closed*, 632.

Ragozin, David L. and Rothschild, Linda Preiss. *Central measures on semisimple Lie groups have essentially compact support*, 585.

Roberson, Fred A. *Recurrence and almost periodicity in a generative transformation group*, 596.

Simon, Barry. *A remark on groups with the fixed point property*, 623.

54. General Topology

Baker, Harvy Lee, Jr. *Maximal independent collections of closed sets*, 605.

Bennett, Donald E. *A sufficient condition for countable-set aposyndesis*, 578.

Canfell, M. J. *An algebraic characterization of dimension*, 619.

Chandler, Richard E. *An alternative construction of* βX *and* vX, 315.

Coppin, C. A. *Continuous functions from a connected locally connected space into a connected space with a dispersion point*, 625.

D'Aristotle, Anthony J. *A note on* $\mathscr{Z}$*-realcompactifications*, 615.

Frolík, Z. and Liu, Chen Tung. *An embedding characterization of almost realcompact spaces*, 294.
Hempel, John. *Residual finiteness of surface groups*, 323.
Kent, Joseph F. *A characterization of distal and point-distal minimal transformation groups*, 304.
Potoczny, H. B. *A nonparacompact space which admits a closure-preserving cover of compact sets*, 309.
Rice, M. D. *A short proof that metric spaces are realcompact*, 313.
Roberson, Fred A. *Recurrence and almost periodicity in a generative transformation group*, 596.
Sharma, P. L. and Naimpally, S. A. *On two problems of Harris concerning RC-proximities*, 312.
Stein, James D., Jr. *Uniform boundedness in metric spaces*, 299.

55. Algebraic Topology

Copeland, Arthur H., Jr. *H-structures on products*, 611.
* Feder, S. *On the embedding $CP_n \subset CP_{2n}$*, 327.
Gilbert, William J. *Homotopical nilpotence of the seven sphere*, 621.
Gordon, C. McA. *Twist-spun torus knots*, 319.
Gutiérrez, M. A. *An exact sequence calculation for the second homotopy of a knot*, 571.
Johnson, David Copeland. *Skeleta of complexes with low MU_* projective dimension*, 599.
Vogt, R. M. *A note on homotopy equivalences*, 627.

57. Manifolds and Cell Complexes

Anderson, Douglas R. *A note on the Whitehead torsion of a bundle modulo a subbundle*, 593.
* Feder, S. *On the embedding $CP_n \subset CP_{2n}$*, 327.
Gutiérrez, M. A. *An exact sequence calculation for the second homotopy of a knot*, 571.
Miller, John David. *Finite groups acting on spheres*, 289.
Roberson, Fred A. *Recurrence and almost periodicity in a generative transformation group*, 596.
* Stern, Ronald J. *The tangent microbundle of a suitable manifold*, 324.

58. Global Analysis, Analysis on Manifolds

Marsden, J. *Darboux's theorem fails for weak symplectic forms*, 590.
Singer, Ivan J. *Dirichlet finite solutions of $\Delta u = Pu$*, 464.

AUTHOR INDEX

*Starred items are "Shorter Notes"

Akcoglu, M. A. and Chacon, R. V. *Approximation of commuting transformations*, 111.
Alperin, J. L. and Gorenstein, Daniel. *A vanishing theorem for cohomology*, 87.
Amir-Moéz, A. R. and Perry, C. R. *Positive transformations restricted to subspaces and inequalities among their proper values*, 363.
Anderson, Douglas R. *A note on the Whitehead torsion of a bundle modulo a subbundle*, 593.
Arena, O. *A strong maximum principle for quasilinear parabolic differential inequalities*, 497.
Bajpai, S. K. and Srivastava, R. S. L. *On the radius of convexity and starlikeness of univalent functions*, 153.
Baker, Harvy Lee, Jr. *Maximal independent collections of closed sets*, 605.
Barth, K. F. and Schneider, W. J. *On a problem of Erdös concerning the zeros of the derivatives of an entire function*, 229.
Bennett, Donald E. *A sufficient condition for countable-set aposyndesis*, 578.
Bernau, S. J. *The Boolean ring generated by a distributive lattice*, 423.
Berndt, Bruce C. *Two new proofs of Lerch's functional equation*, 403.
Blozinski, Anthony P. *Convolution of $L(p, q)$ functions*, 237.
Blumenthal, Robert G. *The closed ideals of some Dirichlet and hypo-Dirichlet algebras*, 469.
Bresinsky, H. *Semigroups corresponding to algebroid branches in the plane*, 381.
Brown, B. M. *Erratum to "A general three-series theorem"*, 634.
Bunce, John. *Representations of strongly amenable C*-algebras*, 241.
Burnham, J. T. *Closed ideals in subalgebras of Banach algebras. I*, 551.
Canfell, M. J. *An algebraic characterization of dimension*, 619.
Carlitz, L. and Subbarao, M. V. *A simple proof of the quintuple product identity*, 42.
Chacon, R. V. See Akcoglu, M. A.
Chandler, Richard E. *An alternative construction of βX and vX*, 315.
Chartrand, Gary, Kaugars, Agnis and Lick, Don R. *Critically n-connected graphs*, 63.
Chen, Bang-yen and Ludden, Gerald D. *Riemann surfaces in complex projective spaces*, 561.
Chvátal, Václav and Harary, Frank. *Generalized Ramsey theory for graphs. II. Small diagonal numbers*, 389.
Cohn, J. H. E. *A condition for a finite group to be cyclic*, 48.
Conway, John B. *The compact operators are not complemented in $\mathscr{B}(\mathscr{H})$*, 549.
Copeland, Arthur H., Jr. *H-structures on products*, 611.
Coppin, C. A. *Continuous functions from a connected locally connected space into a connected space with a dispersion point*, 625.
D'Aristotle, Anthony J. *A note on $\mathscr{Z}$-realcompactifications*, 615.
Davie, A. M. *Bounded limits of analytic functions*, 127.
Davis, Robert C. *Multivalued operations and universal coalgebra*, 385.
* Deddens, James A. *A necessary condition for quasitriangularity*, 630.
Djoković, D. Ž. and Tang, C. Y. *On the Frattini subgroup of the generalized free product with amalgamation*, 21.
Dowson, H. R. and Spain, P. G. *An example in the theory of well-bounded operators*, 205.
Doyen, Jean. *Constructions of disjoint Steiner triple systems*, 409.

Dunkl, Charles F. and Ramirez, Donald E. *Existence and nonuniqueness of invariant means on* $\mathscr{L}^\infty(\hat{G})$, 525.
Eakin, Paul and Kubota, K. K. *A note on the uniqueness of rings of coefficients in polynomial rings*, 333.
Eifler, Larry Q. *Peano curves in function algebras*, 537.
* Embry, Mary R. *An invariant subspace theorem*, 331.
* Feder, S. *On the embedding* $CP_n \subset CP_{2n}$, 327.
Fein, Burton. *Embedding rational division algebras*, 427.
Fieldhouse, David J. *Regular modules*, 49.
Frolík Z. and Liu, Chen Tung. *An embedding characterization of almost realcompact spaces*, 294.
Gasper, George. *An inequality of Turán type for Jacobi polynomials*, 435.
Gilbert, William J. *Homotopical nilpotence of the seven sphere*, 621.
Gordon, C. McA. *Twist-spun torus knots*, 319.
Gorenstein, Daniel. See Alperin, J. L.
Gregory, John. *An approximation theory for focal points and focal intervals*, 477.
Grimmer, R. *Stability of a scalar differential equation*, 452.
Grossman, Nathaniel. *On characterization of Riemannian manifolds by growth of tubular neighborhoods*, 556.
Gutiérrez, M. A. *An exact sequence calculation for the second homotopy of a knot*, 571.
Hag, Kari, *A convergence theorem for limitärperiodisch T-fractions of rational functions*, 491.
Hagis, Peter, Jr. and McDaniel, Wayne L. *A new result concerning the structure of odd perfect numbers*, 13.
Hahn, Liang-Shin. *On the Bloch-Nevanlinna problem*, 221.
Harary, Frank. See Chvátal, Václav.
Hartman, Philip. *On invariant sets and on a theorem of Ważewski*, 511.
Hempel, John. *Residual finiteness of surface groups*, 323.
Hill, Paul. *The number of isotype and l-pure subgroups of an abelian p-group*, 69.
Hinohara, Yukitoshi. *On semilocal OP-rings*, 16.
Hinton, Don. *Solutions of* $(ry^{(n)})^{(n)}+qy=0$ *of class* $\mathscr{L}_p[0, \infty)$, 134.
Hogan, D. A. See Kelly, E. P., Jr.
Hogan, Guy T. *Elements of maximal order in finite p-groups*, 37.
Isaacs, Godfrey L. *The abscissa of absolute summability of Laplace integrals*, 142.
Iskander, A. A. *On subalgebra lattices of universal algebras*, 32.
Johnson, C. S., Jr. and McMorris, F. R. *Injective hulls of certain S-systems over a semilattice*, 371. •
Johnson, David Copeland. *Skeleta of complexes with low* MU_* *projective dimension*, 599.
Kaufman, R. *Sets of multiplicity and differentiable functions*, 472.
Kaugars, Agnis. See Chartrand, Gary.
Kazdan, Jerry L. and Warner, Frank W. *Surfaces of revolution with monotonic increasing curvature and an application to the equation* $\Delta u=1-Ke^{2u}$ *on* S^2, 139.
Kelly, E. P., Jr. and Hogan, D. A. *Bounded, conservative, linear operators and the maximal group*, 195.
Kent, Joseph F. *A chraacterization of distal and point-distal minimal transformation groups*, 304.
Khan, I. A. *Generating functions for Jacobi and related polynomials*, 179.
Kodama, Tetsuo. *On the group indices of parasymplectic group of level F*, 349.
Kritt, Brian. *A theory of unbounded generalized scalar operators*, 484.

Kubota, K. K. See Eakin, Paul.
Kuelbs, J. and Mandrekar, V. *The Wiener closure theorems for abstract Wiener spaces*, 169.
Lambert, Joseph M. *Simultaneous approximation and interpolation in* l_1, 150.
Lando, Barbara A. *Jacobi's bound for first order difference equations*, 8.
LePage, Raoul D. *Note relating Bochner integrals and reproducing kernels to series expansions on a Gaussian Banach space*, 285.
Levitz, Kathleen B. *A characterization of general Z.P.I.-rings*, 376.
Lewis, D. R. *A vector measure with no derivative*, 535.
Lick, Don R. See Chartrand, Gary.
Liu, Chen Tung. See Frolík, Z.
Ludden, Gerald D. See Chen, Bang-yen.
McDaniel, Wayne L. See Hagis, Peter, Jr.
McIntosh, Alan. *On the comparability of* $A^{1/2}$ *and* $A^{*1/2}$, 430.
McMorris, F. R. See Johnson, C. S., Jr.
Mandrekar, V. *A characterization of oscillatory processes and their prediction*, 280.
———. See Kuelbs, J.
Markham, T. L. *Factorizations of nonnegative matrices*, 45.
Marsden, J. *Darboux's theorem fails for weak symplectic forms*, 590.
Martin, R. H., Jr. *Strongly dissipative operators and nonlinear equations in a Fréchet space*, 161.
Mason, G. R. *On self-injective group rings*, 85.
Masuda, Kyuya. *On the existence of invariant subspaces in spaces with indefinite metric*, 440.
Mazhar, S. M. *On the absolute Nörlund summability factors of infinite series*, 233.
Metzger, T. A. and Rajeswara Rao, K. V. *On integrable and bounded automorphic forms*. II, 201.
Miller, John David. *Finite groups acting on spheres*, 289.
Mordeson, J. N. and Vinograde, B. *On high order derivations of fields*, 421.
Mukherjea, A. *On the convolution equation* $P=P*Q$ *of Choquet and Deny for probability measures on semigroups*, 457.
Mukherjee, N. P. *The hyperquasicenter of a finite group*. II, 24.
Naimpally, S. A. See Sharma, P. L.
Narayana Rao, M. L. *A flag transitive plane of order* 49, 256.
Newman, James M. *Coercive inequalities for certain classes of bounded regions*, 120.
Noonan, J. W. *On functions of bounded rotation*, 91.
O'Malla, Heppé. *Dirichlet finite biharmonic functions on the unit disk with distorted metrics*, 521.
Pachl, Jan. *An elementary proof of a Radon-Nikodým theorem for finitely additive set functions*, 225.
Park, W. J. *On the equivalence of Gaussian processes with factorable covariance functions*, 275.
Peake, E. James and Peters, Galen R. *Extension of algebraic theories*, 358.
Perry, C. R. See Amir-Moéz, A. R.
Peters, Galen R. See Peake, E. James
Potoczny, H. B. *A nonparacompact space which admits a closure-preserving cover of compact sets*, 309.
Putcha, Mohan S., Wilson, Robert S. and Yaqub, Adil. *Structure of rings satisfying certain identities on commutators*, 57.
Putcha, Mohan S. and Yaqub, Adil. *Rings satisfying monomial identities*, 52.

* Ragozin, David L. *A normal subgroup of a semisimple Lie group is closed*, 632.
Ragozin, David L. and Rothschild, Linda Preiss. *Central measures on semisimple Lie groups have essentially compact support*, 585.
Rajeswara Rao, K. V. See Metzger, T. A.
Ramirez, Donald E. See Dunkl, Charles, F.
Range, R. Michael. *A small boundary for H^∞ on the polydisc*, 253.
Rant, William H. *Left perfect rings that are right perfect and a characterization of Steinitz rings*, 81.
Reiten, Idun. *The converse to a theorem of Sharp on Gorenstein modules*, 417.
Renaud, P. F. *Centralizers of the Fourier algebra of an amenable group*, 539.
Rice, M. D. *A short proof that metric spaces are realcompact*, 313.
Roberson, Fred A. *Recurrence and almost periodicity in a generative transformation group*, 596.
Roberts, Leslie G. *K_1 of a commutative von Neumann regular ring*, 425.
Rosencrans, S. I. *Derivation of the Hopf-Cole solution to Burgers' equation by stochastic integrals*, 147.
Roth, B. *Submodules of $C(X)\times\cdots\times C(X)$*, 543.
Rothschild, Linda Preiss. See Ragozin, David L.
Rowe, Paul P. *Partially-orthogonal polynomials*, 215.
* Ruston, Anthony F. *On operators with rational resolvent*, 329.
Saff, E. B. *The convergence of rational functions of best approximation to the exponential function*. II, 187.
Schneider, W. J. See Barth, K. F.
Schrader, Keith. *Second and third order boundary value problems*, 247.
Searby, D. G. and Wamsley, J. W. *Minimal presentations for certain metabelian groups*, 342.
Sharma, P. L. and Naimpally, S. A. *On two problems of Harris concerning RC-proximities*, 312.
Sharma, R. R. *An abstract measure differential equation*, 503.
Sidki, Said. *Automorphism of a finite group scalar on the cosets of a subgroup*, 399.
Simon, Barry. *A remark on groups with the fixed point property*, 623.
Singer, Ivan J. *Dirichlet finite solutions of $\Delta u=Pu$*, 464.
Sinkhorn, Richard. *Continuous dependence on A in the D_1AD_2 theorems*, 395.
Spain, P. G. See Dowson, H. R.
Spence, Edward. *Hadamard designs*, 29.
Srivastava, R. S. L. See Bajpai, S. K.
Stebe, Peter F. *Conjugacy separability of groups of integer matrices*, 1.
Stein, James D., Jr. *Uniform boundedness in metric spaces*, 299.
* Stern, Ronald J. *The tangent microbundle of a suitable manifold*, 324.
Subbarao, M. V. See Carlitz, L.
Tang, C. Y. See Djoković, D. Ž.
Teufel, Hugo, Jr. *On the behavior of solutions of sublinear second order differential equations*, 445.
Tomkins, R. J. *A generalization of Kolmogorov's law of the iterated logarithm*, 268.
Vasudeva, Harkrishan. *On a characterisation of matrix functions which are differences of two monotone matrix functions*, 531.
Vilms, Jaak. *Submanifolds of Euclidean space with parallel second fundamental form*, 263.
Vinograde, B. See Mordeson, J. N.
Vogt, R. M. *A note on homotopy equivalences*, 627.
Wamsley, J. W. See Searby, D. G.

Warner, Frank W. See Kazdan, Jerry L.
Wehlen, Joseph A. *Cohomological dimension and global dimension of algebras*, 75.
Widder, D. V. *Time-variable singularities for solutions of the heat equation*, 209.
Williams, Kenneth S. *Representation of a binary quadratic form as a sum of two squares*, 368.
Wilkins, J. Ernest, Jr. *The bold strategy in presence of house limit*, 567.
Wilson, Robert Lee. *A characterization of p-reductive Lie algebras*, 89.
Wilson, Robert S. See Putcha, Mohan S.
Yaqub, Adil. See Putcha, Mohan S.
Zander, Vernon. *Fubini theorems for Orlicz spaces of Lebesgue-Bochner measurable* functions, 102.

Submission of Manuscript

Send papers directly to one of the editors listed under the subject field of the paper.

Algebra and algebraic number theory.

JOSEPH J. ROTMAN, Department of Mathematics, University of Illinois, Urbana, Illinois 61801

GEORGE B. SELIGMAN, Department of Mathematics, Yale University, New Haven, Connecticut 06520

Modern or classical analysis and analytic number theory.

JACOB FELDMAN, Department of Mathematics, University of California, Berkeley, California 94720

LEE A. RUBEL, Department of Mathematics, University of Illinois, Urbana, Illinois 61801

ALLEN L. SHIELDS, Department of Mathematics, University of Michigan, Ann Arbor, Michigan 48104

Algebraic geometry.

GEORGE B. SELIGMAN, Department of Mathematics, Yale University, New Haven, Connecticut 06520

Set-theoretic and general topology.

W. WISTAR COMFORT, Department of Mathematics, Wesleyan University, Middletown, Connecticut 06457

Algebraic topology and all other types of geometry.

GLEN E. BREDON, Department of Mathematics, Rutgers University, New Brunswick, New Jersey 08903.

Applied mathematics, differential equations, and related areas of analysis.

FRED G. BRAUER, Department of Mathematics, University of Wisconsin, Madison, Wisconsin 53706

Probability, statistics, and related fields.

JAMES D. KUELBS, Department of Mathematics, 213 Van Vleck Hall, University of Wisconsin, Madison, Wisconsin 53706

Logic, set theory, and related areas.

ROBERT I. SOARE, Department of Mathematics, University of Illinois at Chicago Circle, Chicago, Illinois 60680

All other communications should be addressed to the Managing Editor, JOSEPH J. ROTMAN, at the above address.

Reprints and Address Changes

Any inquiries concerning a paper which has been accepted for publication, including information regarding reprints or changes of address for mailing proof, should be sent directly to the Editorial Department, American Mathematical Society, P.O. Box 6248, Providence, Rhode Island 02904.

A strong maximum principle for quasilinear parabolic differential inequalities. By O. ARENA 497
An abstract measure differential equation. By R. R. SHARMA 503
On invariant sets and on a theorem of Ważewski. By PHILIP HARTMAN 511
Dirichlet finite biharmonic functions on the unit disk with distorted metrics. By HEPPÉ O'MALLA 521
Existence and nonuniqueness of invariant means on $\mathscr{L}^\infty(\tilde{G})$. By CHARLES F. DUNKL and DONALD E. RAMIREZ 525
On a characterisation of matrix functions which are differences of two monotone matrix functions. By HARKRISHAN VASUDEVA 531
A vector measure with no derivative. By D. R. LEWIS 535
Peano curves in function algebras. By LARRY Q. EIFLER 537
Centralizers of the Fourier algebra of an amenable group. By P. F. RENAUD 539
Submodules of $C(X)\times\cdots\times C(X)$. By B. ROTH 543
The compact operators are not complemented in $\mathscr{B}(\mathscr{H})$. By JOHN B. CONWAY 549
Closed ideals in subalgebras of Banach algebras. I. By J. T. BURNHAM 551

D. GEOMETRY

On characterization of Riemannian manifolds by growth of tubular neighborhoods. By NATHANIEL GROSSMAN 556
Riemann surfaces in complex projective spaces. By BANG-YEN CHEN and GERALD D. LUDDEN 561

F. STATISTICS AND PROBABILITY

The bold strategy in presence of house limit. By J. ERNEST WILKINS, JR. 567

G. TOPOLOGY

An exact sequence calculation for the second homotopy of a knot. By M. A. GUTIÉRREZ 571
A sufficient condition for countable-set aposyndesis. By DONALD E. BENNETT 578
Central measures on semisimple Lie groups have essentially compact support. By DAVID L. RAGOZIN and LINDA PREISS ROTHSCHILD 585
Darboux's theorem fails for weak symplectic forms. By J. MARSDEN 590
A note on the Whitehead torsion of a bundle modulo a subbundle. By DOUGLAS R. ANDERSON 593
Recurrence and almost periodicity in a generative transformation group. By FRED A. ROBERSON 596
Skeleta of complexes with low MU_* projective dimension. By DAVID COPELAND JOHNSON 599
Maximal independent collections of closed sets. By HARVEY LEE BAKER, JR. 605
H-structures on products. By ARTHUR H. COPELAND, JR. 611
A note on $\mathscr{X}$-realcompactifications. By ANTHONY J. D'ARISTOTLE 615
An algebraic characterization of dimension. By M. J. CANFELL 619
Homotopical nilpotence of the seven sphere. By WILLIAM J. GILBERT 621
A remark on groups with the fixed point property. By BARRY SIMON 623
Continuous functions from a connected locally connected space into a connected space with a dispersion point. By C. A. COPPIN 625
A note on homotopy equivalences. By R. M. VOGT 627

SHORTER NOTES

A necessary condition for quasitriangularity. By JAMES A. DEDDENS 630
A normal subgroup of a semisimple Lie group is closed. By DAVID L. RAGOZIN 632

Erratum to Volume 28 634
AMS (MOS) Major Subject Headings 635
Index to Volume 32 637

CONTENTS*

Vol. 32, No. 2 APRIL 1972 Whole No. 154

Page

A. Algebra and Number Theory

A note on the uniqueness of rings of coefficients in polynomial rings. By Paul Eakin and K. K. Kubota 333
Minimal presentations for certain metabelian groups. By D. G. Searby and J. W. Wamsley 342
On the group indices of the parasymplectic group of level F. By Tetsuo Kodama 349
Extension of algebraic theories. By E. James Peake and Galen R. Peters..... 358
Positive transformations restricted to subspaces and inequalities among their proper values. By A. R. Amir-Moéz and C. R. Perry..... 363
Representation of a binary quadratic form as a sum of two squares. By Kenneth S. Williams..... 368
Injective hulls of certain S-systems over a semilattice. By C. S. Johnson, Jr. and F. R. McMorris 371
A characterization of general Z.P.I.-rings. By Kathleen B. Levitz..... 376
Semigroups corresponding to algebroid branches in the plane. By H. Bresinsky 381
Multivalued operations and universal coalgebra. By Robert C. Davis 385
Generalized Ramsey theory for graphs. II. Small diagonal numbers. By Václav Chvátal and Frank Harary 389
Continuous dependence on A in the D_1AD_2 theorems. By Richard Sinkhorn .. 395
Automorphism of a finite group scalar on the cosets of a subgroup. By Said Sidki 399
Two new proofs of Lerch's functional equation. By Bruce C. Berndt 403
Constructions of disjoint Steiner triple systems. By Jean Doyen 409
The converse to a theorem of Sharp on Gorenstein modules. By Idun Reiten .. 417
On high order derivations of fields. By J. N. Mordeson and B. Vinograde 421
The Boolean ring generated by a distributive lattice. By S. J. Bernau..... 423
K_1 of a commutative von Neumann regular ring. By Leslie G. Roberts 425
Embedding rational division algebras. By Burton Fein..... 427

B. Analysis

On the comparability of $A^{1/2}$ and $A^{*1/2}$. By Alan McIntosh..... 430
An inequality of Turán type for Jacobi polynomials. By George Gasper..... 435
On the existence of invariant subspaces in spaces with indefinite metric. By Kyuya Masuda 440
On the behavior of solutions of sublinear second order differential equations. By Hugo Teufel, Jr. 445
Stability of a scalar differential equation. By R. Grimmer 452
On the convolution equation $P=P*Q$ of Choquet and Deny for probability measures on semigroups. By A. Mukherjea..... 457
Dirichlet finite solutions of $\Delta u=Pu$. By Ivan J. Singer 464
The closed ideals of some Dirichlet and hypo-Dirichlet algebras. By Robert G. Blumenthal 469
Sets of multiplicity and differentiable functions. By R. Kaufman..... 472
An approximation theory for focal points and focal intervals. By John Gregory 477
A theory of unbounded generalized scalar operators. By Brian Kritt 484
A convergence theorem for limitärperiodisch T-fractions of rational functions. By Kari Hag 491

* The volume indexes contain a mapping showing the correspondence between sections A-G and the AMS (MOS) subject classification numbers.

Continued on inside back cover