

C O M B I N A T O R I C S

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Combinatorics is the newsletter of the Combinatorial Mathematics Society of Australasia, and is published by the Society. The annual subscription rate for individual non-members and institutions is \$4(AUST). During 1983 all enquiries should be directed to the CMSA, C/- Dr. Derrick Breach, Department of Mathematics, University of Canterbury, Christchurch, New Zealand.

NOW IS THE TIME FOR ALL GOOD MEMBERS OF MATHEMATICS AND COMPUTER SCIENCE DEPARTMENTS TO THINK ABOUT ATTENDING THE XI ACCM IN CHRISTCHURCH, NZ, 29 AUGUST TO 2 SEPTEMBER, 1983.

1. The Eleventh Australian Conference on Combinatorial Mathematics
(XI ACCM) 29 August - 2 September, 1983, Christchurch, New Zealand.

(i) Publicity

A first notice in the form of a small poster has been sent to all members, all participants of the past two conferences, all mathematics and computer science departments in Australia and New Zealand, most such departments in Canada, also selected departments and individuals in the UK, the USA, Malaysia, Hong Kong, China, etc. etc. usw, κτλ.

(ii) Invited Speakers

The following will give invited one-hour talks:
Professor Brian Alspach, ^{Simon Fraser} University, of British Columbia,
Professor John Abrahm, University of Toronto,
Dr. Elizabeth Billington, University of Queensland,
Professor Ralph Stanton, University of Manitoba.
Dr. R.G.T. Bennett, University of Canterbury
(Bell ringing). This list is not complete.

(iii) Contributed Papers

Papers are welcome in all areas of pure and applied combinatorics and their associated computational problems. Contributed talks will be of 30 minutes each of which five minutes should be allowed for discussion and questions.

(iv) Proceedings

It is expected that Springer-Verlag will publish the proceedings as they have done in the past as a volume of their Lecture Notes in Mathematics. Papers submitted for the proceedings are refereed and the publishers ask that they be of a high standard and current interest. Apart from major surveys, outlines at least of proofs are expected, enough being given to enable the reader to complete them. Thus research announcements, outlines and abstracts are excluded. However it is understood that often a contributed talk describes work in progress which may well be published elsewhere later.

All authors wishing to contribute to the proceedings are asked to bring a finished draft of their paper, either typed or legibly and neatly handwritten, to the conference with them. At the latest these papers must be in by September 30th, 1983. The editor for the proceedings will be Dr. D.F. Robinson of the Mathematics Department, The University of Canterbury, Christchurch, New Zealand.

(v) Accommodation

Space has been reserved in the University of Canterbury Halls of Residence. It will not be known until later in the year which of the halls has been assigned to us by the committee which partitions them among the various conferences. The charge for a single room is

\$21.00 (NZ) per adult for dinner, bed and breakfast. Children are welcome; for those between 5 and 12 years the rate is half the adult one, children under 5 years are free. A deposit of \$15 (NZ) per adult is required by July 2nd 1983.

All the Halls are on the campus and are on or very near the airport bus route which is part of the municipal transport system. The campus lies almost half way between the airport and the city and is about 15 minutes travelling time from each. The bus-fare from the airport to the campus is 45 cents. The taxi-fare is between six and seven dollars (NZ) per car. The buses run about every thirty minutes during the day.

Typical rates for the motels on the edge of the campus are \$36 (NZ) for 2 adults per night with \$6 (NZ) for each child, and infants free. There are no hotels close to the campus although Christchurch does not lack such establishments of all grades and since all bus routes go through the Square at the centre of the city anyone staying at one of these should have no transport problems.

If you wish to be met at the airport please let us know.

(vi) Registration

Registration fees are payable at the conference and will be \$45 (NZ) for CSMA members;

\$50 (NZ) for non-members (giving membership for the rest of the year);

\$22.50 (NZ) for students and unemployed persons.

A PRE-REGISTRATION FORM FOR THOSE WISHING TO ATTEND THE CONFERENCE IS ON THE LAST PAGE OF THIS NEWSLETTER.

(vii) Banking and Financial Arrangements

The Westpac Banking Corporation and the Bank of New Zealand both have branches on the campus. To handle the finances of the conference and the CMSA in New Zealand an account has been opened with Westpac, University Branch, Ilam, Christchurch, New Zealand. The full number of the account is 028562-030857-0059810-00. On the cheques the bank has created a very distinctive title, XI COMBINATORIES MATHEMATICS CONFERE. We think we know what a 'confere' is but are not sure about 'combinatories' (winter wear for Mrs. Thatcher's government?) Anyway it saves a lot of time if cheques and bank drafts are made out to this title - 'torics' is acceptable for 'tories'!

Credit cards are used in New Zealand. In particular Bankcard, Visa, Diners Club and American Express are valid.

Tipping is not the custom in New Zealand except perhaps at an expensive restaurant. In particular taxi-drivers do not expect a tip.

(viii) Social

It is hoped to have some of the traditional diversions associated with this series of conferences. The Students' Union has Space Invader machines. There is a vineyard (alas only one and that is new) near Christchurch. Day and half-day tours of Banks Peninsular and other places are easy to arrange. Bridge playing is a popular sport in Christchurch. During the conference there will be a display of polyhedron models, about 200 in all, including a matched set of the 59 icosahedra and a complete set of the 76 uniform polyhedra. Christchurch Cathedral has a peel of 13 bells and it is hoped that some instruction or demonstration on bell ringing can be arranged. On the last night the conference dinner will be held in the Staff Club which is the old Ilam homestead set in extensive gardens.

(ix) General Information

The University of Canterbury was founded in 1873 as a constituent college of the University of New Zealand. It became the University of Canterbury in 1957 and in 1962 became autonomous as the old federated University of New Zealand was dissolved. One of its earlier and best known graduates was Lord Rutherford. In 1974 the University completed its move from its beloved but cramped site in the city centre to the 70 hectare campus at Ilam. The historic victorian gothic stone buildings on the old site were then transformed into an arts centre. Internal enrolments in 1982 totalled 7,464. There are faculties of arts, science, engineering, law, commerce, music and fine arts, and forestry.

The urban area of Christchurch has a population of 300,000. The greater part of the city lies on flat area where the Canterbury plains reach the hills of Banks Peninsular. The city is noted for its parks and gardens and through it winds the river Avon. The city is centred on the Square which surrounds the anglican Cathedral. Within the central area are many fine examples of victorian colonial architecture. Christchurch has a long history of musical, dramatic and artistic culture and all these flourish. With its QE2 park, built for the Commonwealth Games, its playing fields and its easy access to the ski-fields of the Southern Alps, Christchurch has great attractions for sportsmen. It is also the base for the Antarctic Deep Freeze projects and the long association with polar exploration can be traced in the new antarctic wing of the Christchurch museum.

2. Personal Column

Congratulations to Drs. David and Elizabeth Billington on the birth of a son Richard Arin on Australia Day, 26th January, 1983.

Professor G. Szekeres, FAA has been invited to give an address to the Eighteenth New Zealand Mathematics Colloquium, Massey University, 23-25 May 1983.

3. Subscription Renewal

Members are reminded that the 1983 subscriptions for the Combinatorial Mathematics Society of Australasia fell due on January 1st. The rates are \$4(Aust) for those in full-time employment and \$2(Aust) otherwise. Prompt payment would be appreciated. Please make cheques, drafts, etc. payable to the CMSA and post with full name and address to Dr. D.R. Breach, Director, CMSA, Department of Mathematics, University of Canterbury, Christchurch, New Zealand. Receipts will be issued. Those within New Zealand send \$5.50(NZ). Those remitting in \$US by cheque send \$6(US).

4. Recent Books

(i) Combinatorial Mathematics IX

Proceedings of the Ninth Australian Conference on Combinatorial Mathematics, Brisbane, 1981. Edited by Elizabeth J. Billington, Sheila Oates-Williams and Anne Penfold Street. Springer-Verlag Lecture Notes in Mathematics No. 952, 1982, 443pp.

Invited Papers:

D.R. BREACH : Star gazing in affine planes.
 P.J. CAMERON : Orbits, enumeration and colouring.
 A. GARDINER : Classifying distance - transitive graphs.
 W.L. KOÇAY : Some new methods in reconstruction theory.
 V. PLESS : On the uses of contracted codes.
 C.E. PRAEGER : When are symmetric graphs characterized by their local properties?
 R.G. STANTON : Old and new results on perfect coverings.

Contributed Papers:

D. BILLINGTON: The graph of hypergraphic realisations of denumerable multisets of degrees; E.J. BILLINGTON: Construction of some irreducible designs; E.J. BILLINGTON and J.M. FITZGERALD: Partitions and the sequence counting problem in economic lot scheduling; J.E. DAWSON: Matroid bases, opposite families and some related algorithms; P. EADES, L. FOULDS and J. GIFFIN: An efficient heuristic for identifying a maximum weight planar subgraph; M.N. ELLINGHAM: Constructing certain cubic graphs; H.M. FINUCAN: Some decompositions of generalised Catalan numbers; D.A. HOLTON, B.D. MCKAY and M.D. PLUMMER: A corollary to Perfect's theorem; J.A. HOSKINS: Factoring binary matrices: a weaver's approach; St. J.G. KETTLE: A class of natural bijections between Catalan families; C. LAM, L. THIEL and S. SWIERCZ: A feasibility study of a search for ovals in a projective plane of order 10; C.H.C. LITTLE: An interesting decomposition of $K_{4n,4n}$ into planar subgraphs; A. MARCZYK and Z. SKUPIEN: Characterizations of different line graphs of graphs; K.K. MCAVENEY:

Some even composite graphs with stability index greater than one; P.J. ROBINSON: Fault-free rectangles titles with rectangular polyominoes; J. SEBERRY: Some families of partially balanced incomplete block designs; D.B. SKILLICORN: Directed coverings and packings of pairs and quadruples; A.P. STREET and ROBERT DAY: Sequential binary arrays II: further results on the square grid; D.J. STREET: A difference set construction for inversive planes; M. SVED: On configurations of Baer subplanes of the projective plane over a finite field of square order.

(ii) Geometries and Groups

Proceedings, Berlin 1981. Edited by M. Aigner and D. Jungnickel.
Springer-Verlag Lecture Notes in Mathematics No. 893, 250pp.

Invited Papers:

F. BUEKENHOUT : The basic diagram of a geometry.
J. DOYEN : Linear spaces and Steiner Systems.
D.R. HUGHES : On designs.
U. OTT : Some remarks on representation theory in finite geometry.
K. STRAMBACH : Geometry and loops.

Contributed Papers:

J. ANDRE: On possible orders of noncommutative tactical spaces; Th. BETH and D. JUNGNICHEL: Mathieu groups; Witt designs, and Golay codes; A. BEUTELSPACHER and U. PORTA: Extending strongly resolvable designs; A.E. BROUWER: Some unitals on 28 points and their embedding in projective planes of order 9; W. FUMY: The large Witt design - materialized; E. KÖHLER: k-difference-cycles and the construction of cyclic t-designs; E.S. LANDER: characterization of biplanes by their automorphism groups; H. LUNEBURG: Ein einfacher Beweis für den Satz von Zsigmondy über primitive Primteiler von A^N-1 ; A. NEUMAIER: On a class of edge-regular graphs; N. PERCSY: Geometries uniquely embeddable in projective spaces; K.E. WOLFF: Strong point stable designs.

(iii) Cryptography, A Primer

by Alan G. Konheim, Wiley-Interscience, 1981, 432pp.

(iv) The Geometric Vein; The Coxeter Festschrift.

Edited by Chandler Davis, Branko Grünbaum and F.A. Sherk. Springer-Verlag, 1981, 598pp.

With contributions by Patrice Assoud, C.M. Campbell, Jeffrey Cohen, H.S.M. Coxeter, Donald W. Crowe, Patrick Du Val, W.L. Edge, Erick W. Eilers, G. Ewald, L. Fejes-Tóth, J.C. Fisher, David Ford, Cyril W.L. Garner, William J. Gilbert, J.M. Goethals, P.R. Goodey, Branko Grünbaum, N.I. Haritovna, Howard L. Miller, S.G. Hoggar, Norman W. Johnston, William M. Kantor, I.N. Kashirina, Ignace I. Kolodner, Joseph Malkevith, John McKay, P. McMullen, J.C.P. Miller, W.O.J. Moser, Stanley E. Payne, Jean J. Pedersen, J.F. Rigby, E.F. Roberston, C.A. Rogers, B.A. Rosenfeld, D. Ruoff, I.J. Schoenberg, J.J. Seidel,

G.C. Sheppard, J. Shilleto, J. Tits, W.T. Tutte, Harold N. Ward, Asia Weiss, J.B. Wilker, J.M. Wills, M.M. Woodcock, I.M. Yaglom.

(v) Combinatorics and Graph Theory

Proceedings, Calcutta 1980. Edited by S.B. Rao.

Springer-Verlag Lecture Notes in Mathematics, No. 885, 1981, 500pp. ← *

Invited Papers:

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| C. BERGE | : Dierfect graphs. |
| P. ERDŐS | : Some new problems and results in graph theory and other branches of combinatorial mathematics. |
| E.V. KRISHNAM-URTHY | : A form invariant multivariable polynomial representation of graphs. |
| L. LOVASZ and A. SCHRIJVER | : Some combinatorial applications of the new linear programming algorithm. |
| K. BALASUBRAMANIAN and K.R. PARTHASARTHY | : In search of a complete invariant for graphs. |
| D.K. RAY-CHAUDHURI | : Affine triple systems. |
| F.C. BUSSEMAKER, R.A. MATHON and J.J. SEIDEL | : Tables of two-graphs. |
| S.S. SHRIKHANDE and N.M. SINGHI | : Designs, adjacency multigraphs and embeddings: a survey. |
| G.A. PATWARDHAN and M.N. VARTAK | : On the adjugate of a symmetrical balanced incomplete block design with $\lambda = 1$. |

Plus 36 contributed papers.

5. Abstract of M.Sc. Thesis

T.E. Gilham, University of Western Australia.
Degree awarded 1982.

Abstract

The concept of a homogeneous tuple system (HTS) was introduced in a paper by Neumaier [1], and further developed in a series of papers by Neumaier and McFeat (see [2], [3]). Their aim was to develop various design-theoretical results within the framework of a uniform and transparent theory. In this thesis we discuss the theory of HTS's and extend many known results.

Firstly we introduce the idea of an HTS, and give some examples and properties. We then consider various recursive constructions to build larger HTS's from small ones. In chapter 3 we relate HTS's to designs and other combinatorial structures, which enables us to summarize some known results more briefly and elegantly. Chapter 4 shows how Hadamard systems and a certain class of HTS's are equivalent, and uses known results on Hadamard systems to derive new constructions for HTS's.

The final two chapters of this thesis discuss the concept of isotopism, or equivalence, of HTS's. In chapter 5 we show how isotopism and design-isomorphism are equivalent, and then we

discuss isotopism of HTS's arising from various examples in chapters 1 and 2. In the final chapter we state some necessary and sufficient conditions for HTS's to exist. We also give a construction for a symmetric matrix with certain properties, which gives information on the existence of HTS's.

- [1]. A NEUMAIER, "Tupelsysteme-eine Gemeinsame Theorie fur Blockplane und Orthogonale Arrays", *Journal of Combinatorics, Information-System Sciences* 2(1977), 41-96.
- [2]. R.B. McFEAT and A. NEUMAIER, "Tuple Systems and some New Constructions For Affine 2-Designs", Submitted to *Journal of Combinatorial Theory (B)*.
- [3]. A. NEUMAIER, "Designs and Tuple Systems", *Lecture Notes*, Westfield College, University of London, 1977.

6. Changes of address, etc.

Please bring to our attention any changes, lapses and omissions in addresses and misdirections on our part. Also tell us news of recent promotions, appointments and awards. In particular the plans of those about to go on leave are always of interest and if known can cut down delays in communications.

7. General News Items

These are always welcome. Send abstracts of theses, recent publications lists, anecdotes, problems, notice of visitors to your departments, complaints, etc. and do not be frightened of tooting your own trumpet. How about a review of one of your own books? Do you know people who might be interested in a sample copy of this newsletter?