Open University
Winter Combinatorics Meeting

Wednesday 21 January 2004

Timetable

10:40 - 10:45	Welcome and introduction Peter Cameron Chair of the British Combinatorial Committee
10:45 - 11:25	Dan Archdeacon, University of Vermont, United States *Problems in Topological Graph Theory*
11:30 - 12:10	Lowell Beineke, Indiana-Purdue University, United States *On the Efficient Elimination of Cycles from Graphs*
12:10 - 13:30	Lunch
13:30 - 14:10	Donald Keedwell, University of Surrey *Tests for loop nuclei and a new criterion for a Latin square to be group-based*
14:15 - 14:55	Ken Gray, University of Queensland, Australia *An introduction to Proportionally Balanced Designs*
14:55 - 15:30	Tea/Coffee
15:30 - 16.10	Jozef Širáň, Slovak University of Technology, Bratislava *Classification of regular maps of negative prime Euler characteristic*
16:15 - 16:55	Peter Cameron, Queen Mary, University of London *Some combinatorics of permutations*

The Meeting is financially supported by the British Combinatorial Committee. Dan Archdeacon's and Jozef Širáň's visits are financially supported by the Leverhulme Trust.

Problems in Topological Graph Theory

Dan Archdeacon, University of Vermont, United States

Do you think you've got problems? I know I do. I'll present a variety of open questions in Topological Graph Theory. Some are old and some are new, all of them (I think) are interesting. Topics include the genus of a graph, automorphisms of maps, coloring maps, crossing numbers of graphs, and many other questions.

On the Efficient Elimination of Cycles from Graphs

Lowell Beineke, Indiana-Purdue University, United States

The decycling number of a graph (also known as the vertex feedback number) is the minimum number of vertices that must be deleted in order to obtain a cycle-free graph. We will give a survey of results on this parameter, including its computational complexity, bounds, and connections with other parameters. We will also give some exact values for graphs in some common families, including grids, hypercubes, and tournaments.

Tests for loop nuclei and a new criterion for a Latin square to be group-based

Donald Keedwell, University of Surrey

We provide easy-to-implement tests for an element of a loop L to lie in one of the three nuclei of L. As a bye-product, we give a new criterion for a Latin square to be group-based.

An introduction to Proportionally Balanced Designs

Ken Gray, University of Queensland, Australia

Balanced block designs can be thought of as collections of subsets of a set of elements, V say with:

- all subsets of the same size,
- all elements occurring in precisely the same number of blocks,
- all pairs of elements occurring in the same number of blocks (the property of balance).

These stringent properties of balanced designs rendered them unsuitable for solving a problem that arose in allocating markers of the Queensland Core Skills Test to the questions they were to mark (see the explanation on the next two pages).

This marking situation required a design in which some elements occurred much more often than others, and yet the design still had to have a property that in some way 'balanced' the occurrences in the blocks of all the pairs of elements.

In essence, if r_i represents the number of occurrences of the element i and $\lambda_{i,j}$ represents the number of occurrences of the pair of elements i, j, then we require that

$$\lambda_{i,k}/\lambda_{j,k} = r_i/r_j \text{ for all } i, j, k$$

In this presentation the speaker will

- introduce the designs that were motivated by the situation, known as proportionally balanced designs,
- outline fundamental results relating to the existence of these designs, and some examples of proportionally balanced designs,
- divulge some new results, including some unexpectedly elegant conditions on the parameters, that relate to the existence of the complementary designs of proportionally balanced designs.

Classification of regular maps of negative prime Euler characteristic

Jozef Širáň, Slovak University of Technology, Bratislava

A regular map is a cellular embedding of a graph in a surface, such that the automorphism group of the embedding is transitive on flags. It is known that (finite) regular maps can be identified with (finite) groups with partial presentation

$$\langle x, y, z : x^2 = y^2 = z^2 = (xy)^2 = (yz)^m = (zx)^n = \ldots = 1 \rangle$$

In the talk we will present a classification of all regular maps on nonorientable surfaces with a negative odd prime Euler characteristic (equivalently, on nonorientable surfaces of genus $p + 2$ where p is an odd prime). One of the consequences of our classification is that there are no regular maps on nonorientable surfaces of genus $p + 2$ where p is a prime such tha $p \equiv 1 \pmod{12}$ and $p \neq 13$.

The talk is based on joint work with A. Breda and R. Nedela.

Some combinatorics of permutations

Peter Cameron, Queen Mary, University of London

Much of Combinatorics concerns set systems (which can also be regarded as hypergraphs, or block designs, or codes, identifying a set with a zero-one vector).Many results and questions have analogues for sets of permutations; sometimes results are known, sometimes they are just conjectured, and sometimes the analogy suggests undiscovered connections. The talk will cover some of these analogies, including intersection theorems, bases and polynomials for permutation groups, and covering radius.