

The 5th Combinatorics Day - Covilhã, April 17, 2015

Programme

Sala de reuniões do Departamento de Matemática
Departamento de Matemática, Universidade da Beira Interior

10:30-11:30 Anna de Mier (Universitat Politècnica de Catalunya)

Approximating and decomposing clutters with matroids

There are several clutters (aka antichains) that can be associated with a matroid, as the clutter of circuits, the clutter of bases or the clutter of hyperplanes. This talk is about the following question: given an arbitrary clutter L , which are the matroidal clutters that are closest to L ? To answer it we must first decide what is the meaning of closest, and to which of the different matroidal clutters we are referring to.

In joint work with Jaume Martí-Farré, we showed that for almost all choices above there is a finite set of matroidal clutters that approximate L and, moreover, that L can be recovered from them. We speak in this case of a decomposition of L . In addition to proving the existence of the decompositions theoretically, we give an algorithmic procedure to compute them.

The same framework also allows us to decompose matroidal clutters of non-representable matroids into representable ones, or into other classes of matroids.

11:30-12:00 Coffee break

12:00-12:30 Maria Elisa Fernandes (UA, CIDMA):

Regular and chiral hypertopes

In 1983 Aschbacher proved that string C -groups are thin, residually connected, regular geometries. Here we will consider C -groups with nonlinear Coxeter diagrams. We show that thin, residually connected regular geometries are C -groups, but the converse is not true. Nevertheless ag-transitivity is a sufficient condition if we want to go the other way around. That is, ag-transitive C -groups are thin, residually connected regular geometries (we use Tits algorithm to get incidence geometry from a C -group). Abstract regular polytopes are string C -groups, as described by McMullen and Schulte in their book (2002). For this reason we use the term (regular) hypertope to designate a thin, residually connected (regular) geometry. Abstract regular polytopes are regular hypertopes with linear Coxeter diagram. Guided by the ideas of chirality in the abstract polytope theory, we extend the concept to a more general setting of incidence geometries. Indeed, when the geometry is thin, it is possible to define chirality, as in the case of polytopes. We give characterizations of automorphism groups of thin residually connected chiral geometries and we show how to construct such chiral objects group-theoretically. One of our focus is the classification of hypertopes of a certain type. Here we consider spherical, locally spherical and locally toroidal hypertopes (hypertopes having all parabolic subgroups either spherical or toroidal).

12:30-13:00 Raquel Simões (UL, CEAFFEL)

Torsion pairs in negative Calabi-Yau triangulated categories.

Calabi-Yau (CY) triangulated categories, i.e. those satisfying a useful duality, are increasingly important throughout mathematics and physics. Much work has been carried out on understanding positive CY triangulated categories, especially in representation theory and algebraic combinatorics. However, little is known in the negative CY case. One way to understand triangulated categories is to study their torsion pairs. These play an important role in tilting theory, as means of comparing different module categories, and have recently been subject to intensive study in the positive CY world, especially in the context of cluster-tilting theory. In this talk we will consider some examples of negative CY triangulated categories, and give a combinatorial classification of their torsion pairs, via 'Ptolemy diagrams'. This is a report on joint work with D. Pauksztello (Manchester).

13:00-15:00 Lunch

15:00-15:45 Carlos André (UL, CEAFFEL)

Supercharacters of the finite unitriangular group $U_n(q)$ are in one-to-one correspondence with colored set partitions of $\{1, 2, \dots, n\}$. If we consider the natural inclusion $U_{n-1}(q) \subset U_n(q)$, we obtain an infinite chain of unitriangular groups. It is possible to define supercharacters of the inductive limit $U_\infty(q)$. Observing that the set of supercharacters of $U_\infty(q)$ is a convex set, we may consider extreme supercharacters of $U_\infty(q)$. In this talk, we define the ramification graph of supercharacters of the finite unitriangular groups and describe briefly the ergodic method to classify the extreme supercharacters of $U_\infty(q)$ as weak limits of certain sequences of supercharacters of the finite unitriangular groups.

15:45-16:30 Ana d'Azevedo Breda (UA, CIDMA)

PL(7, 2) and the Golomb-Welch Conjecture

The Golomb-Welch conjecture, still unsolved, deals with the existence of perfect e -error correcting Lee codes of word length n , $PL(n, e)$ codes. Here and using a methodology inspired in Horak's work on this topic we shall show our approach to $PL(7, 2)$ codes.

16:30-17:00 Coffee break

17:00-17:30 Maria Manuel Torres (UL, CEAFFEL)

Specht modules and critical orbital spaces

We construct bases for critical orbital spaces indexed by standard tableaux and prove that these spaces are canonically isomorphic to Specht modules.

Joint work with José Dias da Silva, Fátima Rodrigues and Pedro C. Silva

17:30-18:00 Manuel Silva (FCT-UNL, CMA)

Ramsey Theory and Combinatorics on Words

The original Ramsey's theorem [1930] is usually described in terms of Graph Theory, but has also many applications in other areas of Combinatorics. We will discuss problems from infinite words in a finite alphabet inspired by Ramsey Theory.

18:00-18:30 Ricardo Mamede (UC, CMUC)

Enumeration of Shi regions with a fixed separating wall

In 2005 Athanasiadis generalized the Narayana numbers by introducing the concept of separating wall for a region in the extended Shi arrangement. Using this concept, Susanna Fishel, Eleni Tzanaki and Monica Vazirani were able to compute the number of dominant regions which have a fixed hyperplane as a separating wall, that is, regions where the fixed hyperplane supports a facet of the region and separates the region from the origin. In this talk we survey some combinatorial results about the extended Shi arrangement and present a bijective proof for the exact number of dominant regions having as a separating wall the hyperplane associated to the longest root in the m-extended Shi arrangement of type A and dimension $n-1$.

This is joint work with Eleni Tzanaki and Alessandro Conflitti.

Organizers: Henrique Cruz (UBI), Ilda Rodrigues (UBI), Rogério Serôdio (UBI), Olga Azenhas (CMUC,UC) and António Guedes de Oliveira (CMUP,FC-UP)

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