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Date Submitted: 2016-07-06 08:21
Title: Sage Days
Event Type: Conference-Workshop

Location:
UBC campus, Earth Science Building room 2012

Dates:
June 29 - July 1st

Topic:
Introduction and contribution to the SageMath software for research in combinatorics.

This is a satellite event to the combinatorics FPSAC conference organized at PIMS the following week.

Methodology:
The event is a mix between:

- * introductory talks and tutorials to get the audience to familiarized with the software and its possibilities
 - * Mathematical lectures related to computer exploration and SageMath development
 - * Project free time where people gather in small groups and work on specific projects
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Objectives Achieved:

- * Get the new comers to SageMath to experiment with Sage and write their first code: around one third of the participants had zero or very little experience with SageMath before the meeting. By the end of the three days, everyone had a way to use SageMath (either online or on their machines) and had written a bit of code.
 - * Get new comers to contribute to SageMath: a lecture was given on how to contribute to SageMath and groups were formed on different projects mixing more experienced people with new comers so that the code that was written could end up being merged to the software.
 - * Get new contributions in the combinatorics component of SageMath: altogether the participants worked on 17 different tickets on the SageMath track system (to track contributions) either reviewing existing ticket, implementing, or creating new tickets. 6 of them already got positive reviews and are on the process of being merged to the software.
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Scientific Highlights:

A neat implementation of Plane Partitions with plotting options was put together as a project during the conference. The two main contributors were Jessica Striker and Jang Soo Kim, the latest didn't have any previous experience with Sage. A demo was given on the last day of the conference.

Organizers:

Viviane Pons, LRI, Universite Paris-Sud
Julien Courtiel, Mathematics department, UBC

Speakers:

Invited speaker:

Mike Zabrocki, Mathematics department, York University
Open Problems in Combinatorial Representation Theory (see abstract below)

Contributed talks:

Viviane Pons, LRI, Universite Paris-Sud
Presentation of Sage

Aram Dermenjian, LACIM, UQAM
Tutorial: introduction to Python and Sage

Jessica Striker, Mathematics department, North Dakota State University
Intro to research-based coding in Sage

Emily Gunawan, Mathematics department, University of Minnesota
Tutorial: Creating a Sage class for a combinatorial object

Amit Jamadagni, undergraduate, Birla Institute of Technology and Science
Knot theory in Sage

Travis Scrimshaw, Mathematics department, University of Minnesota
Crystals in Sage

Dan Romik, Mathematics department, UC Davis
The moving sofa problem

Kevin Dilks, Mathematics department, North Dakota State University
How to contribute to Sage?

Abstract of main lecture from Mike Zabrocki:

Symmetric functions are a tool for understanding the decomposition of S_n/Gln representations into irreducible subspaces. The definitions that arise are well known computations and operations in linear algebra (inverting matrices, conjugation, Gram-Schmit orthogonalization, LU decomposition, etc.), but these computations are very slow compared to manipulations of combinatorial objects.

I'll choose 5 (time permitting) of what I consider some motivating open problems in symmetric functions/combinatorial representation theory. This is a taste of what are just beyond the limits of

algebraic combinatorics now.

k-Schur functions and their structure coefficients

diagonal harmonics, Garsia-Haiman modules, Macdonald symmetric functions, operator nabla

restriction of irreducible modules from GL_n to S_n as permutation matrices

plethysm and inner plethysm structure coefficients

Kronecker product structure coefficients

Sage does all of these computations well, usually as a mix of linear algebra and combinatorics. The algebra of symmetric functions encodes many common combinatorial objects in the coefficients: partitions, tableaux, subsets, words, integer matrices, lattice paths, Dyck paths, parking functions, set partitions, etc. and these objects are used as building blocks to describe combinatorial decompositions.

Links:

The conference wiki page:

<https://wiki.sagemath.org/days78>

The tutorial worksheets and presentation PDF:

<https://cloud.sagemath.com/projects/78ab9ed6-f958-4f9e-9c71-bcd84f7cb06c/files/>

Comments / Miscellaneous:

The workshop was co-funded by the European project OpenDreamKit:

<http://opendreamkit.org/>
