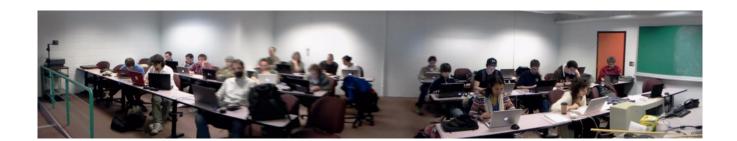# Report on Sage Days at Acadia

Eva Curry (Acadia University)
23 May 2012

Summary

Sage Days 30 was held at Acadia University from May 2-6, 2011. The week-long workshop was organized by Eva Curry of Acadia University and Hugh Thomas of the University of New Brunswick. There were 31 local, national, and international participants. [# projects were developed, other summary of results]. Funding was provided by AARMS (general scientific programs, and Distinguished Lecturer Award), the Fields Institute, Acadia University, and the University of New Brunswick. We are requesting reimbursement for $2888.02 in expenses from AARMS as detailed in the Income and Expenditure Account section.

Description

Sage is an open source mathematical software package which is intended to duplicate and extend the functionality of programs such as Maple and Mathematica, on an open source model. It is a very useful tool for researchers in a number of areas, providing a common interface to specialized software packages such as GAP and Pari. As well, a growing number of resources for using Sage in the classroom are available, including an open content linear algebra textbook (by Rob Beezer of the University of Puget Sound).

Sage Days workshops have been held around the world, and focus simultaneously on introducing new users and developers to Sage, and bringing together expert developers to work on specific development goals. Days 30 followed on from a Sage Days workshop held at the Fields Institute in May, 2010, and focused on two areas of combinatorics (Schubert calculus and cluster algebras) and ergodic number theory (multidimensional digit representations and number systems). This was the first Sage Days workshop to be held in Atlantic Canada.

Presenting at the workshop were Franco Saliola (UQAM, formerly a Fields Postdoctoral Fellow), Nicolas Thiéry (Université Paris Sud), Florent Hivert (Université de Rouen), Anne Schilling (University of California Davis), Jason Bandlow (University of Pennsylvania), and Anders Buch (Rutgers University).

Schedule

Monday

- 9 am: Welcome, and Sage installation help
- 10am-11am : Sage overview (presentation, demo, Sage-Combinat)
- 11am-12pm: coffee break, Introductions, more Sage installations

    Lunch Break

- 1pm: Tutorial: Using the Sage notebook and navigating the help system
- 2pm: Tutorial: Doing the first exercises from Project Euler
- 3pm: coffee break

- 3:15pm: Open tutorials:
  - Tutorial: Linear algebra
  - Tutorial: Combinatorics
  - Tutorial: Words
  - Other resources:
    - The Sage tutorial
    - Sage thematic tutorials and demos
    - Introductory book in French: Introduction à Sage

Tuesday

- 9am-9:30am: Tutorial: Programming in Python and Sage
  - Worksheet: The 3n+1 Conjecture
  - Worksheet: Strings and the Burrows-Wheeler Transform
- 9:30am-noon: Anne: Introduction to implementations for crystal categories.
- 10:30am: coffee break
- 11am: Tutorial: Editing Sage's Sources

  Lunch break

- 2pm: Anders: Strategies for computing Schubert structure constants
- 3:15pm: coffee break
- 3:30pm: Tutorial: how to kindly report a bug or suggest an improvement (20 minutes)
- 3:35pm: Coding sprint organization
- 4pm: Coding sprints

Wednesday

- 9am-9:30: Sign up for projects and short meetings; presentations of work so far
- 9:30-10:45am: Tutorial: Object oriented programming
- 9:30am: concurrent development projects: Scheicher and Thuswaldner algorithm, subspaces, posets
- 10:45am: coffee break
- 11am-11:20am: Tutorial: programming iterators

  Lunch break

- 1:30pm: concurrent development projects: actions
- 3pm: coffee break
- 3:30pm: concurrent development projects: IntegerVectors, crystals, d-complete posets
- 5pm: Coding sprint status report

Thursday

- 10am: coffee break
- 10:15am-12:15pm: Series of Tutorial: Contributing to Sage

- Using and programming sage from the command line
- Creating a patch
- Reviewing a patch, Short step-by-step checklist
- Sage combinat installation

Lunch Break

- 2pm: Coding sprint status report
- 2:30pm: Robert Smith: Equivalence in Computer Algebra
- 3pm: coffee break

Friday

- 10am: coffee break
- 10:15am-11:15am: Tutorial: Contributing to Sage-combinat Mercurial step by step

Lunch break

- submit code for student contribution prize by 1pm
- 2pm: Coding sprint status report
- 3pm: coffee break

Participants

Regional participants included:

Faculty	Eva Curry (Acadia)
	Andre Gagarin (Acadia)
	Jeff Hooper (Acadia)
	John Irving (St. Mary's)
	Mitja Mastnak (St. Mary's)
	Hugh Thomas (UNB)
Graduate students	Neil NcKay (Dalhousie)
Undergraduate students	Kara Allan, (UNB)
	Francis Bischoff (UNB)
	Jeremy Chabot (St. Mary's)
	Calin Fraser (UNB)
	Gaelan Hanlon (UNB)
	Josh Koncovy (UNB)
	Aaron Moss (UNB)
	Ryan Oulton (UNB)
	James Prudhoe (St. Mary's)
	JP Simard (UNB)
	Eric Webster (UNB)

National and international participants included:

Workshop presenters	Jason Bandlow (UPenn) Anders Buch (Rutgers) Florent Hivert (Université de Rouen) Franco Saliola (UQAM) Anne Schilling (UC Davis) Nicolas Thiéry (Université Paris Sud)
Faculty	Rob Beezer (U Puget Sound)
Postdoctoral fellows	Chris Berg (Fields) Christian Stump (UQAM)
Graduate students	Carolina Benedetti (York) Holly Heglin (York)
Other	Jordi Gutiérrez Hermoso Robert Smith

Scientific Highlights

Chris Berg (Fields Institute Postdoctoral Fellow) and Francis Bischoff (UNB) jointly won the Best First Contribution Prize for their implementations of k-Schur functions in non-commutative variables and jeu de taquin for d-complete posets (respectively).

Carolina Benedetti (York University) implemented quantum Grassmanian posets which play a role in her doctoral work.

Nicolas Thiéry, Florent Hivert, and organizer Eva Curry implemented a general method for enumerating points in the integer lattice with bounded l^p norm, an important step toward implementing faster algorithms for generating digit sets and finding neighbors of self-affine tiles arising from number systems.

A number of ongoing projects were completed through the workshop, including:
- patches to Sage's implementation of permutation groups, and
- finalizing the implementations of reflection groups and Coxeter groups.

In addition, substantial progress was made on a number of related development projects during the workshop, including:
- implementing d-complete posets, including slant products, jeu de taquin for increasing tableaux, and cyclic tableaux;
- creating an iterator over LR-tableaux of fixed shape;
- implementing double Schubert and double Grothendieck polynomials;
- implementing set factories, actions on combinatorial free modules, and polyhedral representation of symmetries;
- implementing energy functions of crystals, and bijection between crystal paths and rigged configurations;
- documentation for thematic tutorials; and an Introduction to Sage book.

Income and Expenditure Account

We received grant funding from AARMS ($4000 from the general scientific program + funding for travel for Anne Schilling under the Distinguished Lecturer program), The Fields Institute ($2500), Acadia University ($4000), and the University of New Brunswick (for travel and lodging expenses for students from UNB). Given this generous support, we were able to offer the workshop free to all participants. Expenses for which we are requesting reimbursement from AARMS are detailed below.

Expense	Amount
Travel (round trip airfare between Montreal and Halifax, local travel between Halifax and Wolfville) for workshop presenter Franco Saliola	$530.11
Travel (round trip airfare between Montreal and Halifax, local travel between Halifax and Wolfville) for workshop participant and speaker Christian Stump	$482.45
Lodging for workshop presenters at Victoria's Inn, Wolfville, 2 double rooms at $106/night, 1 single room at $145/night, for 5 nights	$1875.46
Total	$2888.02

Additional information

Resources developed during the workshop are collected on the web site:
http://wiki.sagemath.org/days30

Summary of finances for Sage Days at Acadia, May 2011

Expenses

Airfare for Heglin	$635.35
Taxis for Heglin	$62.00
Airfare for Benedetti	$473.02
Taxis for Benedetti	$95.00
Accommodation for Heglin and Benedetti	$585.95
Airfare for Berg	$452.21
Taxis for Berg	$120.00
Accommodations for Berg	$345.00
Travel for speaker Franco Saliola	$530.11
Travel for speaker Christian Stump	$482.45
Travel and meals for speaker Anne Schilling	$1705.86
Accommodation for speaker Anne Schilling	$761.74
Accommodation for the four other speakers	$1113.72
Travel for the students from UNB	$361.19
Accommodation subsidy for the students from UNB	$1044.19

Total expenses $8771.79

Income

Support from AARMS $6271.79
     up to $4000 for the conference plus
     up to $2500 for the Distinguished Lecturer (Schilling)
Support from Fields (for Benedetti, Berg, Heglin) $2500.00

Total support $8771.79

Support for travel for two of the speakers (Hivert, Thiéry) was handled independently of the conference budget, using funding directly from Acadia University.

The support from AARMS breaks down as $2888.02 which was already invoiced by Acadia, and a further $3383.77 which is now being invoiced by UNB.