Intro to Sage(-Combinat)

Sage Days 49

Free and Practical Software for
(Algebraic) Combinatorics

Orsay, France

Sage

- “Creating a viable free open source alternative to Magma, Maple, Mathematica, and Matlab.”
- Free (As in Speech)
- Free (As in Beer)
- Open Source
- Active Developer Community

Sage

Combines the best open-source math software, glued together with Python:

- ATLAS
- Symmetrica
- GAP
- R
- NumPy
- NetworkX
- Maxima
- Gfan
- … and more (80+ components in all)
- And even more functionality new to Sage itself, e.g. Crystal Bases.

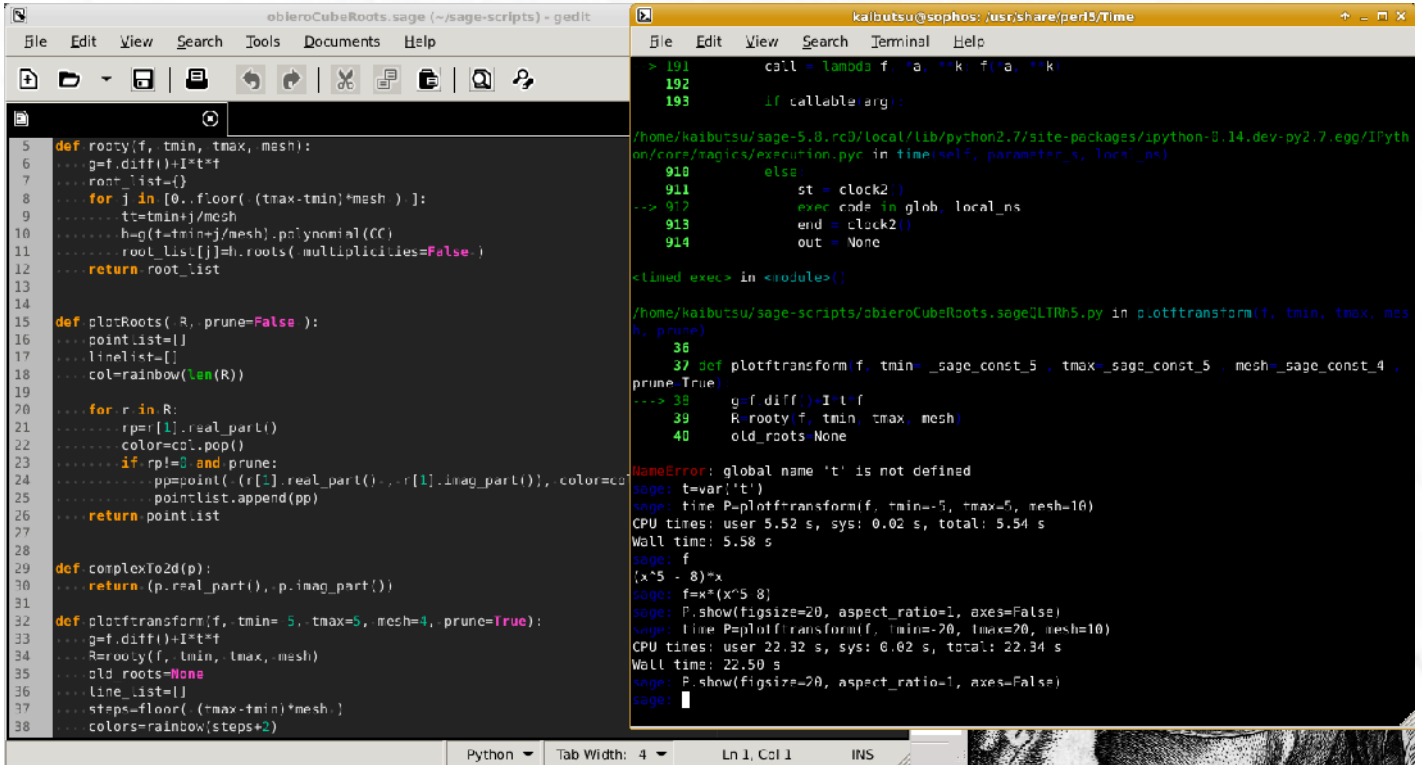
Multiple Architectures

- Linux (Download, unpack, run!)
- OSX (Install Apple Developer Tools first)
- Windows (Via Virtual Box)
- ARM7
- Android?
- Raspberry Pi?

Using Sage: iPython

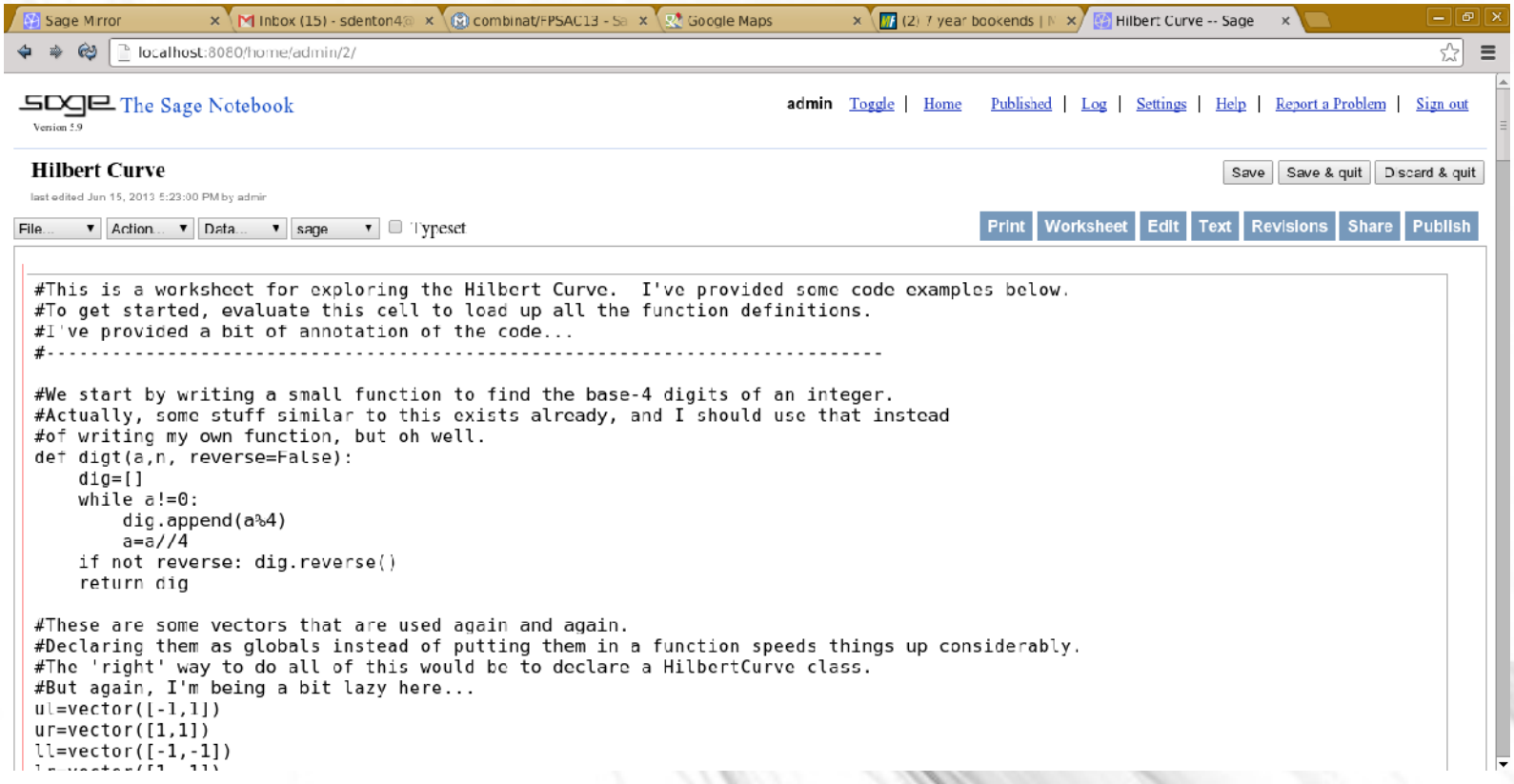
- Sage uses iPython to provide a rich interactive shell.
- 'Command line programming'
- %attach foo.sage

- Not pretty, but great for developers intending to put their code into Sage.
- Also excellent for running 'headless' computations that might take days or months to run.



Using Sage: The Notebook

- Web-based notebook
- 'Cells' for code which evaluate independently, sharing variables and results
- Nice for exploration, in-line graphics
- User-friendly
- Can also be used directly as an interface for R, python, etc

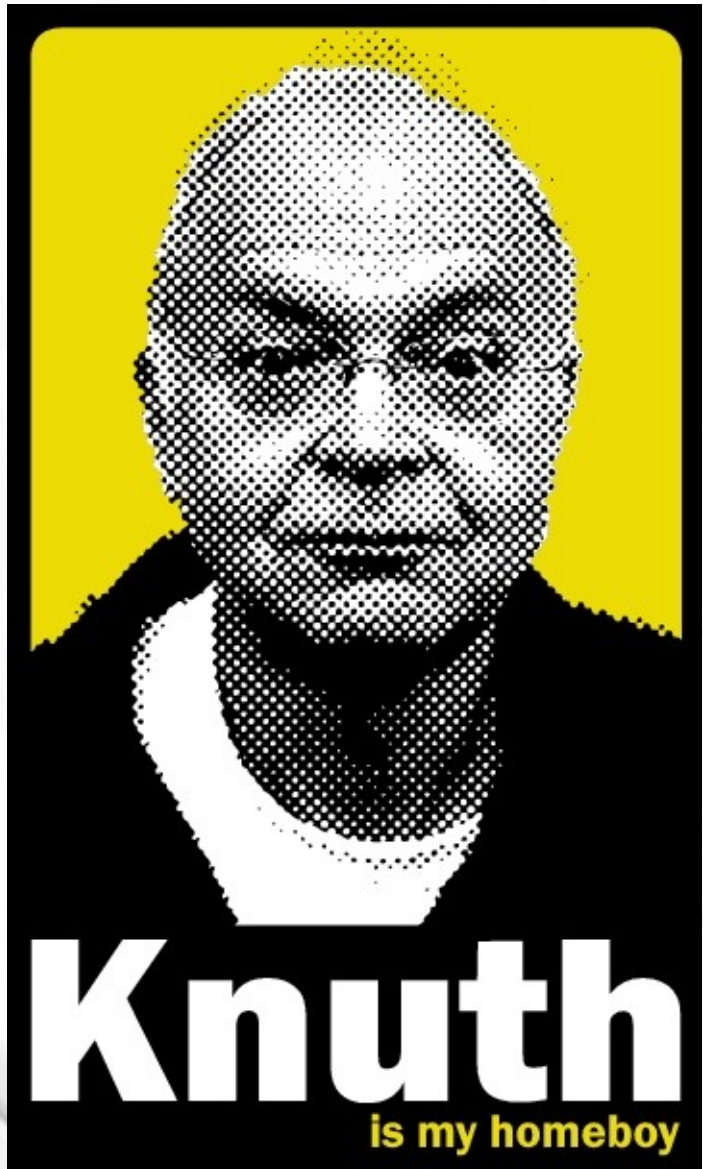


Sage and Python

- Sage uses **Python** inside and out:
  Can think of Sage as (i)Python with super libraries.
- Learn a useful life skill while using your computer algebra system!
- **Cython** is also available:
  Dialect of Python which compiles into C. Cython code is typically many times faster than standard Python/Sage.

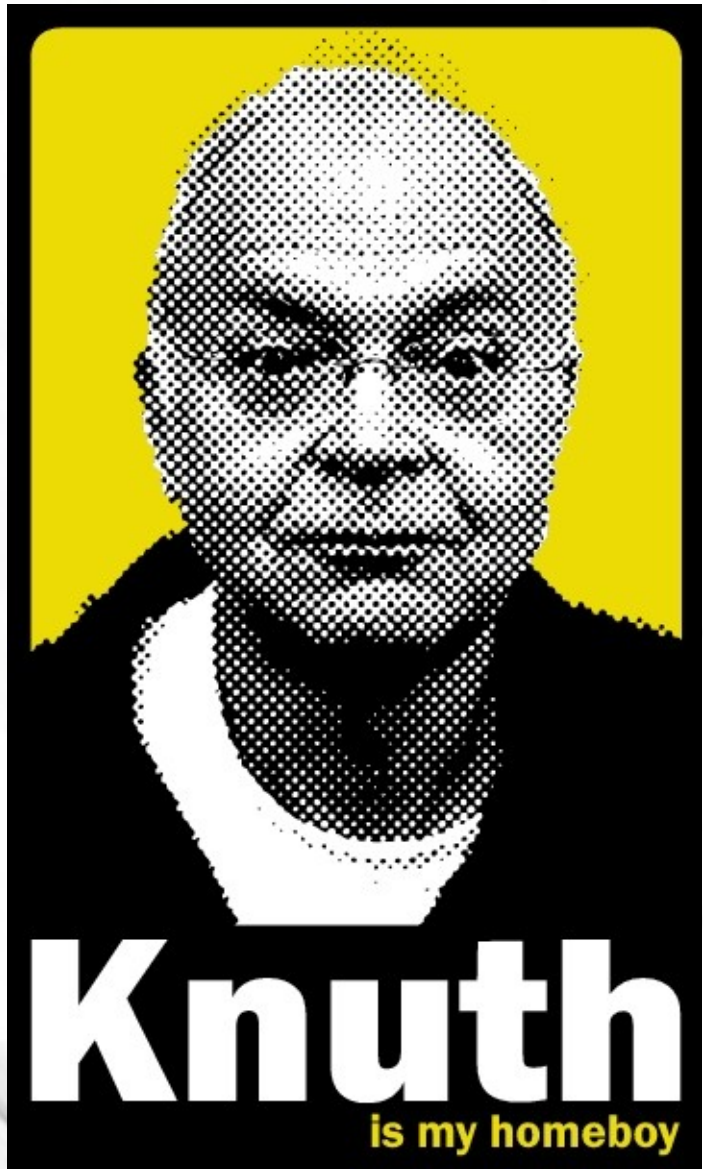
Doing the Math

- “Science is what we understand well enough to explain to a computer. Art is everything else we do.”
- Read,
- Code,
- Conjecture,
- Prove.
  (I search for a proof while Sage searches for a counterexample.)



Teaching with Sage

- Sage Cell Server allows us to build interactive web notes and books.
- Remove illusion that by-hand computation is actually the objective of a class.
- Project Euler, Rosalind (bio):
  Big sets of problems that require programming to solve.



*-Combinat

- Combinat was originally an open-source combinatorics extension for MuPad for sharing research code.
- MuPad itself is not open source; limits size of community.
- In 2009, MuPad-Combinat became Sage-Combinat, after much porting of code.
- Sage-Combinat now exists as a branch of Sage, with its own Mercurial-driven version control system.

Sage in Developing Countries

Sage in Developing Countries

- We live in the future!
- Research-level access for Anyone, Anywhere:
  Arxiv+Sage+Latex =>
  Lower barriers to research-level mathematics
- Allows us to expand the math community....

- But eventually you have to talk to people!

Sage in Developing Countries

- AIMS model
- Workshop model (Sage Days and more)

Problems:

- Separation of disciplines
- Lack of local support – Academic, Institutional
- And and and and and and and and and and and...

Thanks!

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