

## Math 480a: Algebraic, Scientific, and Statistical Computing, an Open Source Approach Using Sage

<b>When</b>	Spring 2008 at the UW; MWF 1:30-2:20 in Sieg Hall 224
<b>Professor</b>	William Stein, <a href="mailto:wstein@gmail.com">wstein@gmail.com</a>
<b>URL</b>	<a href="http://wiki.wstein.org/2008/480a">http://wiki.wstein.org/2008/480a</a>
<b>Office Hours</b>	MWF 2:30-3:30 in Sieg Hall 312 (the Sage lab)
<b>Software</b>	Install Sage (free) and/or sign up for <a href="https://sagenb.org">https://sagenb.org</a>
<b>IRC</b>	#sage-devel on <a href="http://irc.freenode.net">irc.freenode.net</a> ; my nick is wstein.
<b>Mailing list</b>	Subscribe to <a href="http://groups.google.com/group/sage-uw">http://groups.google.com/group/sage-uw</a> and <a href="http://groups.google.com/group/sage-support">http://groups.google.com/group/sage-support</a>

### Your Grade:

- 40% *weekly homework* assignments:
  - Assigned and due each Wednesday.
  - You will grade each other's homework and returned graded homework on Friday; an official grader will also grade the homework.
  - The grader can change any student assigned homework grade.
- 20% *take-home midterm*
- 40% *final project*:
  - Each student will do a final project (more details later).
  - Students may work alone or in groups of two on projects.
  - *You get to choose the topic; start thinking about possibilities now!*

### Relevant Textbooks:

- I am writing a new book as part of teaching this course, and will make the notes available as I write them.
- *The Sage Tutorial, etc.*: <http://sagemath.org/documentation.html>
- *The Python Tutorial*: <http://docs.python.org/tut/>; see also the new <http://docs.python.org/dev/>.
- *Dive Into Python*: <http://www.diveintopython.org/>
- *Scientific Computing with MATLAB and Octave*, by Alfio Quarteroni and Fausto Saleri.
- *A Handbook of Statistical Analyses Using R*, by Brian S. Everitt (Author), Torsten Hothorn.

### Related Course:

- Rekha Thomas's Math 480 this quarter on solving equations will also use Sage. That course meets 10:30-11:20 MWF in Seig 225.

## Detailed Schedule:

<b>Part 1. Computing with Sage</b>	
Monday, March 31	Introduction to Sage; Overview of the course
Wednesday, April 2	Sage: installation, command line, notebook, interfaces
Friday, April 4	Python: control flow, data structures, errors, exceptions
Monday, April 7	Python: classes and inheritance
Wednesday, April 9	Cython: compiled Python
Friday, April 11	Debugging and profiling
Monday, April 14	Distributed source control management
<b>Part 2. Algebraic Computing</b>	
Wednesday, April 16	Groups, rings, and fields
Friday, April 18	Prime numbers and integer factorization
Monday, April 21	Elliptic curves
Wednesday, April 23	Public-key cryptography
Friday, April 25	Matrix arithmetic and echelon form
Monday, April 28	Vector spaces and free modules
Wednesday, April 30	Linear systems
Friday, May 2	Systems of polynomial equations (take-home midterm)
Monday, May 5	Graph theory (take-home midterm due)
<b>Part 3. Scientific Computing</b>	
Wednesday, May 7	Floating point numbers
Friday, May 9	Interval arithmetic
Monday, May 12	Single variable root finding and optimization
Wednesday, May 14	Multivariable root finding and optimization
Friday, May 16	Numerical solution of linear systems
Monday, May 19	Eigenvalues and eigenvectors
Wednesday, May 21	Symbolic integration, differentiation, and limits (rough draft of final projects due)
<b>Part 4. Statistical Computing</b>	
Friday, May 23	Introduction to R and scipy.stats
Wednesday, May 28	Descriptive statistics
Friday, May 30	Inferential statistics
Monday, June 2	Regression
<b>Wrap Up: Student Projects</b>	
Wednesday, June 4	Student project presentations
Friday, June 6	Student projects presentations (final projects due)