Math 581g: Lectures on Modular Forms and Hecke Operators

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Class:

- Monday, Wednesday, Friday at 2:30PM in Denny Hall 313.

Webpage:

- `http://wiki.wstein.org/edu/2011/581g`

Evaluation:

- **70% homework:** assigned each Friday, due the following Friday
- **30% final project:** about 5–10 typed pages and/or computer code on something related to this course
- No exams

Office Hours:

- Thursdays 11:00AM–3:15PM in Sieg 311 (the Sage lab). There is space, so you can just come in and work on the course problems.

Textbook:

- We will follow this (free, unpublished) book closely:

  `http://wstein.org/books/ribet-stein/`

- See also my (free, published) book on computing with modular forms:

  `http://wstein.org/books/modform/`

Software:

- Use Sage to do computations related to the course:

  `http://www.sagemath.org`

Related Seminar:

- The number theory seminar is Thursdays at 3:30 in Padelford C401, and if you're in this course, you should go to the number theory seminar.

Tentative List of Lectures:

- The main objects of this course: torsion points, Galois representations, modular forms, and Hecke operators
- Modularity of elliptic curves and Serre's conjecture
- Modular forms of level 1
- Hecke operators on modular forms of level 1
- Duality and eigenforms of level 1
- Integrality (level 1)
- Modular curves (analytic definition)
- Cusp forms, modular curves, and Eichler Shimura
- Modular symbols (part 1)
- Modular symbols (part 2)
- Modular symbols (part 3)
- Modular forms of higher level
- Atkin-Lehner theory (part 1)
- Atkin-Lehner theory (part 2)
- Field of definition of modular curves (part 1)
- Field of definition of modular curves (part 2)
- Hecke operators as correspondences (part 1)
- Hecke operators as correspondences (part 2)
- The Eichler-Shimura relation
- Abelian varieties (part 1)
- Abelian varieties (part 2)
- Neron models
- Abelian varieties attached to modular forms (part 1)
- Abelian varieties attached to modular forms (part 2)
- L-functions attached to modular forms
- The Birch and Swinnerton-Dyer conjecture: rank conjecture
- The Birch and Swinnerton-Dyer conjecture: leading coefficient
- Survey of results toward the BSD conjecture