Reed College Test-site Report

Math 332: Abstract Algebra

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Portland, OR

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Class structure

M, T, W, F (50 minutes/class)

Texts

Contemporary Abstract Algebra, Joseph Gallian,

Abstract Algebra: Theory and Applications, Tom Judson.

15 students

4 sophomores, 10 juniors, 1 seniors

12 math majors, 2 math/physics/, 1 math/philosophy

Weekly assignments

Sage exercises

- weekly Sage assignments, not mandatory
- 5-minute tutorial at beginning of each class
- student helper: Sam Hopkins, 2 hrs./week
- students turned in printed worksheets

Familiarity with Sage

7 students new to Sage (5 made a sincere attempt)

8 students already familiar with Sage (4 quite good)

What worked?

- Sage provided an avenue into the subject for some students.
- Results discovered using Sage were more easily remembered.
- Sage led to ideas/concepts not covered in class. (Examples to follow.)

Example I

Sage showed $|\mathrm{Aut}(D_4)| = 8$.

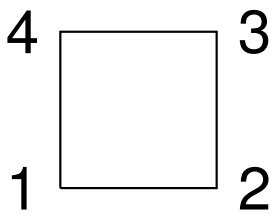
Students knew $D_4/Z(D_4) \approx \mathrm{Inn}(D_4)$.

Led to a discussion of presentations of groups, free groups, etc. and eventually the students proved $|\mathrm{Aut}(D_n)| = n\,\phi(n)$.

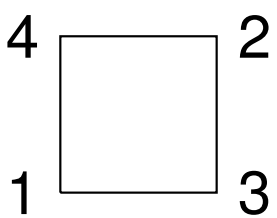
Example II

Exercise: Find the number of conjugates of $(12)(34)$ in S_n for $n \geq 4$.

Students discovered with the help of Sage that $C((12)(34)) \approx D_4$, and tried to relate the elements of $C((12)(34))$ with the isometries of



Correct labeling:



More Examples

1. For which n is $U(n)$ cyclic?
(Ans: $n = q^t$ or $2q^t$ or 4, where q is an odd prime.)

2. What are the order and characteristic of $\mathbb{Z}[i]/(a+bi)$?
(Ans: a^2+b^2 and $(a^2+b^2)/\gcd(a,b)$, respectively.)

3. What are the primes of $\mathbb{Z}[i]$?

4. For which x do $(1,x)$ and $(1,2,\ldots,n)$ generate S_n?
(Ans: Iff $\gcd(x,n) = 1$.)

Complications due to Sage

- Some students felt discouraged and perhaps felt punished for their lack of computer skills.
- Some spent too much time writing code.
- Some assignments called for more knowledge of Sage than provided by the tutorials.

What to do next year?

- Better if students knew Sage before beginning the class.
- Better exercises.
- Cheat sheet for groups, rings, and fields.
- Respond to student evaluations (SALG-M).