**Math 561 Fall 2013- Final Project Guidelines**

The purpose of the final project is for you to learn some representation theory topic that is not covered in class, and then share it with your fellow students. All projects should include some written component, and should convince me that you have actually mastered something new. Beyond that I am willing to be very flexible. Maybe you read a paper and then work out details of some proofs that are left to the reader, or compute some new examples that aren’t in the paper. Class presentations are encouraged but not required. If you do not present in class, your written project should be readable by someone who has taken the class. You can work individually or with a partner (expectations are higher though for two people and both should understand the entire project.)

\*By **Monday November 4** you should give me your proposed idea so I can approve it and set aside enough class time. At this point I am planning on the last week of class and the final exam.

**Ideas for Projects:**

1. Representation theory in chemistry (see James/Liebeck application to molecular vibration or paper on Buckminsterfullerene by Gordon James or Dover book by Bishop.)
2. Present Alperin’s weight conjecture and demonstrate some examples where it holds.
3. Okounkov-Vershik approach to repr theory of S\_n.
4. Character theory proof of Frobenius kernels being subgroups.
5. Representation type of an algebra, examples of finite, tame and wild type.
6. Applications of symmetric group character theory to voting, ranking, shuffling.
7. Classification of irreducible representations of alternating groups.
8. Plethysm and Foulkes’ conjecture.
9. Fast Fourier transforms on finite groups.
10. Representation theory in probability and statistics (start with book by Diaconis)
11. Littlewood-Richardson rule and related topics.
12. Representations of Hecke algebras of type A.
13. Character table of SL(2,2^n)
14. P-modular reduction and decomposition matrices.
15. Asymptotic representation theory of symmetric groups.
16. Representations of Lie algebra sl\_3(C).
17. Representation theory of quantum enveloping algebra U\_q(sl2) (Problem 2.16.5 in the book)
18. Representation theory in physics (Problem 4.12.11 or many other possibilities).
19. Category equivalences in representation theory.
20. Representations of diagram algebra.