Pries: 467 Abstract Algebra II, Spring 2013
Information about project reports and presentations.

The project presentations and reports are an opportunity to learn something new in greater depth. They provide a good way to develop skills at speaking and writing mathematics. In addition, they will give us a chance to have an overview of many interesting topics in abstract algebra that we wouldn't see otherwise.

Presentations: 20 minutes long per person, during last two weeks of class.
Delivery method: dotcam, computer, or blackboard.
Make sure to practice - especially if you're using the blackboard.
Written report: 10 pages, due 5/14 at 10 am.

Things to include:

1. What: topic title, definitions needed for topic.
2. Where/When/Why: motivation for studying topic, history of topic, applications of topic.
3. **** Facts: important properties and theorems about topic.
4. *** Examples: by hand or using computer.
5. ** Visual: graph, data, picture.
6. Proofs (especially for written report).
7. References: (only for written report).

Possible topics The topic of your project should be connected to one of the central themes of this class: non-abelian groups and/or group actions.

1. Semi-direct products (generalization of dihedral groups).
2. Alternating groups: simple for $n \geq 5$, isomorphism between A_5 and the symmetry group of a dodecahedron.
3. Solvable groups, composition series.
4. The Sylow theorems: structure of p-group subgroups of a group. Artin 6.4.
5. Special unitary groups, orthogonal representation of SU_2.
6. Linear groups: generators, center, projective linear groups. There are infinitely many simple linear groups.
7. Motions of $\mathbb{R}^2$ and $\mathbb{R}^3$: classification of finite subgroups of $O(2)$ (cyclic and dihedral) and $O(3)$ (platonic solids), discrete subgroups and lattices, 17 crystallographic groups. Classification of conics in n dimensions. Artin chapter 5.

8. $\mathbb{C}[t]$-modules (abelian group with action of $\mathbb{C}[t]$).

9. Bilinear forms, symmetric positive definite forms, diagonalizing real symmetric matrix, orthogonal complements.

10. Hermitian forms, Hermitian matrices, unitary matrices, spectral theorem.

11. The Todd-Coxeter algorithm: using generators and relations for describing a group operation in terms of an action on cosets. Artin 6.9.