

### **3 Quiz 3**

This is a take home quiz. It is supposed to be closed book. The time limit is 90 minutes (one and a half hours). It is due on Wednesday. The quiz has three questions about permutations, Lagrange's theorem and the isomorphism theorems. When you are ready to take the quiz go to page 2.

- 1) a) What is the definition of the *order* of an element?  
b) What is the relationship between the cycle form of a permutation and its order.

c) What numbers are the orders of elements of  $S_8$ ?

2) a) What is the statement of Lagrange's theorem?

b) If  $K < H < G$  are finite groups prove that

$$|G : K| = |G : H||H : K|$$

3) a) What is the statement of the first isomorphism theorem?

b) Use the first isomorphism theorem to prove that  $\mathbb{Z}_3$  is isomorphic to  $\mathbb{Z}_{27}/\mathbb{Z}_9$ .