MAT 334
Group Explorer Assignment
Friday, March 10, 2006

1. Download a copy of *Group Explorer v2.0* from `www.platosheaven.com`

2. Run Group Explorer

3. Open the group D_4.

4. For each subgroup H_i inside of D_4, do the following:

   (a) What is the order of the subgroup H_i?

   (b) What is the index of the subgroup H_i in D_4?

   (c) Find the Left and Right Cosets of the subgroup H_i in D_4. To do this, right click on $H_i \rightarrow$ Compute $\rightarrow$ all left cosets gH_i of H_i.

   (d) Is the subgroup H_i normal? That is, do the left and right cosets coincide?

   (e) Highlight the subgroup. Right click on the Subgroup $\rightarrow$ Highlight item by $\rightarrow$ Pick any.

   (f) Organize the group by the subgroup. In the Table tab, under "Organize by subgroup:" pick H_i.

   (g) Is the table "nice"?

5. Compare your answers in part (b) and part (e). Do you see any relation?

6. Lagrange's Theorem states that if H is a subgroup of a finite group G, the the order of H divides the order of G. Is the converse of Lagrange's Theorem true? That is, if G is a group of order n, does G necessarily have a subgroup of order d for all divisors d of n? Hint: Look at the group A_4.