299 SPRING 2009 **HOMEWORK 13**

Turn in your solution to at least two of the problems. **Explain your solution in full sentences. Give detailed reasonings.** Include diagrams and figures if appropriate.

Definition. The *optimal stone number* $\pi_{opt}(G)$ of a graph G is the minimum number of stones for which there is an initial stone distribution of $\pi_{opt}(G)$ stones such that it is possible to move a stone to any goal vertex.

The *cover stone number* $\gamma(G)$ of a graph G is the minimum number of stones such that it is possible to move a stone simultaneously to all the vertices from any initial stone distribution of $\gamma(G)$ stones.

Problem 1. Find the optimal stone number of a path containing 3 vertices. Find the optimal stone number of a path containing 4 vertices. Find a conjecture for a path with n vertices?

Problem 2. Find the cover stone number of a cycle containing 3 vertices. Find the cover stone number of a cycle containing 4 vertices. Find a conjecture for a cycle with n vertices?

Problem 3. We have a cube on the table. We are allowed to rotate the cube by 90 degrees around an edge that touches the table. Is it possible to rotate the cube around every edge of the cube exactly once so that the cube returns to the orighinal location when we are done?