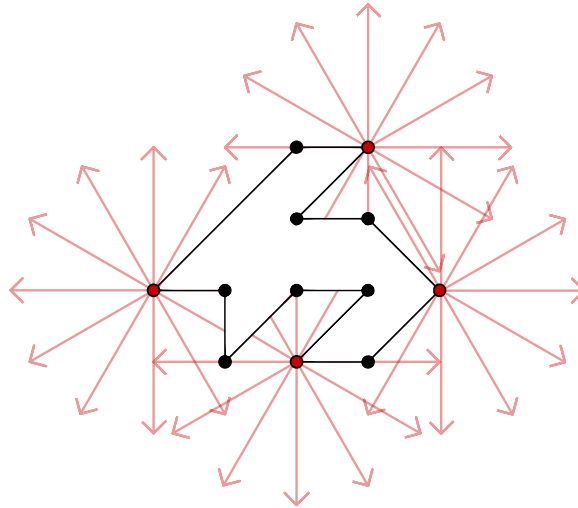


Homework 4: The Art Gallery Problem

*Due Tuesday, week 5, at the start of class**UCSB 2014***Checkdown/also extra-credit problem.**

So, this week is slightly weird. To get credit for this problem, just work on it; i.e. think about it, write down ideas, and otherwise spend a hour or two trying to figure out what's going on. Assignments that show effort (i.e. $> 1/2$ page of work and writing, coherent thoughts, good questions for me) will get credit. If you fully answer the problem, you get the extra-credit half-point as well!

1. (**Fortress problem.**) Take a polygon P with n sides. Consider the following task: we want to station observers at the vertices of P , such that they can guard the entire "outside" of P . In this situation, we assume that the guards cannot "see through" P 's walls, and can only look out from their positions. For example, here is a polygon P being guarded by four guards:



A polygon with observers guarding its outside. Observers are denoted by red vertices; sample sight lines are drawn in pale red.

Basically, this is the art gallery problem, except we're guarding the outside instead of the inside!

Suppose that P is an arbitrary polygon with n vertices. What is the maximum number of guards needed to guard the exterior of P ? Justify your answer; i.e. explain why you must be right!