Problem set 1

This problem set is due in class on September 15th, 2005. It is compulsory, but as the main question is quite challenging, it will only be used to increase your grade.

1. Name and email?

   Which math classes have you taken?

   Have you seen linear programming before and if so, to what extent?

2. The goal of this exercise is to familiarize you with the intrinsic complexity of combinatorial optimization problems. Consider the 7×7 grid drawn in Figure 1. Given an assigment of signs (+ or -) to the vertices of this grid, a *violation* corresponds to either a thick (solid) edge with two different signs at its endpoints or a thin (dashed) edge with identical signs at its endpoints. The goal is to find an assignment of signs which minimize the total number of violations in the grid.

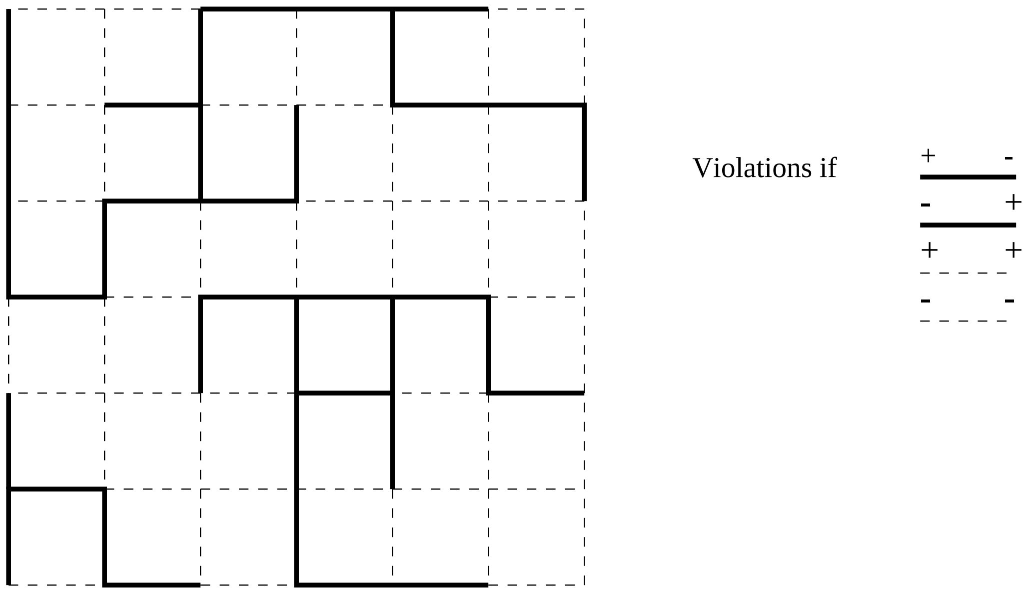

Figure 1: The instance

As you'll probably realize, although finding a "good" assignment of signs might not be that difficult, convincing yourself that your solution is optimal is in fact quite challenging. In addition to the assignment of signs and the corresponding number of violations, a perfect answer should thus also include a proof that the solution is indeed optimum.