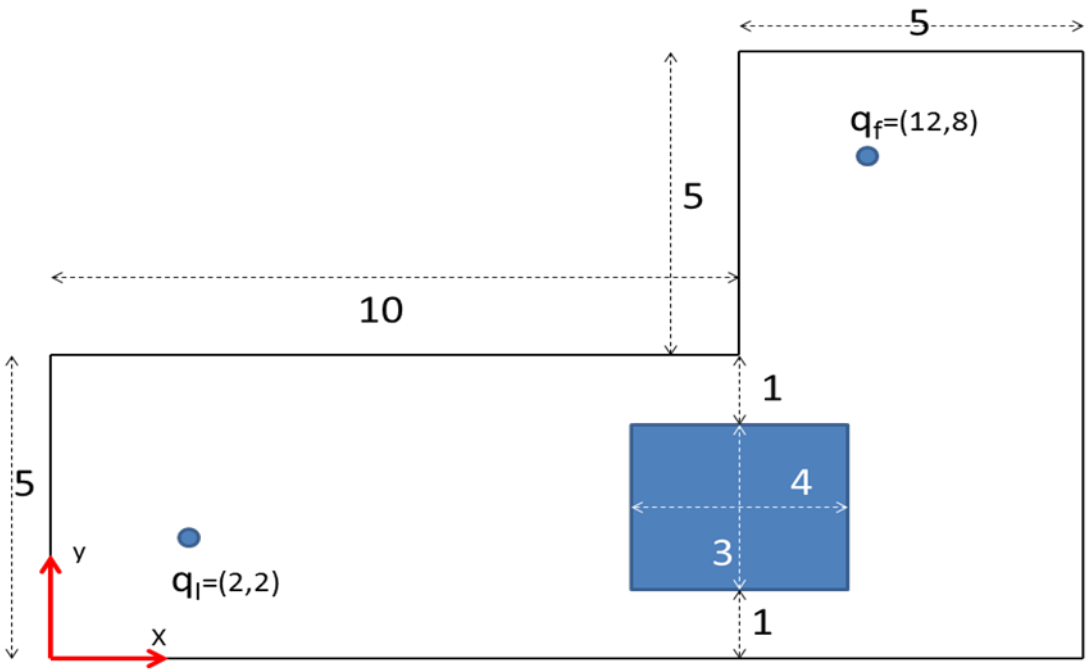
ME 132: Homework #2
(due Thurs. May 2, 2013)

Problem #1 (35 points): This homework focuses on road map based planners. Consider the motion planning environment below, consisting of an L-shaped room with a rectangular obstacle symmetrically located in the "neck" of the L. For convenience a reference coordinate system is placed in the lower left hand corner of the room. The goal is to find a collision-free path for a point-like robot from the initial configuration (2,2), as measured in the reference system, to the goal location (12,8).



You should implement (in any programming environment that you choose) a bare bones road map planner to solve this problem (so far we have discussed the visibility graph and the Voronoi diagram. You can use one of these, or another method). No matter which approach you choose, you should implement the following subroutines:

1. ***Road Map Generation.*** Construct a procedure to build the 1-dimensional set of curves. Describe the principle behind your road map if you don't use the visibility graph or Voronoi diagram.
2. ***Accessibility/Departability planner.*** If you don't use the visibility graph, then you will need to construct a method to get onto the roadmap from the starting configuration q_i, and then get off of the roadmap at q_f.
3. ***Graph Search Method.*** You need not implement a detailed graph search algorithm (such as an A* or depth-first search), though you will most likely have to implement such a search algorithm for your final project.

To demonstrate your planner, show the road map you generate, as well as the actual planned path of the robot.

Problem #2 (5 points): The "silhouette" of a configuration space obstacle (c-obstacle) is the *projection*, along the rotation axis, of the c-obstacle boundary onto the x-y plane. The silhouette is a conservative approximation of an actual c-obstacle, and hence it is useful in practical motion planning algorithms where computational speed is an issue. The silhouette also allows roadmap algorithms (such as the visibility graph) which are limited to 2-dimensional c-spaces to be applied approximately to 3-dimensional c-spaces. which are Sketch an algorithm for computing the silhouette of a planar polygonal robot. Hint: this algorithm is simple if one assumes that the *convex-hull* of a polygon can be computed.