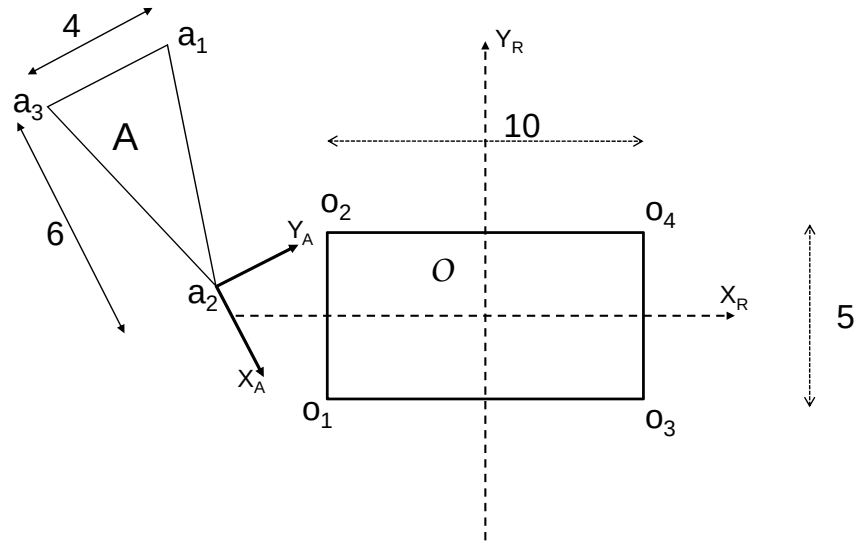
ME/CS 132: Homework #1

(Due Thursday, April 18, 2013)

Consider the convex polygonal robot, $\mathcal{A}$, and obstacle, $\mathcal{O}$, shown in Figure . The obstacle is a rectangle with side dimensions of 5 and 10 units, whose center is coincident with the origin of the fixed workspace observing reference frame (whose axes are denoted by X_R and Y_R). The rectangle faces are parallel to the workspace reference frame axes. The robot is an isoceles triangle whose base dimension is 4 and whose height is 6. Its body fixed reference frame is located so that its x-axis is aligned with the triangle's centerline, and its origin is located at the vertex bounded by the two equal sides.



Problem 1: Write a Mathematica (or other programming language) function to create the outline of the c-obstacle for a fixed orientation of $\mathcal{A}$. Create the c-obstacle outline for the case of $\theta = 45^o$, where θ is the orientation of $\mathcal{A}$.

Problem 2: Using the function from Problem 1, create an visualization of the c-obstacle by superimposing on a single 3-dimensional view the constant orientation c-obtacle boundaries for orientations of $\mathcal{A}$ in 10^o increments (in the range $\theta \in [0^o, 360^o]$). That is, plot 36 constant orientation slices (with each orientation differing by 10^o) on a single 3-dimensional view (with the axes being x, y, and θ).

Problem 3: Create the function that describes the surface boundary "patch" of the c-obstacle associated with Type EV contact between robot edge $E_1^{\mathcal{A}}$ (which connects vertices a_1 and a_2) and obstacle vertex o_1. Also determine the boundaries of this patch. Plot this patch using Mathematica, Matlab, or anoother approach.