Homework 2: Control

1. (60 pts) Apply iLQR to the differential drive vehicle for a length of time $T = 2\pi sec$ using $(x_d, y_d, \theta_d) = (\frac{4}{2\pi}t, 0, \pi/2)$ subject to the dynamics,

$$\begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \end{bmatrix} = \begin{bmatrix} \cos(\theta)u_1 \\ \sin(\theta)u_1 \\ u_2 \end{bmatrix}, \ (x(0), y(0), \theta(0)) = (0, 0, \pi/2).$$

   Use a semi-circle as an initial trajectory and $(x_d, y_d, \theta_d) = (\frac{4}{2\pi}t, 0, \pi/2)$ as a reference trajectory. Note this corresponds to an infeasible trajectory for parallel parking. **Turn in:** Plots of the initial trajectory, the final optimized trajectory, and the optimized control signal.(Hint: You can get the semi-circle by simulating the system forward using $u_1(t) = 1$, $u_2(t) = -1/2$ for a length of time $T = 2\pi sec$)

2. (40 pts) Apply SAC to the same vehicle example over the time $(0, 2\pi)$. **Turn in:** Plots of the initial trajectory, the final optimized trajectory, and the optimized control signal.