Exercise 1.1

Consider a sysetm with dynamics given by

$$\begin{bmatrix} \ddot{x} \\ \ddot{y} \end{bmatrix} = \begin{bmatrix} u_x \\ u_y \end{bmatrix} \tag{1}$$

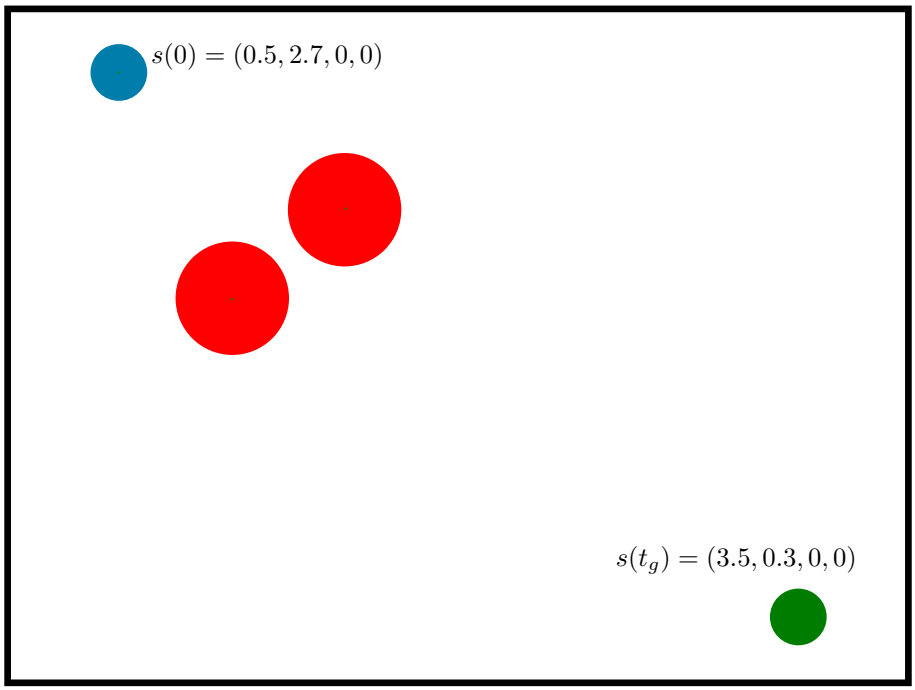
where $(u_x, u_y) \in \mathbb{R}^2$ is the control input.
The following constraints are imposed on the system

$$\dot{x}^2 \leq 1 \tag{2}$$

$$\dot{y}^2 \leq 1 \tag{3}$$

$$\begin{bmatrix} u_x \\ u_y \end{bmatrix} \in \left\{ \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 0 \\ -1 \end{bmatrix} \right\} \tag{4}$$

The robot operates in a 3 m by 4 m workspace and occupies a disc of diameter 0.25 m. Disk-shaped obstacles with diameter 0.5 m are located at $(x, y) = (1 \text{ m}, 1.7 \text{ m})$ and $(x, y) = (1.5 \text{ m}, 2.1 \text{ m})$.



Find a path connecting $s = (0.5, 2.7, 0, 0)$ with $s' = (3.5, 0.3, 0, 0)$.