Congratulations! You passed!
TO PASS 80% or higher

Keep Learning

GRADE
100%

Quiz 6

LATEST SUBMISSION GRADE
100%

1. Which of the following statements is true? **1 / 1 point**

- ○ In a world populated solely by convex obstacles, simple go-to-goal and purely reactive (point straight away from the obstacle) avoidance behaviors will suffice.
- ◉ The induced modes can avoid robots getting stuck in complex environments.
- ○ They are all false.
- ○ It is always better to switch among behaviors than to blend them.
- ○ Without the induced modes, the navigation system can potentially exhibit Type 2 Zeno Behavior.

Correct
Review the concepts from lectures this week, and think through each of the scenarios described to answer this question.

2. In Week 6, we used a point-robot model, **1 / 1 point**

$$\dot{x} = u, \;\; x \in \Re^2,$$

to describe the robot dynamics. But, the actual robot is nonlinear. So, when implementing the behaviors, we have to map the point-robot input

$$u = \begin{bmatrix} u_1 \\ u_2 \end{bmatrix},$$

onto the real control signals, i.e., onto (v, ω) in the unicycle case. Which of the following control designs would make a unicycle model mimic the point-robot model reasonably well?

- ◉ $v = \|u\|, \;\; \omega = K(\text{atan}(u_2/u_1) - \phi), \; K > 0$
- ○ $v = \|u\|, \;\; \omega = K(\text{atan}(u_1/u_2) - \phi), \; K > 0$
- ○ $v = \|u\|, \;\; \omega = K(\text{atan}(u_1/u_2) - \phi), \; K < 0$
- ○ $v = \|u\|, \;\; \omega = K(\text{atan}(u_2/u_1) - \phi), \; K < 0$
- ○ $v = u_1, \;\; \omega = u_2$

Correct
If you're having trouble working through the geometry in this question, look through the available answers and use the process of elimination. Once you decide whether v should be the magnitude of u ($\|u\|$), move on to whether K should be positive, etc....

3. Assume that we have constructed two different behaviors that give the desired direction of travel as u_1 and u_2, where $u_1, u_2 \in \Re^2$. Moreover, assume that the induced mode on the switching surface between these two behaviors is given by **1 / 1 point**

$$u_{ind} = M u_2,$$

where M is given by

$$M = \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} \\ -1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}.$$

What do we know about the new, induced behavior u_{ind}?

- ◉ u_{ind} is u_2 rotated $-\pi/4$ radians.
- ○ u_{ind} is $u_2/\sqrt{2}$.
- ○ u_{ind} is u_2 rotated $-3\pi/4$ radians.

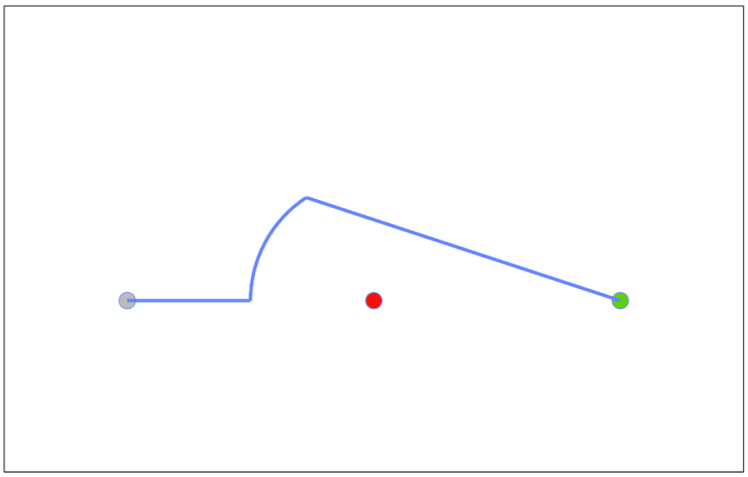
u_{ind} is u_2 rotated $3\pi/4$ radians.

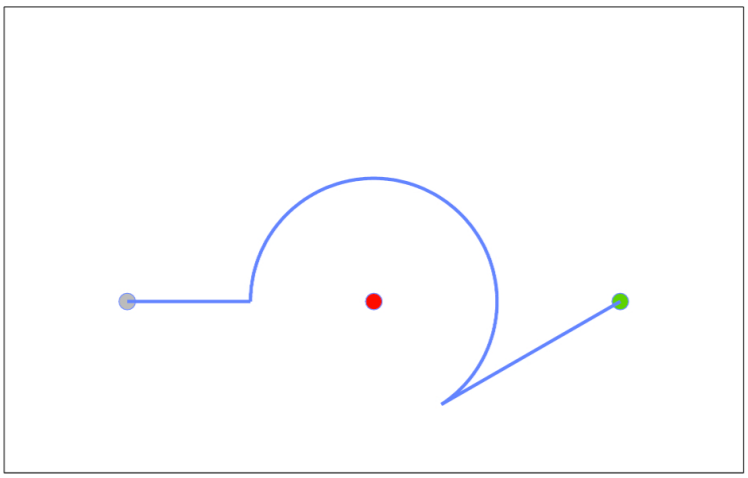
u_{ind} is u_2 rotated $\pi/4$ radians.

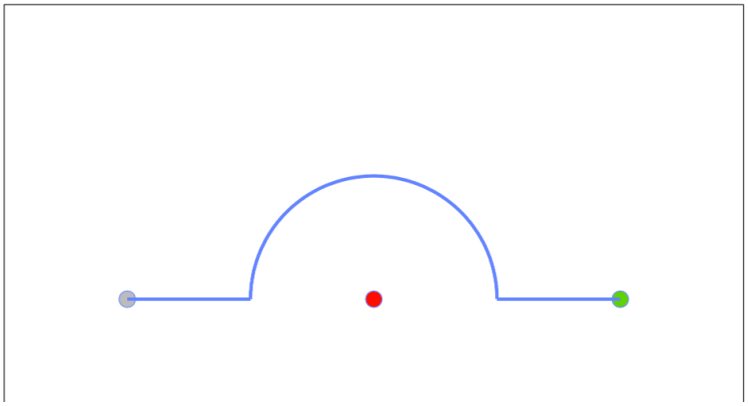
Correct

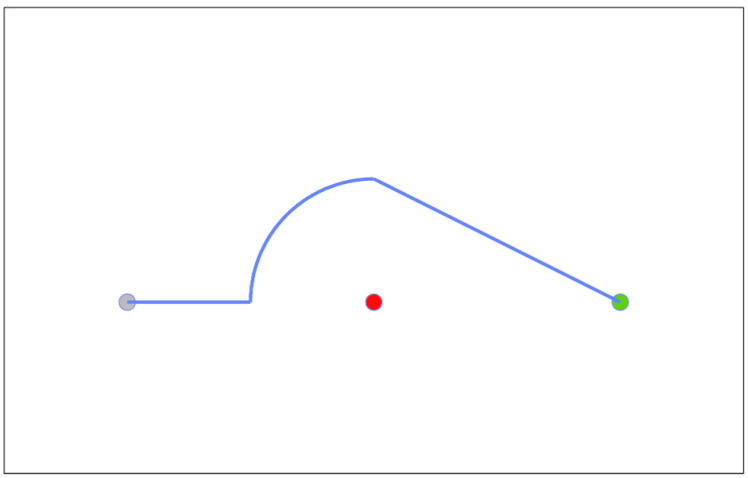
Pay careful attention to the structure of M. Have you seen matrices of this form? Go back and find the general form of a rotation matrix.

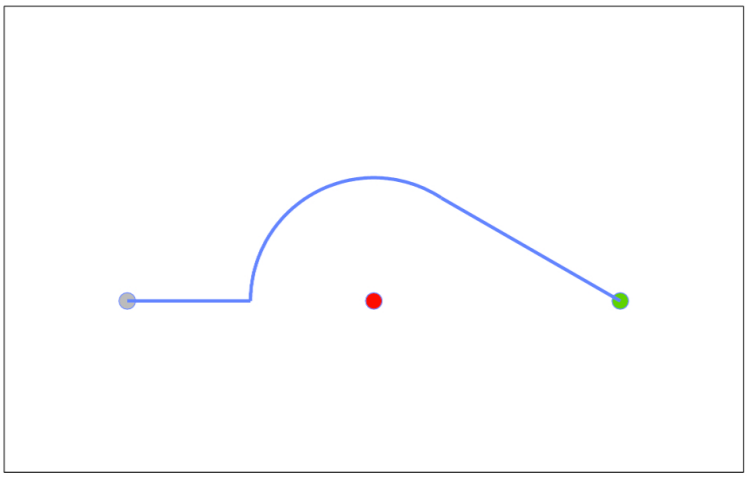
4. Given a point-robot in the environment shown below. Let the robot execute the navigation scheme in slide 6.6.3. Which of the following trajectories is correct? (Note that the robot goes clockwise around the obstacle -- this is arbitrary as both clockwise and counter-clockwise follow-wall behaviors are consistent with the geometry). **1 / 1 point**











✓ **Correct**
Think through the vectors and switching conditions for the follow wall and avoid obstacle and go-to-goal behaviors!

5. In the videos in Lecture 6.8, the light was dimmed when driving the robots around. What is the reason for this? **1 / 1 point**

- The light-bulbs went out in the recording studio.
- The wheel encoders are affected by bright lights.
- The obstacle-avoidance behaviors use ultra-sonic sensors, and they are light sensitive.
- It made the movies look more mysterious.
- The obstacle-avoidance behaviors use infra-red sensors, and they are light sensitive.

✓ **Correct**
Hint: Think (or google)!