Congratulations! You passed!

TO PASS 80% or higher

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Module 6 Graded Quiz

LATEST SUBMISSION GRADE

100%

1. True or false, a kinematic model gives the equations of motion for our robot, while disregarding the impacts of mass and inertia.

1 / 1 point

- (•) True
- ( ) False

Correct
Correct, kinematic models focus on motion and not mass or inertia.

2. True or false, a dynamic model is a model used exclusively for rotating robots.

1 / 1 point

- ( ) True
- (•) False

Correct
Correct, a dynamic model is a model that takes mass and inertia into consideration within the equations of motion.

3. For the bicycle model, the state of the robot contains which of the following values?

1 / 1 point

- [x] Heading

Correct
Correct, the position and heading form the state in the bicycle model.

- [ ] Curvature
- [x] X Position

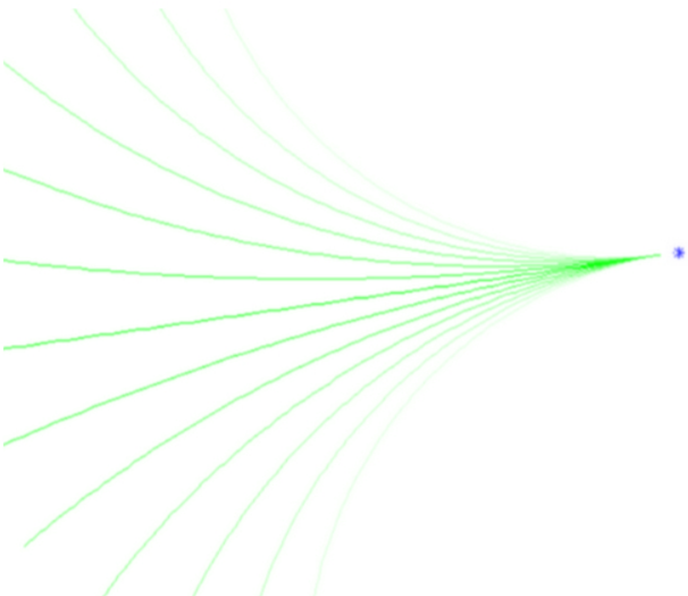
Correct
Correct, the position and heading form the state in the bicycle model.

Correct, the position and heading form the state in the bicycle model.

- [x] Y Position

✓ **Correct**
Correct, the position and heading form the state in the bicycle model.

4. For this image, assuming each path is of equal length, what input parameter to the bicycle model is being varied across each path? **1 / 1 point**



- (•) Steering Angle
- ( ) Velocity

✓ **Correct**
Correct, each path is of equal length in the same time horizon, so they must have the same velocity. Each path corresponds to an arc of different curvature, so the steering angle must vary across each path.

5. True or false, implementing trajectory propagation recursively is slower than computing the entire sum at each step. **1 / 1 point**

- ( ) True
- (•) False

✓ **Correct**

Correct, implementing trajectory propagation recursively is much more efficient than re-computing the entire sum at each step.

6. Why is collision checking computationally challenging in exact form?

1 / 1 point

- ◯ It requires perfect information about the surroundings
- ◯ It requires heavy geometric computation in a continuous domain
- ◯ The problem scales with the number of obstacles in a given scene
- ◉ All of the above

✓ **Correct**

Correct, all of these contribute to the challenge of collision checking.

7. What is the swath of an autonomous vehicle as it drives along a path?

1 / 1 point

- ◯ The region surrounding an autonomous vehicle that is occupied by static obstacles in a given driving situation
- ◉ The union of all sets of space occupied by the autonomous vehicle as it traverses the path
- ◯ The entire region surrounding an autonomous vehicle that is safe for traversal in a given driving situation

✓ **Correct**

Correct, this is the space the car occupies along the path.

8. Suppose the ego vehicle is currently at the origin, (0.0, 0.0, 0.0), and one of the points in its footprint is at (0.5, 0.5). One point along the ego vehicle's path is (3.0, 2.0, pi/4). After performing rotation and translation on this footprint point relative to this path point, what is the footprint point's corresponding position?

1 / 1 point

- ◯ (3.0, 3.0)
- ◉ (3.0, 2.707)
- ◯ (3.707, 3.0)
- ◯ (3.707, 2.0)

✓ **Correct**

Correct, this comes from rotating the point about the origin by pi/4 and then translating it by (3.0, 2.0)

(3.0, 2.0).

9. True or false, swath-based collision checking sweeps the ego vehicle's footprint along its path, and checks to see if any obstacles lie within this set of space.

1 / 1 point

- (●) True
- ( ) False

✓ **Correct**

Correct, swath-based collision checking computes the union of all footprints along the ego vehicle's path, then checks if obstacles lie within the region given by the swath.

10. Which of the following is not true about circle based collision checking?

1 / 1 point

- ( ) It uses circles to quickly estimate collision points by checking if the distance to an obstacle is less than any circle radius
- (●) It uses the friction circle to estimate how close the ego vehicle can be to nearby obstacles
- ( ) It conservatively approximates the vehicle footprint using multiple circles
- ( ) It relies on discretizing the path into a sequence of points that the circles can be rotated and translated to

✓ **Correct**

Correct, the friction circle is not relevant for the circle-based collision checking algorithm.

11. To generate a set of arcs in the trajectory rollout algorithm, which input needs to be varied in our bicycle model?

1 / 1 point

- ( ) Heading
- ( ) Velocity
- ( ) Angular Acceleration
- (●) Steering Angle

✓ **Correct**

Correct, by varying the steering angle we get a set of arcs of varying curvature.

12. What is the objective function used in the trajectory rollout algorithm for determining which trajectory to select from the trajectory set?

1 / 1 point

- ○ Maximize the distance from obstacles along the path
- ○ Minimize the integral of heading changes along the path
- ◉ Minimize the distance from end of trajectory to goal
- ○ Minimize the total absolute jerk along the path

✓ **Correct**
Correct, by minimizing the distance from the end of the trajectory to the goal region, we greedily search for the goal region.

13. True or false, for a fixed velocity, larger steering angles will result in larger curvatures in our bicycle model. **1 / 1 point**

- ◉ True
- ○ False

✓ **Correct**
Correct

14. True or false, the trajectory rollout algorithm finds an optimal path to the goal state according to the kinematic model. **1 / 1 point**

- ○ True
- ◉ False

✓ **Correct**
Correct, the trajectory planner is myopic, and as a result only searches for locally optimal solutions at each planning step.

15. True or false, the trajectory rollout planner is always able to find a path to the goal state, if one exists. **1 / 1 point**

- ○ True
- ◉ False

✓ **Correct**
Correct, because the trajectory rollout planner is a receding-horizon planner, it is possible for it to get stuck in certain situations. It can therefore only handle "simple" obstacles in a given scenario.

16. True or false, linear velocity is a higher-order term in the kinematic bicycle model. **1 / 1 point**

True

False

Correct

Correct, the linear velocity is an input to the bicycle model, not a higher-order term.

17. What is the purpose of dynamic windowing?

1 / 1 point

To allow the trajectory rollout algorithm to see farther ahead into the planning process.

To improve the maneuverability of the vehicle when performing trajectory rollout.

To ensure the angular acceleration and linear acceleration lie below a set threshold

Correct

Correct, we use dynamic windowing to filter out paths that would result in too much acceleration applied to the vehicle.

18. Suppose we have a bicycle model travelling at constant velocity v = 1.0 m/s, and length L = 1.0 m. If the time between planning cycles is 0.1 seconds, the previous steering angle delta_ 1 was 0.0 rad, and the current steering angle is 0.5 rad, what is the approximate angular acceleration?

1 / 1 point

5.46

Correct

Correct

19. Suppose we have a bicycle model travelling at constant velocity v = 1.0 m/s, and length L = 1.0 m. If the time between planning cycles is 0.1 seconds, and the previous steering angle delta_ 1 was 0.0 rad. If the maximum angular acceleration is 2.5 rad/s^2, can a path with delta_2 = 0.2 rad be selected this iteration? A. Yes B. No

1 / 1 point

Yes

No

Correct

Correct, this gives us an angular acceleration of 2.027, which is below our threshold.

20. Suppose we have a bicycle model travelling at constant steering angle delta = 0.0 rad, and length L = 1.0 m. If the time between planning cycles is 0.1 seconds, the previous velocity was 20.0 m/s, and the current velocity is 20.5 m/s, what is the approximate linear acceleration?

1 / 1 point

5

Correct

Correct