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Module 4 Graded Quiz

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1. Which of the following best describes an example of a maneuver-based prediction assumption for motion prediction? 1 / 1 point

- ○ The behaviour of other agents on the road reduces the space of potential actions
- ○ Certain vehicle models restrict vehicle maneuverability, reducing the prediction space
- ○ The kinodynamic constraints on a vehicle restricts its potential set of motions
- ◉ The operating domain of a vehicle restricts the number of feasible or probable maneuvers it can take

✓ **Correct**
Correct, the operating domain restricts which maneuvers are feasible depending on the conditions of the scenario.

2. Which of the following best describes an example of an interactions-aware prediction assumption for motion prediction? 1 / 1 point

- ○ The kinodynamic constraints on a vehicle restricts its potential set of motions
- ○ Engine dynamics are affected by pedestrian motion, restricing the space of potential actions
- ◉ The behaviour of other agents on the road reduces the space of potential actions
- ○ The operating domain of a vehicle restricts the number of feasible or probable maneuvers it can take

✓ **Correct**
Correct, the behaviour of other agents results in interactions with the ego vehicle that restricts the ego vehicle's behaviour.

3. **Which of the following are aspects of pedestrian motion?** 1 / 1 point

- [ ] They often have designated lanes on roads due to their slower speed
- [x] Low top speed, but rapid changes in direction and speed are possible

Correct
Correct, pedestrians move slowly but with a high variance in direction.

- [x] Potential to leave designated areas unpredictably

Correct
Correct, pedestrian behaviour can be unpredictable.

- [ ] High top speed, but must obey the rules of the road

4. **Which of the following are scenarios for which constant velocity estimation provides a useful estimate?** 1 / 1 point

- [ ] Roundabouts
- [x] Straight roads

Correct
Correct - Straight roads are the only situation where constant velocity assumptions can be true.

- [ ] Turns and curved roads

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- [ ] Traffic light controlled intersections

5. Which of the following are issues with constant velocity prediction? 1 / 1 point

- [x] Ignores the shape of the road

> ✓ **Correct**
> Correct, the road shape does not affect a constant velocity prediction.

- [x] Ignores regulatory elements

> ✓ **Correct**
> Correct, a constant velocity prediction is unaware of regulatory elements.

- [x] Doesn't fully account for vehicle kinodynamics

> ✓ **Correct**
> Correct, constant velocity assumptions ignore potential acceleration of the vehicle.

- [ ] Computationally expensive

6. Which of the following are position-based assumptions for map-aware prediction algorithms? 1 / 1 point

- [x] Vehicles driving down a lane are likely to follow that lane

> ✓ **Correct**
> Correct, vehicles are likely to follow their current lane based on their position in the map.

- [ ] Stop signs will cause vehicles to decelerate to a complete stop

- [x] Lane changes can be predicted based on the state of the blinker light of a vehicle

> ✓ **Correct**
> Correct, this is possible if the other vehicle is in a position to perform a lane change in the map.

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- [ ] A high-curvature road segment necessitates a slower vehicle speed

7. Which of the following are velocity-based assumptions for map-aware prediction algorithms? 1 / 1 point

- [x] A yellow light will cause vehicles to reduce their velocity as they approach an intersection

✓ **Correct**
Correct, this is a necessity for other vehicles to drive safely.

- [ ] Lane markings enforce constraints on the location of vehicles in the road
- [x] Stop signs will cause vehicles to decelerate to a complete stop

✓ **Correct**
Correct, this is required by law.

- [x] A high-curvature road segment necessitates a slower vehicle speed

✓ **Correct**
Correct, high curvature results in high lateral forces, restricting speed.

8. True or false, the more constraints added to our prediction model, the less generalizable it is to all possible traffic scenarios. 1 / 1 point

- (•) True
- ( ) False

✓ **Correct**
Correct, it can become too specialized to specific scenarios.

9. True or false, in the case of the multi-hypothesis prediction approach, the most likely nominal behaviour of a dynamic obstacle based on its state, appearance, and track information is taken as the object's predicted motion. 1 / 1 point

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- [ ] True
- [x] False

Correct
Correct, the multi-hypothesis approach instead assigns probabilities to each of the nominal maneuvers available to the dynamic obstacle.

10. Which of the following are properties of multi-hypothesis prediction approaches? 1 / 1 point

- [x] Offers alternative predictions, allowing for fast replanning in case new information arises

Correct
Correct, there are multiple predictions available.

- [ ] Provides a maximum likelihood estimate based on the information present in the current traffic scenario
- [x] Provides a probability distribution over nominal predictions based on the state of the environment.

Correct
Correct, each hypothesis has an associated probability.

- [x] Can result in ambiguous predictions

Correct
Correct, there is not always a clear dominant prediction.

11. At a high level, what best describes the two fundamental steps in computing time to collision? 1 / 1 point

- [ ] Estimating the first vehicle position, then estimating the other vehicle's velocity

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- [ ] Running trajectory rollout to generate potential paths, then checking each path for intersection points
- [x] Compute the location of a collision point along the predicted paths of the dynamic objects, then compute the amount of time to reach said collision point
- [ ] None of the above

Correct

Correct, this outlines the general process of computing time to collision.

12. True or false, the simulation based approach propogates the movement of every vehicle in the scene over a given time horizon into the future, where the state is computed at multiple time steps along the horizon. 1 / 1 point

- [x] True
- [ ] False

Correct

Correct, with this method we are forward simulating the entire scenario.

13. In estimation-based approaches, which of the following are some of the common simplifying assumptions used in the swath intersection computation? 1 / 1 point

- [x] Identifying collision points based on path intersection points

Correct

Correct, these are often easy to compute.

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- [ ] Assuming the objects ignore regulatory elements
- [x] Assuming a constant speed profile along an object's predicted path

Correct
Correct, this helps constrain the space of possible collision points.

- [x] Estimating spatial occupancy using simple geometric primitives

Correct
Correct, these can allow for efficient computation.

14. Suppose two vehicles are approximated with a single circle each. The center of one circle is at (1.0 m, 3.0 m) and the other is at (4.0 m, 2.0 m). If the radius of both collision checking circles is 1.5 m, will a collision be detected? **1 / 1 point**

- ( ) Yes
- (•) No

Correct
Correct, the distance between the circle centers is greater than the sum of the collision circle radii.

15. Suppose two vehicles, a leading vehicle and a following vehicle, are moving along a straight line. The center of the leading vehicle is 20 m ahead of the center of the following vehicle. The leading vehicle is moving at 15 m/s, and the following vehicle is moving at 20 m/s. The distance from the center to the front bumper of both vehicles is 2.5 m, and the distance from the center to the rear bumper of both vehicles is 2.5 m. What is the time to collision in this scenario? **1 / 1 point**

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Correct

Correct