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Module 2: Graded Quiz

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1. What are the differences between **exteroceptive sensors** and **proprioceptive sensors**? (Select all that apply) **1 / 1 point**

- [ ] Exteroceptive sensors can determine distance traveled by the vehicle, whereas proprioceptive sensors cannot.
- [x] Exteroceptive sensors can determine obstacle size and distance away, whereas proprioceptive sensors cannot.

✓ **Correct**
Proprioceptive sensors do not observe nor measure environment surroundings.

- [ ] Proprioceptive sensors can determine distance traveled by the vehicle, whereas exteroceptive sensors cannot.
- [ ] Proprioceptive sensors are used to determine vehicle position, whereas exteroceptive sensors are used for sensing the environment.
- [x] Proprioceptive sensors do not interact with the environment, whereas exteroceptive sensors do.

✓ **Correct**
Exteroceptive sensors contain active sensors such as Lidar or Sonar, which interact with the environment by emitting light or sound and waiting for response.

2. Which of the following exteroceptive sensors would you use in **harsh sunlight**? **1 / 1 point**

- [ ] Lidar
- [x] Sonar

Correct

Sonar is unaffected by harsh sunlight.

- [ ] Cameras
- [x] Radar

Correct

Radar is unaffected by harsh sunlight.

3. Why is synchronization and timing accuracy important in the self driving system? **Choose the primary reason.** **1 / 1 point**

- ( ) Synchronization is important to ensure organized computation.
- (•) Synchronization is important to ensure correct sensor fusion.
- ( ) Synchronization is important to ensure that sensors measure the environment at the same time.
- ( ) Synchronization is important to check sensor failure.

Correct

Correct!

4. Your autonomous vehicle is driving on the German autobahn at 150 km/h and you wish to maintain safe following distances with other vehicles. Assuming a safe following distance of 2s, **what is the distance (in m) required between vehicles**? Round your answer to **2 decimal places**. **1 / 1 point**

83.33

Correct

150*2/3.6

5. Using the same speed of 150 km/h, **what is the braking distance (in m) required for emergency stops**? Assume an aggressive deceleration of 5 m/s^2. Round your answer to **2 decimal places**. **1 / 1 point**

173.61

Correct

(150/3.6)^2/(2*5)

6. Suppose your vehicle was using long range cameras for sensing forward distance, but it is now nighttime and the images captured are too dark. **Which of the following sensors can be used to compensate**? **1 / 1 point**

- [x] Radar

Correct

Radar can be configured for long range detection and can also operate in darkness.

- [ ] IMU
- [ ] Sonar
- [x] Lidar

Correct

Lidar can be configured for long range detection and can also operate in darkness.

7. What are the differences between an **occupancy grid** and a **localization map**? (Select all that apply) **1 / 1 point**

- [ ] The localization map uses only lidar data, whereas the occupancy grid can use both lidar and camera data.

- [ ] The occupancy grid only contains static objects, while the localization map contains only dynamic objects.

- [x] The localization map is primarily used to estimate the vehicle position, whereas the occupancy grid is primarily used to plan collision free paths.

Correct

Correct. The vehicle position is a critical measurement to estimate how the ego vehicle is moving through the environment, and relies on matching sensor measurements at the current time to the localization map. The occupancy grid map stores live collision avoidance data in the form of occupied and unoccupied cells around the vehicle.

- [x] An occupancy grid uses a dense representation of the environment, whereas a localization map does not need to be dense.

Correct

Since localization mapping is only concerned with identifying the vehicle pose in the environment, it can use point features or object locations and does not need to densely cover the entire environment, whereas occupancy grid mapping must capture the locations of all obstacles to be avoided and must therefore be dense.

8. The vehicle steps through the software architecture and arrives at the controller stage. What information is required for the **controller** to output its commands to the vehicle? **1 / 1 point**

- [ ] Environment maps

- [ ] Locations of obstacles and other vehicles

- [x] Vehicle state

Correct

The controller requires the vehicle position and velocity to determine the appropriate amount of steering, throttle, and brake.

- [x] Planned paths

Correct

The controller commands the vehicle to follow the planned paths.

9. What is (are) the role(s) of the **system supervisor**? (Select all that apply) **1 / 1 point**

- [x] To ensure that the maps update at the correct frequencies

Correct

The system software is responsible for monitoring software and ensuring operation at correct frequencies.

- [x] To ensure that the sensors are working correctly

Correct

The system supervisor is responsible for monitoring hardware and ensuring that the sensors are not broken.

- [ ] To ensure that the planned paths are collision free
- [ ] To ensure that the controller outputs are within operating range

10. Which of the following tasks should be assigned to the **local planner**? **1 / 1 point**

- (•) Planning to avoid a parked car in the ego vehicle's lane
- ( ) Planning a route to a destination
- ( ) Planning a merge onto the highway
- ( ) Planning a lane change to turn left

Correct

This is a reactive planning task, so it should be designated to the local planner.

11. What common objects in the environment appear in the **occupancy grid**? **1 / 1 point**

- (•) Parked vehicles
- ( ) Lane boundaries
- ( ) Other moving vehicles
- ( ) Traffic lights

✓ **Correct**

The occupancy grid contains static obstacles which block vehicle movement.

12. Which of the following maps contain **roadway speed limits**? **1 / 1 point**

- ( ) Occupancy grid
- ( ) Localization map
- (•) Detailed roadmap

✓ **Correct**

The detailed roadmap contains traffic regulations.