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Module 5 Graded Quiz

LATEST SUBMISSION GRADE

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1. **True or false, behavioural planning does not need to take dynamic obstacles into consideration, as it is too low level and should be handled by the local planner.**

1 / 1 point

- ○ True
- ● False

✓ **Correct**

Correct, dynamic obstacles are at the correct level of abstraction for behavioral planning and therefore are taken into consideration during the behavioural planning process.

2. **As an autonomous vehicle approaches an intersection, which of the following best describes the role of a behavioural planner?**

1 / 1 point

- ○ Determine the throttle angle, brake, and steering angle required to track the reference path through the intersection
- ○ Navigate through the map to find the most efficient path to the required destination.
- ○ Plan a path to the required goal state subject to static/dynamic obstacles and kinodynamic constraints
- ● Plan when and where to stop, how long to stay stopped for, and when to proceed through the intersection

✓ **Correct**

Correct, these steps are crucial for safe behaviour in an intersection.

3. **What is the primary output of a behavioural planning module?**

1 / 1 point

- (selected) The driving maneuver to be executed in the current environment
- A sequence of waypoints that correspond to a feasible, collision-free trajectory
- The throttle, brake, and steering angle values required for tracking the reference trajectory
- The sequence of road segments to be traversed to reach the destination

✓ **Correct**

Correct, this is how the planner outputs the desired behaviour.

4. **Which of the following are common inputs to the behavioural planner?**

1 / 1 point

- [ ] A default path in the current lane to follow
- [x] High definition roadmap

✓ **Correct**

Correct, this is helpful for localizing other agents, and for map-aware prediction.

- [x] A mission plan

✓ **Correct**

Correct, this guides the behavioural planner's goal states.

- [x] Localization information

✓ **Correct**

Correct, this lets us know where we are in the map.

5. **Which of the following are a disadvantage of using finite state machines for behavioural**

1 / 1 point

planning?

- ( ) As the number of states decreases, it becomes more computationally complex to evaluate state transitions
- (x) As the number of states increases, it becomes increasingly complicated to define all possible transition conditions
- ( ) Finite state machines can only handle uncertainty when there are many states available
- ( ) None of the above

Correct

Correct, this grows exponentially as we add more states.

6. **Which portion of the intersection best describes when the ego vehicle is on the intersection?** 1 / 1 point

- (x) The interior of the intersection
- ( ) The lane exiting the intersection
- ( ) The lane preceding the intersection
- ( ) None of the above

Correct

Correct, by our definitions in Lesson 2 of Module 5 on Handling an Intersection Scenario Without Dynamic Objects.

7. **Which of the following can increase the size of the "approaching", "at", and "on" zones of an intersection?** 1 / 1 point

- [ ] The number of dynamic obstacles present
- [ ] The size of the ego vehicle
- [x] The size of the intersection

/

Correct

Correct, as the size of the intersection increases, the size of the intersection zones increases accordingly.

- [x] The speed of the ego vehicle

Correct

Incorrect. Please refer to Lesson 2 of Module 5 on Handling an Intersection Scenario Without Dynamic Objects to review this material.

8. **For a 2-lane, 4-way intersection, which of the following maneuvers are absolutely required?** 1 / 1 point

- [x] Decelerate to stop

Correct

Correct, this behaviour is required for any intersection.

- [x] Track speed

Correct

Correct, this behaviour is required to make forward progress.

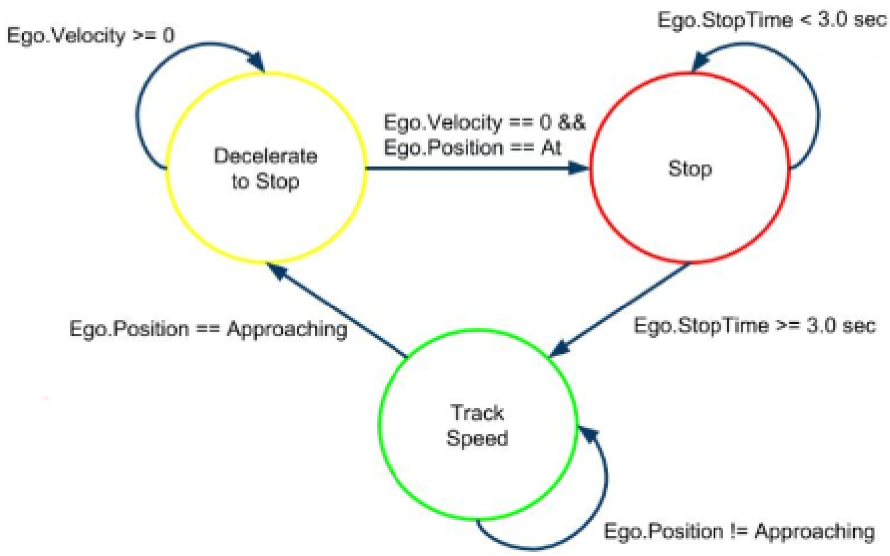
- [ ] Merge to lane
- [x] Stop

Correct

Correct, this behaviour is necessary for any intersection.

9. **For this question, let us use our finite state machine discussed in Module 5 Lesson 2. Suppose** 1 / 1 point

the car has entered the "Stop" state while at the intersection. Which of the following is the correct transition condition for the vehicle to enter the "Track Speed" state?

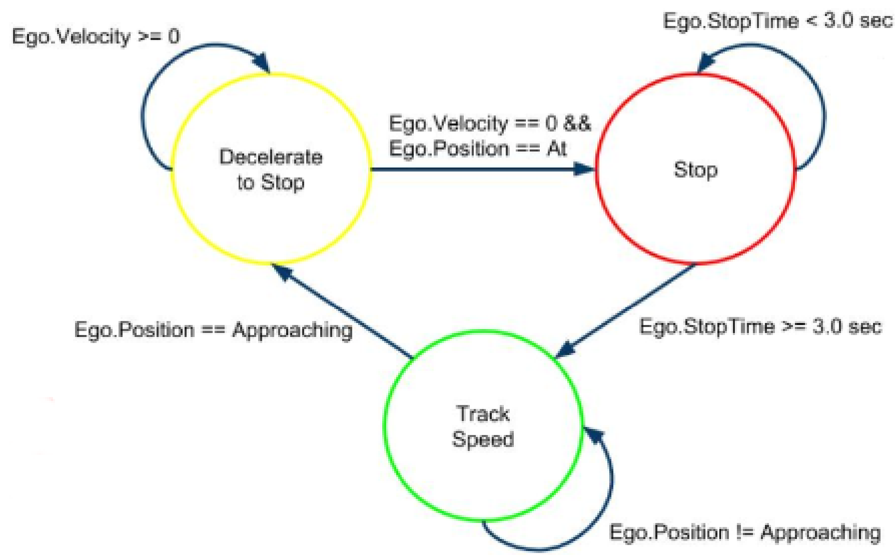


- [ ] Ego.StopTime < 3.0 sec
- [ ] Ego.Velocity >= 0
- [ ] Ego.Position == Approaching
- [x] Ego.StopTime >= 3.0 sec

✓ **Correct**

Corrrect, we are required to remain at a complete stop before moving again.

10. **For this question, let us use our finite state machine discussed in Module 5 Lesson 2. Suppose the car has entered the "Track speed" state before reaching any zone of the intersection. Which of the following is the correct transition condition for the vehicle to enter the "Decelerate to Stop" state?** 1 / 1 point



- [x] Ego.Position == Approaching
- [ ] Ego.StopTime < 3.0 sec
- [ ] Ego.Velocity >= 0
- [ ] Ego.Position != Approaching

Correct

Correct, if we are approaching an intersection we need to decelerate.

11. Which of the following are the key aspects of dynamic objects that we focus upon in behavioural planning?

1 / 1 point

- [x] Distance to collision point

Correct

Correct, this is useful for computing time to collision.

- [x] Distance to dynamic object

Correct

Correct, this is useful for determining the relevance of a dynamic object.

/

Correct, this is useful for determining the relevance of a dynamic object.

- [x] Time to collision

✓ **Correct**

Correct, this influences our behaviour with the dynamic object.

- [ ] Maximum velocity

12. Which of the following best describes the "Follow Leader" maneuver? 1 / 1 point

- ○ In a safe and comfortable manner, decelerate to a complete stop to avoid the leading vehicle
- ○ When a lead vehicle is performing a lane change, we wait until it is safe and follow them into the adjacent lane
- ◉ Follow the speed of, and maintain a safe distance from the lead vehicle
- ○ Accelerate to the speed of the lead vehicle, passing the lead vehicle if they are below our reference speed

✓ **Correct**

Correct, this is according to our definition in Lesson 3 of Module 5 on Handling an Intersection Scenario With Dynamic Objects.

13. True or false, using the state machine developed in L3, when the ego vehicle is in the "Stop" state when in the presence of dynamic obstacles, it should transition to the "Track Speed" state after 3 seconds have elapsed. 1 / 1 point

- ○ True
- ◉ False

✓ **Correct**

Correct, it can proceed if the intersection is clear, and 3 seconds have elapsed.

/

14. **True or false, using the state machine developed in L3, suppose the ego vehicle is "at" the intersection, and is currently in the "Stop" state and 3 seconds have elapsed. Suppose the only dynamic obstacle is "on" the intersection has a heading of 180 degrees relative to the ego heading, and suppose the ego vehicle intends to drive straight. Which state will the state machine transition to?**

1 / 1 point

- (x) Track Speed
- ( ) Follow Leader
- ( ) Stop
- ( ) Decelerate to Stop

Correct

Correct, the dynamic obstacle is heading in the opposite direction of the ego vehicle, and thus does not interfere with the ego vehicle's desire to proceed straight. Since 3 seconds have elapsed, it will transition to "Track Speed".

15. **True or false, using the state machine developed in L3, suppose the ego vehicle is "at" the intersection, and is currently in the "Stop" state and 3 seconds have elapsed. Suppose the only dynamic obstacle is "on" the intersection has a heading of 180 degrees relative to the ego heading, and suppose the ego vehicle intends to turn left. Which state will the state machine transition to?**

1 / 1 point

- ( ) Follow Leader
- ( ) Track Speed
- (x) Stop
- ( ) Decelerate to Stop

Correct

Correct, the dynamic obstacle is heading in the opposite direction of the ego vehicle, and will interfere with the ego vehicle's desire to turn left. Even though 3 seconds have elapsed, it will remain in the "Stop" state.

It will remain in the "Stop" state.

16. **Which of the following are disadvantages of using a single state machine to handle multiple scenarios?**

1 / 1 point

- [x] Rule explosion when adding new scenarios to the state machine

Correct
Correct, transition rules grow exponentially with the number of states.

- [ ] Not able to handle a small set of scenarios
- [x] The amount of computation time required at each step

Correct
Correct, many different conditions will need to be checked at each step.

- [x] Complicated to create and maintain all possible cases

Correct
Correct, analyzing all possible transitions with a single state machine can grow to be intractable.

17. **True or false, an example of a hierarchical state machine in the behavioural planning context involves superstates representing each potential scenario and substates representing the maneuvers to be handled in each scenario.**

1 / 1 point

- (•) True
- ( ) False

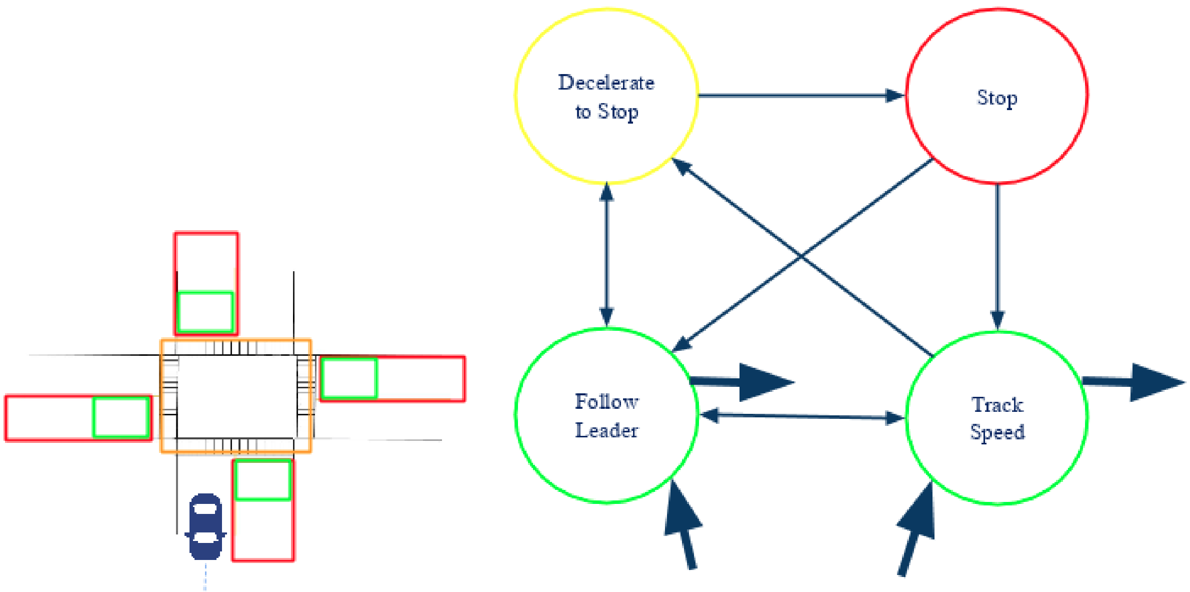
/

Correct

Correct

18. **Following the hierarchical state machine introduced in Module 5 Lesson 4, if we are exiting the intersection and we are currently in the "Intersection Scenario" superstate, which substates of the "Intersection Scenario" will allow us to change to a different superstate?**

1 / 1 point



- [x] Track Speed

Correct

Correct, while performing nominal speed tracking we can transition to a different super state.

- [ ] Declerate to Stop
- [x] Follow Leader

Correct

Correct, while performing lead vehicle speed tracking we can transition to a different super state.

/

- [ ] Stop

19. **True or false, the hierarchical state machine is immune to the effects of rule explosion.**

1 / 1 point

- ○ True
- ◉ False

Correct

Correct, while the hierarchical state machine can allow for its designer to add more complexity to the system, it is still affected by rule explosion as there are many duplicative transitions in each superstate's state machine.

20. **True or false, the hierarchical state machine limits the amount of computation time at each time step by restructuring the search space more efficiently.**

1 / 1 point

- ◉ True
- ○ False

Correct

Correct

21. **Which of the following are some issues with the state machine approaches presented in Lessons 1-4?**

1 / 1 point

- [x] State machines are unlikely to handle situations that have not been explicitly programmed

Correct

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Correct, they do not generalize well to unforeseen scenarios.

- [x] The state machines discussed are only able to handle noise in very limited situations

Correct
Correct, in general the state machines we discussed cannot handle noise.

- [x] The number of hyperparameters required increases as the behaviours get more complex, and inputs get more noisy

Correct
Correct, the complexity of computation grows quickly as the number of desired behaviours increases.

- [ ] There is no method to handle multiple scenarios when using state machines

22. What is an advantage of rule based systems over state machines? 1 / 1 point

- ( ) Rule based systems can handle multiple scenarios
- (•) Rule based systems do not duplicate transitions, as rules can apply throughout significant portions (or all of) the ODD
- ( ) Rule based systems do not require as much attention as state machines do, as rules do not impact one another
- ( ) None of the above

Correct
Correct, this results in higher planning efficiency.

23. True or false, fuzzy logic systems are more robust to environmental noise than traditional discrete systems, such as a finite state machine. 1 / 1 point

- (•) True
- ( ) False

Correct

Correct, they can handle a wider range of inputs and as a result are more robust to noise.

24. **True or false, reinforcement learning involves clustering unlabeled data to inform the behavioural planner on the best course of action in each scenario.**

1 / 1 point

- [ ] True
- [x] False

Correct

Correct, reinforcement learning is a form of machine learning in which an agent learns how to interact with a given environment by taking action and receiving continuous rewards.

25. **Which of the following are some of the shortcomings of reinforcement learning approaches for behavioural planning?**

1 / 1 point

- [ ] Reinforcement learning is unable to handle continuous variables, such as the distance to a dynamic obstacle, and these are commonly used in behavioural planning

- [x] It is challenging to perform rigorous safety assessment or safety guarantees of learned systems, as they are largely black boxes

Correct

Correct, the policies learned by reinforcement learning are often not human-interpretable

- [x] The model simplicity used for reinforcement learning means the results transfer poorly to real-world scenarios

Correct

Correct, to remain tractable reinforcement learning models are often too simple for what is required in the real world.

- [ ] Reinforcement learning do not generalize well to scenarios that weren't explicitly programmed