Traffic Lights and Intersection Problem

The issue we're tackling pertains to the intricate system of traffic lights at an intersection. Traffic lights, with their three distinct states - Red, Green, and Yellow, play a pivotal role in maintaining order and safety on the roads. Each traffic light is associated with a specific road, and if multiple traffic lights are present on the same road, they must display identical signals. This uniformity is crucial in preventing accidents by avoiding the dissemination of conflicting information to drivers.

The primary function of traffic lights is to regulate traffic and prevent accidents. They achieve this by allowing only one road to proceed at a time. For instance, if the traffic light for one road displays green, the lights for the intersecting roads must be red. This arrangement prevents vehicles from different roads from moving simultaneously and potentially colliding. However, there can be instances where multiple roads display red lights simultaneously. This scenario replicates the brief pause that occurs after a light turns red and before the lights for the other roads turn green.

In addition to the basic functionality, we could consider implementing a 'protected left' state for the traffic lights. This would necessitate the modeling of additional relationships to represent lanes, as the protected left would only apply to the leftmost lane. Consequently, this would increase the number of states a traffic light could display, such as 'left green' and 'left yellow', while maintaining a single 'red' state.

As a further enhancement, we could also consider incorporating pedestrian walk signs into the intersection. This addition would introduce the challenge of preventing accidents between pedestrians and vehicles. To ensure pedestrian safety, the system must never display a walk sign for pedestrians to cross a road that simultaneously has a green light for vehicular traffic. This requirement would establish a relationship between the walk sign and the road, adding another layer of complexity to the system.

It's important to note that while our focus is on the traffic lights and their functionality, we will not be modeling the vehicles themselves. Our primary concern is the behavior and states of the traffic lights, and how they interact with each other and with pedestrian signals to regulate traffic flow and ensure safety. The specific characteristics of individual vehicles fall outside the scope of our model.

In conclusion, the design and operation of traffic lights at an intersection involve a complex interplay of states, relationships, and safety considerations. Whether it's managing vehicular traffic, implementing a protected left turn, or ensuring pedestrian safety, each aspect contributes to the overall efficiency and safety of our road systems. By understanding and

addressing these complexities, we can create a safer and more efficient environment for all road users.

Functionality:

1. Red, green, and yellow states
    1.1. Lights on different streets can't be green at the same time
    1.2. All light on the same road should be the same color
    1.3. Protected left states green left and yellow left
    1.4. Caveats to rule 1.2 for protected lefts
2. Roads
    2.1. The should be a least 2 streets possibly more
    2.2. Streets can't go the same direction (N/S vs E/W)
3. Pedestrian walk signs
    3.1. Pedestrians should not cross a street that has a green
    3.2. Pedestrians should not cross a street that has a protected left green turning onto it.

Non-Functionality

1. Cars
2. Pedestrians
3. Traffic light timing
4. Traffic light state flow
5. Driver behavior
6. Weather conditions
7. Road conditions
8. Traffic volume
9. Emergency situations/vehicles
10. Power outages
11. Malfunctioning traffic lights
12. Traffic light maintenance