Summary

The session on September 18th focused on a specific example of Dubin's car, where I attempted to apply the signed-distance function as the value function in the Hamilton-Jacobi-Bellman (HJB) equation and solve the associated min-max problem. I started with the simple dynamics of Dubin's car, but Dr. Yoon was confused by the dynamics because I made a mistake in considering the constraints. I incorrectly applied the constraint to θ, which represents the car's rotation in the global coordinate system, instead of φ, which is the rotation of the tires in the local coordinate system and this constraint is related to input. After that, I discussed the signed distance function and explained its role in this example, including what happens if a trajectory violates safety. I described how the signed distance function can be modified in such cases. However, since I used a GIF without adding sufficient information to the plot, it became very confusing, and it was difficult to understand what the blue points represented. Next, I moved on to solving the value function using *helperOC-master* and *ToolboxLS*. However, I struggled to understand exactly how these toolboxes work, which left me confused about the optimization problem or (HJB) equation that we were trying to solve.

Dr. Yoon mentioned that I should understand how this value function is being solved. Dr. Begum also advised me not to treat these toolboxes as black boxes and suggested that it would be better to write down my thoughts. Dr. Petrik asked me to start from scratch, and when I said I had tried but couldn't solve it, he said it would be a good idea to understand the different types of partial differential equations (PDEs) and the various approaches to solving them.

Since there was a deadline for the ACC paper, I couldn't remember the details from the last session. For this session, I plan to debug my code and carefully read more about how these toolboxes work. I also found some papers that use value iteration policy to solve the HJB, which might help us solve it.