CEE 6680 – SYSEN 5680/6680

Term Project

Due on:

Monday, April 29, 2024, AT 11:40 AM

The grade on late submission will be reduced 30% per day.

Problem: You are managing a fleet of electric vehicles (EVs) for a ride-sharing service, and you need to schedule their charging to minimize the overall charging time while ensuring that all vehicles have enough charge to complete their assigned trips.

Find the optimal decision-making strategy that minimizes the total time spent charging the vehicles while ensuring they have enough charge to complete their assigned trips.

Assumptions:

- The fleet consists of multiple electric vehicles with varying battery capacities.

- Each vehicle has a known initial charge level and a set of trips to complete.

- Each trip has a known distance and time duration.

- Charging stations are available at certain locations with limited capacity.

- Charging a vehicle at a station takes a certain amount of time.

You should come up with your own values of the parameters of the problem. Your code should locate all parameters in a given place appropriately marked.

DP Solution   [25 points]

– Code the DP decomposition. Provide clear explanations and justifications in your code.

– Plot the optimal control strategy with respect to the state and time.

– Provide any other plots to justify your solution.

– Similarilty with GhatGPT code will result in zero in this step.

Approxiamate DP   [20 points]

– Formulate an one-step lookahead DP approxiamation.

– Code the one-step lookahead DP decomposition. Provide clear explanations and justifications in your code.

– Plot the sub-optimal control strategy with respect to the state and time.

– Provide any other plots to justify your solution.

– Compute a performance bound in your solution.

– Similarilty with GhatGPT code will result in zero in this step.

Q-Learning   [20 points]

– Formulate the Q-learning formulation.

– Code the Q-learning formulation. Provide clear explanations and justifications in your code.

– Plot the control strategy derived by Q-learning with respect to the state and time.

– Provide any other plots to justify your solution.

– Similarilty with GhatGPT code will result in zero in this step.

Deliverables: the report, code, and the presentation file   [10 points]

– Upload in a zip file the following:

  – The results of your study in a report (pdf file). The report should compare the solutions of DP, one-step lookahead DP approximation, and Q-learning.

  – The files of your code with any instructions for execution.

  – The presentation file (ppt or pdf). Plan to give a 15-minute presentation of your results.

In-person participation of the final presentations   [10 points]

    – Plan to attend in person the presentations of the term projects on April 29, May 1, and May 6.

Schedule of presentations:

    – **April 29**

        1. Tolkien Bagchi
        2. Zhijie Cheng
        3. Ioannis Faros
        4. Yuhe Pan

    – **May 1**

        1. Nishanth Senthil Kumar
        2. Bolin Song
        3. Simon Jiahe Tian
        4. Filippos Tzortzoglou

    – **May 6**

        1. Sisa Visvesvaran
        2. Shanting Wang
        3. Minghao Yang
        4. Yufan Zhu