Connected and Autonomous Vehicles: Challenges and Design

COMP_ENG 495/395, Winter 2024

Homework 2

Due: March 10, 2024 11:59pm

Upload your answers to CANVAS as a single document, either in pdf or WORD.

Problem 1 is from the book "Introduction to Embedded Systems: A Cyber-Physical Systems Approach" by Prof. Edward Lee and Prof. Sanjit Seshia:

https://ptolemy.berkeley.edu/books/leeseshia/.

Problem 1. (40 points)

This problem studies fixed-priority scheduling. Consider two tasks to be executed periodically on a single processor, where task 1 has period $p_1 = 4$ and task 2 has period $p_2 = 6$.

(a) Let the execution time of task 1 be $e_1 = 1$. Find the maximum value for the execution time e_2 of task 2 such that the RM schedule is feasible.

(b) Again let the execution time of task 1 be $e_1 = 1$. Let non-RMS be a fixed-priority schedule that is not an RM schedule. Find the maximum value for the execution time e_2 of task 2 such that non-RMS is feasible.

(c) For both your solutions to (a) and (b) above, find the processor utilization. Which is better?

(d) For RM scheduling, are there any values for e_1 and e_2 that yield 100% utilization? If so, give an example.

Problem 2. (30 pts) Please search the literature and the web to compare the following bus protocols in vehicles: CAN, FlexRay, TSN (Time-Sensitive Networking), in terms of their speed, bandwidth, message types, arbitration policy, physical transmission media, etc. Please build a comparison table to summarize the main bus features and highlight their advantages and disadvantages; and use additional text for more detailed information. No need to write very long response. Around 0.5 to 1 page should suffice.

Problem 3. (30 pts) For autonomous driving hardware, there are many products, including major ones such as the Tesla Full Self-Driving (FSD) chip, the NVIDIA DRIVE platforms, and the Mobileye SuperVision. Please compare their features and limitations. No need to write very long response. Around 0.5 to 1 page should suffice.