

Second Re-Exam for the Distributed Systems Course

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Solve the exam in anyway that is easy for you. Upload a PDF, write on your laptop, on a piece of paper then scan it, or whatever is appropriate for you. I expect your submission to make it easy for me to grade, so please be organized and neat. The exam has only 70 points.

1- Your company has given you the task of writing software for automating an entire factory using smart robots that can communicate. Your task is to make sure that the robots do not collide with themselves, or with the humans on the factory floor. The main job of the robots is to move raw materials and semi-finished goods to the different work-stations. Each robot is equipped with two LIDAR sensors. The whole factory is expected to have 200 of these robots, and the factory is 10000 square meters. Discuss how such a system should be built, in terms of architecture, consistency, fault-tolerance, communication, naming, and anything you find relevant.(25 points)

2- Should the CAP theorem be taken into account for your system design? Reason about your choice. (5 points)

3- In the above design, the security engineers have suggested that data poisoning can be problematic. Data poisoning is an attack against online learning models where an adversarial entity tries to change the input data to the system by poisoning the data to, e.g., a sensor. Explain how using distributed systems you can try to reduce the risk for such an attack. (5 points)

5- Suppose that the adversary can gain control of a maximum of 4 LIDAR sensors in your system, how can you make sure that your machine learning algorithm can still operate correctly on the data that is collected from the system? What do you need to do/have? (5 points)

6- What is the maximum number of sensors that an adversary can control before your system fails. (10 points)

7- The robots from the factory send monitoring data to be stored in a central repository. This data includes how much battery power is left on the robots. Write a map-reduce program to sort the robots in ascending order by battery power remaining. (10 points)

8- You have chosen a consistency model for your system above. Reason about other consistency models that you have not chosen, and why would they work or not work in your system. (pick a maximum of two) (10 points)

