Re-Exam for the Distributed Systems Course

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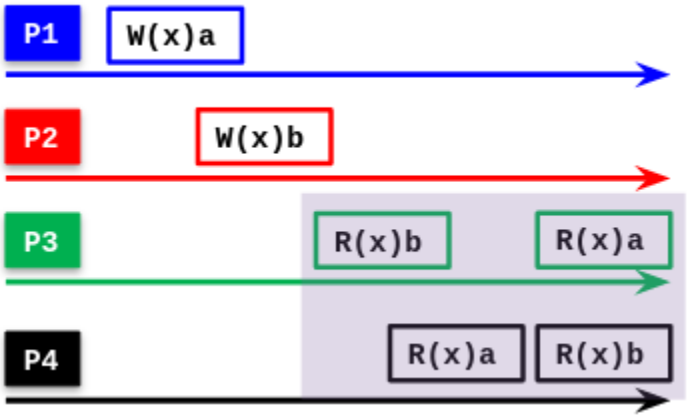
Solve the exam in anyway that is easy for you. Upload a PDF, write on your laptop, on a piece of paper then scan it, or whatever is appropriate for you. I expect your submission to make it easy for me to grade, so please be organized and neat. The exam has only 70 points.

1- You have been hired to lead the design of a new autonomous vehicle company that aims to make vehicles communicate to avoid accidents, streamline traffic, decrease congestions, and operate efficiently. Since the company is formed of mostly mechanical engineers, you are the only one who knows about distributed systems. In light of what you have learnt in the course, design the distributed system required for these vehicles. Discuss how such a system should be built, in terms of architecture, consistency, fault-tolerance, communication, naming, and anything you find relevant.(20 points)

2- Should the CAP theorem be taken into account for your system design? Reason about your choice. (10 points)

3- For the following figures, explain why or why not the operations are sequentially consistent (10 points).



P1:	W(x)a		W(x)c		
P2:		R(x)a	W(x)b		
P3:		R(x)a		R(x)c	R(x)b
P4:		R(x)a		R(x)b	R(x)c

4- Data poisoning against online learning models is an extremely dangerous attack of Machine Learning algorithms where an adversarial entity tries to change the input data to the algorithm 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 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- The Swedish government decided to build an app to track down Covid infections, warn people if they have been near someone who was infected, and allow citizens to book their vaccination slots and know when they will be eligible. You have been tasked to build the system that supports the application. Discuss how such a system should be built, in terms of architecture, consistency, fault-tolerance, communication, naming, and anything you find relevant.(20 points)