Online Resit Exam Distributed Algorithms

Vrije Universiteit Amsterdam, 30 June 2021, 18:45-21:30

I declare to understand that taking an online exam during this corona crisis is an emergency measure to prevent study delays as much as possible. I know that fraud control will be tightened and realize that a special appeal is being made to trust my integrity. With this statement, I promise to make this exam completely on my own, only consult those sources that are allowed explicitly, not share my solutions with other students, and make myself available for any oral clarifications regarding this exam.

You can write your solutions with pen and paper. You are allowed to open the pdf's of the textbook and slides (only) at the following links. You are advised to open them in different tabs in your browser.

- `https://canvas.vu.nl/courses/53186/files/3745199`
- `https://canvas.vu.nl/courses/53186/files/3745089`

(The 7 exercises in this exam sum up to 90 points; each student gets 10 points bonus.)

1. Explain how the values of the vector clock can be computed at run-time in case of *synchronous* message passing communication. (14 pts)

2. Consider the requirement that processes that never crash are never suspected. Argue that this requirement is weaker than strong accuracy and stronger that eventual strong accuracy. (14 pts)

3. Propose an adaptation of the weight-throwing termination detection algorithm that works for decentralized basic algorithms. (12 pts)

4. Consider the Agrawal-El Abbadi algorithm with $N = 2^k - 1$ processes. Let fewer than k processes have crashed. Argue, by induction on the depth of the complete binary tree, that the remaining network still contains a quorum. (14 pts)

5. In the two-phase commit protocol, let only the coordinator crash, right between the voting and the completion phases. Why can the cohorts safely abort the transaction? You may assume there is a known upper bound on network latency. (14 pts)

6. Consider the Chord ring depicted in Example 18.1 of the textbook. Suppose a peer joins the ring at ID 45. Explain in detail how this peer computes its initial finger table. (12 pts)

7. Let Alice and Bob build a private key using the Diffie-Hellman protocol, with $p = 13$ and d the smallest positive integer that is a primitive root modulo 13. Moreover, let $a = 5$ and $b = 4$. Explain how Alice and Bob construct their private key. (10 pts)

After completing the exam, show your solutions to the camera before closing Proctorio.

After closing Proctorio, upload your solutions on Canvas, within 15 minutes.