Online Resit Exam Distributed Algorithms

Vrije Universiteit Amsterdam, 1 July 2020, 18:30-22:00

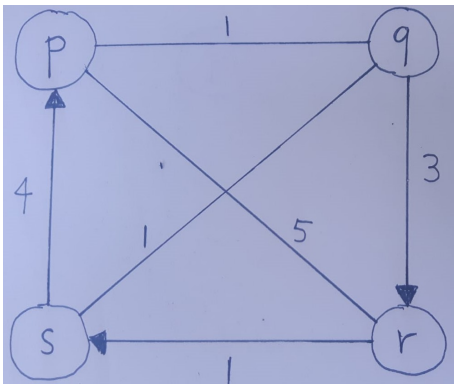
By participating in this exam, I declare to understand that taking an online exam during this corona crisis is an emergency measure to prevent study delays as much as possible. I know that fraud control will be tightened and realize that a special appeal is being made to trust my integrity. With this statement, I promise to:

- make this exam completely on my own,
- not share my solutions with other students, and
- make myself available for any oral explanation of my answers.

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

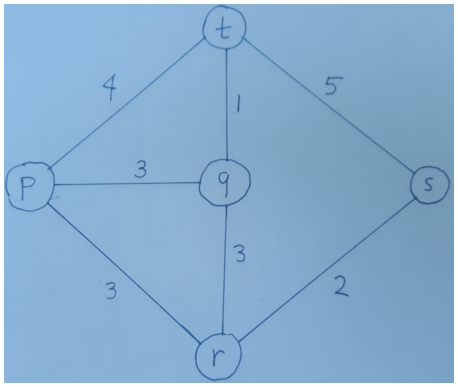
1. Describe in detail a computation of Tarry's algorithm on a complete, undirected network of four processes in which a spanning tree is constructed that it not a depth-first search tree. (12 pts)

2. Consider the network depicted in example 8.2, whereby the initial sink tree is adapted by changing the parent of r from p to s.



Explain in detail why no computation of the Merlin-Segall algorithm on this adapted network computes the correct distance values in one round. (12 pts)

3. Give one possible computation of the Gallager-Humblet-Spira algorithm on the undirected network below to determine a minimum spanning tree.



Note that three channels have the same weight. To avoid deadlock, we define an ordering on these channels: $pq < pr < qr$.

During the computation, the handling of **test** messages from r and t and of a **connect** message from r should be delayed at p. (20 pts)

4. Explain why the rotating coordinator crash consensus algorithm may not terminate if it employs an incomplete, strongly accurate failure detector. (12 pts)

5. In the voting phase of the two-phase commit protocol, why must participants in a distributed transaction copy the tentative changes they made during the transaction to stable storage right before and not right after sending **yes** to the coordinator? (10 pts)

6. Give an example to show how in the Chord ring, a search for a file by a peer p may overshoot its target due to an improper *succ* value at another peer q, resulting from a recently joined peer s. Also explain how the peer r could act when it gets the request that overshoot its target. (12 pts)

7. Consider the Winternitz signature scheme with $k = 11$ and $\ell = 3$. Let 01101010011 be the hash of Alice's message to Bob. Explain how Alice signs her message, taking into account the checksum, and how Bob verifies this signature. (12 pts)