

Resit Distributed Algorithms

VU University Amsterdam, 12 February 2014, 18:30-21:15

(Answers can be given in English or Dutch. You may use the textbook Distributed Algorithms: An Intuitive Approach. Use of slides, handouts, laptop is not allowed.)

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

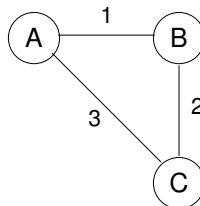
1. Consider the following computation of a decentralized basic algorithm on an undirected ring of size three, with processes p , q and r , where p and q are the initiators. First, p sends a message to q and r and becomes passive, while q sends a message to r . When q receives p 's message, it also becomes passive. After reception of the messages from first p and then q , r sends a message to both p and q and becomes passive. After reception of the message from r , p and q send a message to each other, and after reception of these messages become passive.

Add Safra's termination detection algorithms on top of the basic algorithm, with p as initiator of this control algorithm. Extend the basic computation with control messages, to explain how termination is detected. (10 pts)

2. Suppose that channels can carry negative weights. Explain how the output of Toueg's shortest path algorithm can be used to detect the presence of a negative-weight cycle of at least two channels. (10 pts)

3. Explain in detail how the tree algorithm can be employed to compute the size of an anonymous, undirected, acyclic network. (12 pts)

4. Apply the Gallager-Humblet-Spira algorithm to the following undirected weighted graph:



Give in full detail one possible computation to determine the minimal spanning tree. (12 pts)

5. Apply the Bracha-Toueg algorithm for 2-crash consensus to a complete network of five processes. Let three processes hold the value 0, while two processes hold the value 1. Give one computation where all correct processes decide 0, and one computation where all correct processes decide 1. (12 pts)

6. Determine the worst-case message complexity of the Lamport-Shostak-Pease authentication algorithm with the Dolev-Strong optimization, only taking into account messages from correct processes.
Why should this analysis be restricted to the correct processes? (10 pts)

7. Give an example to show that with the Carvalho-Roucairol optimization, a process can become privileged while its request is larger than some other request in the network.
Also explain why this does not lead to a violation of mutual exclusion. (12 pts)

8. Argue that in the Afek-Kutten-Yung self-stabilizing spanning tree algorithm, each join request eventually results in an acknowledgment. (12 pts)