

Problem Set 10 for lecture Distributed Systems I (IVS1)

Due: 15.01.2019, 14:00 Uhr

Exercise 1

(6 Points)

In this exercise you will implement a simulation of Peterson's election algorithm. To that aim, define a **Process** object that has a status and a UID. **Hint:** To simulate the communication, each **Process** can add and read from a shared queue of messages.

Your implementation should work with any N number of processes. At every step, a **Process** should print „Process [UID] - [Status]“. Submit your code as part of the solution.

- Run your implementation with the example given in the Figure 1. Consider the process with UID=1 as the starter of the election algorithm. Submit the output of your program on this scenario.
- Initialize each process with a random unique UID and run your implementation multiple times with $N = \{8, 16, 32, 64, 128\}$. Plot the average amount of phases taken to elect the leader using Peterson's algorithm per each value of N .

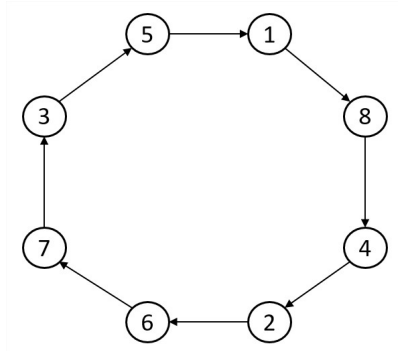


Figure 1: Ring network of processes.

Exercise 2

(4 Points)

The book: „Distributed Systems“ from Coulouris et al. presents two other election algorithms in Chapter 12 - *Coordination and Agreements*¹. Read the description of both algorithms as well as metrics on performance measurement of election algorithms and answer the questions below:

- Compare the ring algorithm from Chang and Roberts with Petersons. What are the advantages and disadvantages of both approaches? Which offers lower bandwidth and lower turnaround time?
- Compare the Bully algorithm with FloodMax algorithm in terms of robustness. Which of the algorithms are more resilient to crashes?

¹Chapter 15 in the 5th Edition

Exercise 3**(2 Points)**

The Proof-of-work voting system by Nakamoto addressed two major challenges of cryptocurrencies: double-spending and Sybil attacks. However, as a democratic voting system, the blockchain is still susceptible to a majority (51%) attack. Read the article „Blockchain: how a 51% attack works“² and explain how this attack may enable double spending operations. What are the likelihood that Bitcoin blockchain is affected by this attack? How does this problem affect smaller blockchains?

Exercise 4**(2 Points)**

Read the article „Blockchain’s Scaling Problem, Explained“³ and briefly summarize the five main points discussed in the article. What are the advantages and downsides of the proposed solutions to the scaling problem?

²<https://medium.com/coinmonks/what-is-a-51-attack-or-double-spend-attack-aa108db63474>

³<https://cointelegraph.com/explained/blockchains-scaling-problem-explained>