University of Freiburg
Dept. of Computer Science
Prof. Dr. F. Kuhn
M. Fuchs, A. Mályusz, Z. Parsaeian

Theory of Distributed Systems
Exercise Sheet 6

Exercise 1: Leader Election with Failures

Consider the leader election problem on a complete graph in the synchronous message passing model. That is, every node has a unique ID and at end of the algorithm, every node that did not crash has to output the ID of the leader node.

Show that if at most $f \leq n-2$ processes fail during the protocol, at least $f+1$ rounds are needed to solve leader election.

Exercise 2: k-Set Agreement with Failures

A generalization of consensus is the k-set agreement problem: Every node has *some* input value and at the end every node has to output a value such that the following validity properties are fulfilled:

1. There must not be more than k different output values.
2. Every node that did not fail must output a value which was input of some node.

Show that on a complete graph in the synchronous message passing model with at most f crash *failures*, the k-set agreement problem is solvable in $\lfloor f/k \rfloor + 1$ rounds. Argue why that upper bound is tight.