

Distributed Computing



HS 2016

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Distributed Systems Part II

Exercise Sheet 5

Quiz _

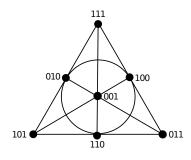
1 The Resilience of a Quorum System

- a) Does a quorum system exist, which still works although all nodes of a specific quorum fail? Give an example or prove its nonexistence.
- b) Consider the *nearly all* quorum system, which is made up of n different quorums, each containing n 1 servers. What is the resilience of this quorum system?
- c) Can you think of a quorum system that contains as many quorums as possible? Note: the quorum system does not have to be minimal.

Basic _

2 A Quorum System

Consider a Quorum System with 7 nodes numbered from 001 to 111, where each three nodes fulfilling $x \oplus y = z$ constitute a quorum. In the following picture this quorum system is represented: All nodes on a line (such as 111, 010, 101) and the nodes on the circle (010, 100, 110) form a quorum.



- a) Of how many different quorums does this system consist and what are its work and its load?
- b) Calculate its resilience f. Give an example where this quorum system does not work anymore with f + 1 faulty nodes.

3 Uniform Quorum Systems

Definitions:

s-Uniform: A quorum system S is *s*-uniform if every quorum in S has exactly *s* elements. Balanced access strategy: An access strategy Z for a quorum system S is balanced if it satisfies $L_Z(v_i) = L$ for all $v_i \in V$ for some value L.

Claim: An *s*-uniform quorum system S reaches an optimal load with a balanced access strategy, if such a strategy exists.

- a) Describe in your own words why this claim is true.
- b) Prove the optimality of a balanced access strategy on an s-uniform quorum system.