

DISTRIBUTED SYSTEMS examination

DAY: December -07 TIME: 4 hours ROOMS: Anywhere

Responsible: Sven-Arne Andreasson 1043

Results ready: -

Grades: GU: G 24p, VG 42p
 CTH: 3:a 24p, 4:a 36p, 5:a 48p
 of maximum 60 points.

Allowed aids: Nothing except paper and pencil.

NOTE:

- All questions **MUST** be answered in English only!
- Write clearly and use the pages in a clever way so it is easy to read.
- Each task should be started on a new sheet. Use only one side of each paper.
- All answers should be motivated!

- Task 1) General.
- Define what is meant by a distributed system.
 - What are the characteristics of a distributed system?
 - Give some motivations for having a distributed system!
- (10 points)
- Task 2) Computer Communication.
- What is meant by *flow control*?
 - What are the main mechanisms when implementing *flow control*?
 - Explain “Saltzer’s *End-To-End-Argument*”.
- (10 points)
- Task 3) A system consists of a number of processes which are cooperating using messages in a computer network
- Give the definition for a partial order between the events in the system.
 - Define a total order on the events in the system.
 - Describe in detail how that total order can be implemented.
What are the requirements on the communication network?
- (10 points)
- Task 4) Assume a number of processes that are co-operating using a computer communication network. Each process has a physical clock that should be synchronized to the others in the network.
- Describe an algorithm that can synchronize clocks in such a way that a limit for their mutual difference can be estimated.
 - Show how their difference limit can be estimated.
- (10 points)
- Task 5) Assume that we are using a Virtual Ring with a Control Token for resource allocation.
- Describe how a Virtual Ring in a general mesh network is defined.
 - Describe an algorithm that guarantees that there will be one and only one Control Token on the ring even if the token is lost.
- (10 points)

Task 6) Byzantine Generals:

- a) Formulate the Byzantine Generals Problem.
- b) A number of processes should cooperate in a task. This cooperation should be done by using message passing. Some of the processes can be wrong in an arbitrary way.
Show how many processes that must be used according to the Byzantine Generals Problem if we allow one of them to be faulty.
- c) Give an example where this solution has been used.

(10 points)