

Tentamen i kursen
Distribuerade System- TDDD25
2016-03-21, kl. 14-18

Hjälpmedel:

Engelsk ordbok.

Supporting material:

English dictionary.

Poänggränser:

Maximal poäng är 40.
För godkänt krävs sammanlagt
21 poäng.

Points:

Maximum points: 40.
In order to pass the exam you need a
total of minimum 21 points.

Jourhavande lärare:

Petru Eles, tel. 0703681396

Good luck !!!

Tentamen i kursen Distribuerade System -TDDD25, 2016-03-21 kl. 14-18
Du kan skriva på svenska eller engelska!

1. What means transparency in a distributed system? We have defined seven aspects of transparency. Enumerate and explain at least five of them.

(3p)

2. We have introduced three fault models. Which are they? Describe each of them.

(2p)

3. BitTorrent and Napster:

a) Explain how each of them works; illustrate by a figure indicating the successive steps performed for access.

b) Compare the two.

(3p)

4. How can *exactly once semantics* be achieved in the case of lost messages (assuming the server never crashes)?

(2p)

5. Consider a system of four processes P_1, P_2, P_3, P_4 . Consider the events a in P_1 , b in P_2 , c in P_3 , and d in P_4 .

a) Let us consider a case such that the Lamport's logical clock timestamps associated to the events are the following:

$$C(a) = 1; C(b) = 3; C(c) = 1; C(d) = 2;$$

What can you say regarding the happened before relation between events a, b, c, d (consider each pair of events)?

b) Let us consider a case such that the vector clock timestamps associated to the events are the following:

$$C^V(a) = (2,0,2,1); C^V(b) = (2,3,1,1); C^V(c) = (3,2,2,1); C^V(d) = (2,3,1,2);$$

What can you say regarding the happened before relation between events a, b, c, d (consider each pair of events)?

(3p)

6. We have introduced a theorem saying that a cut is consistent "if and only if no two cut events are causally related". Illustrate the theorem with two examples (one showing a consistent cut and the other an inconsistent one). Use figures! Show how the theorem applies.

(3p)

Tentamen i kursen Distribuerade System -TDDD25, 2016-03-21 kl. 14-18
Du kan skriva på svenska eller engelska!

7. Publish-Subscribe systems:
- Draw a figure in which you illustrate the three players (publishers, subscribers, and notification service) and their interaction.
 - Explain the filtering function and illustrate by an example.

(3p)

8. What is the basic idea behind the token based distributed mutual exclusion algorithm by Ricart-Agrawala (the second algorithm)? Consider how mutual exclusion is guaranteed and how the token is passed after a process has left the critical section. How many messages are passed in order a process to get permission to a critical section? Compare this number of messages with those needed with the token ring based algorithm. In what circumstances would you prefer Ricart-Agrawala-second and token ring, respectively (think at how frequently processes need the resource)?

(3p)

9. The Byzantine Generals Problem: show how agreement is not or is possible for three and for four participants respectively, in the case one of the generals (not the commander) is a traitor (illustrate the exchange of messages with figures).

(3p)

10. Consider a bully election with 6 processes, P_1, \dots, P_6 . P_6 , the current coordinator, fails and P_3 starts the election. Illustrate the sequence of messages exchanged (use figures).

(3p)

- 11.
- Define total and causal ordering of requests. Illustrate by an example.
 - How can total ordering be implemented using a central sequencer?
 - Consider total ordering based on distributed agreement (no central sequencer); consider one front end and several replica managers.
In this case, the replica managers, after receiving a request, send back to the front end a *cuid*. What does the front end send back to the replica managers after receiving the *cuid* from each replica manager? How does the front end calculate the value it sends back?
 - What happens if a replica manager crashes before sending to the front end the *cuid* for a request it received?

(4p)

Tentamen i kursen Distribuerade System -TDDD25, 2016-03-21 kl. 14-18

Du kan skriva på svenska eller engelska!

12. Explain the following types of redundancy:

- Time redundancy
- Hardware redundancy
- Software redundancy
- Information redundancy

(3p)

13. You know the maximum drift rate of the clocks on two processors and the maximal allowed skew between them. How do you determine the maximum interval between two successive synchronizations between the clocks? Consider both the case when after synchronisation the clocks are perfectly aligned and the case when after synchronisation there exists an offset Φ between the clocks.

(2p)

14. For clock synchronisation with the Precision Time Protocol the communication delays on the way master to slave and slave to master have to be considered. The calculations for clock synchronisation assume that the delays in both directions are equal. This, however, should not be necessarily true, in general. How is this particular problem solved? Explain and illustrate your explanation with a figure?

(3p)