Försättsblad till skriftlig tentamen vid Linköpings universitet

Datum för tentamen	2018-06-07
Sal (1)	TER2(6)
Tid	14-18
Kurskod	TDDD25
Provkod	TEN1
Kursnamn/benämning **Provnamn/benämning**	Distribuerade system Skriftlig tentamen
Institution	IDA
Antal uppgifter som ingår i tentamen	14
Jour/Kursansvarig Ange vem som besöker salen	Petru Eles
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Besöker salen ca klockan	15
Kursadministratör/kontaktperson (namn + tfnr + mailaddress)	Carita Lilja 1463 carita.lilja@liu.se
Tillåtna hjälpmedel	Engelsk ordbok
Övrigt	-
Antal exemplar i påsen	7

LINKÖPINGS TEKNISKA HÖGSKOLA
Institutionen för datavetenskap
Petru Eles

Tentamen i kursen

Distribuerade System- TDDD25

2018-06-07, 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, 2018-06-07 kl. 14-18
Du kan skriva på svenska eller engelska!

1. Synchronous and asynchronous distributed systems. What are their main features and what are the consequences of these features?

(2p)

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

(3p)

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

(2p)

4. 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)

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:
   $C(a) = 1$; $C(b) = 3$; $C(c) = 2$; $C(d) = 2$;
   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:
   $C^V(a) = (2,0,0,1)$; $C^V(b) = (2,3,1,1)$; $C^V(c) = (3,2,2,1)$; $C^V(d) = (2,3,1,2)$;
   What can you say regarding the happened before relation between events *a*, *b*, *c*, *d* (consider each pair of events)?

(3p)

6. Remote Method Invocation: trace the way of a request and of the reply from the client to a remote server and back. Illustrate with a figure.

(3p)

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7. Consider mutual exclusion with the Ricart-Agrawala algorithm (the first algorithm, not using a token). Imagine three processes: P_0, P_1, and P_2. P_1 and P_2 are requesting the same resource, and the timestamp of the requests is (6, 1) and (5, 2) respectively. Illustrate the sequence of messages exchanged (use figures). Who gets the resource fist?

(3p)

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

(3p)

9.

a. Define total and causal ordering of requests. Illustrate by an example.

b. How can total ordering be implemented using a central sequencer?

c. Consider total ordering based on distributed agreement (no central sequencer); consider one front end and several replica managers.

In this case, the replica mangers, 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?

d. What happens if a replica manager crashes before sending to the front end the *cuid* for a request it received?

(4p)

10. What is the basic idea with voting protocols for updating replicated data? How do they work? Consider a set of 12 replica managers. Define two voting protocols. One for a situation when the number of writes is relatively large compared to that of reads, and the other for the reverse situation. Give examples of read and write quorums (use figures).

(3p)

11. Explain the following types of redundancy:
- Time redundancy
- Hardware redundancy
- Software redundancy
- Information redundancy

(3p)

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12. What does it mean by external and internal synchronization of physical clocks? What does it mean by centralised and distributed synchronisation algorithms?

(2p)

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.

(3p)

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)