Försättsblad till skriftlig tentamen vid Linköpings universitet

Datum för tentamen	2018-08-22
Sal (1)	TER2(2)
Tid	8-12
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
Telefon under skrivtiden	070-368 13 96
Besöker salen ca klockan	9:30
Kursadministratör/kontaktperson (namn + tfnr + mailaddress)	Carita Lilja 013 28 1463 carita.lilja@liu.se
Tillåtna hjälpmedel	Engelsk ordbok
Övrigt	-
Antal exemplar i påsen	3

LINKÖPINGS TEKNISKA HÖGSKOLA
Institutionen för datavetenskap
Petru Eles

Tentamen i kursen

Distribuerade System- TDDD25

2018-08-22, kl. 8-12

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, 2018-08-22 kl. 8-12
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. How can *exactly once semantics* be achieved in the case of lost messages (assuming the server never crashes)?.

(2p)

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

(3p)

4. We have identified an important limitation of Lamport's logical clocks (the other one, related to the lack of total ordering is not so important).
   a) What is that limitation? Illustrate by an example.
   b) Show, using the same example, how vector clocks solve that problem.

(3p)

5. 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)

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

(3p)

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?

(2p)

Tentamen i kursen Distribuerade System -TDDD25, 2018-08-22 kl. 8-12
Du kan skriva på svenska eller engelska!

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.

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)

12. 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)

Tentamen i kursen Distribuerade System -TDDD25, 2018-08-22 kl. 8-12
Du kan skriva på svenska eller engelska!

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)