Försättsblad till skriftlig

tentamen vid Linköpings universitet

Datum för tentamen	2011-08-17
Sal	
Tid	8-12
Kurskod	TDDD25
Provkod	
Kursnamn/benämning	Distribuerade system
Institution	*IDA*
Antal uppgifter som ingår i tentamen	14
Antal sidor på tentamen (inkl. försättsbladet)	5
Jour/Kursansvarig	Petru Eles
Telefon under skrivtid	0703681396
Besöker salen ca kl.	10
Kursadministratör (namn + tfnnr + mailadress)	Gunilla Mellheden, 2297, gunilla.mellheden@liu.se
Tillåtna hjälpmedel	Ordbok
Övrigt (exempel när resultat kan ses på webben, betygsgränser, visning, övriga salar tentan går i m.m.)	
Vilken typ av papper ska användas, rutigt eller linjerat	
Antal exemplar i påsen	

LINKÖPINGS TEKNISKA HÖGSKOLA
Institutionen för datavetenskap
Petru Eles

Tentamen i kursen

Distribuerade System- TDDD25

2011-08-17, kl. 8-12

Hjälpmedel:

Engelsk ordbok.

Poänggränser:

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

Jourhavande lärare:

Petru Eles, tel. 0703681396

Good luck !!!

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. Define the following three possible semantics for remote procedure calls:
    a. At least once semantics
    b. At most once semantics
    c. Exactly once semantics.

    Is it possible to achieve *exactly once semantics* in the case of lost messages? But in the case of server crashes? Explain.

    (3p

3. 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)

4. 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:
        $C^V(a) = (2,0,0,1)$; $C^V(b) = (2,3,1,1)$; $C^V(c) = (3,2,2,1)$; $C^V(d) = (2,3,1,2)$;
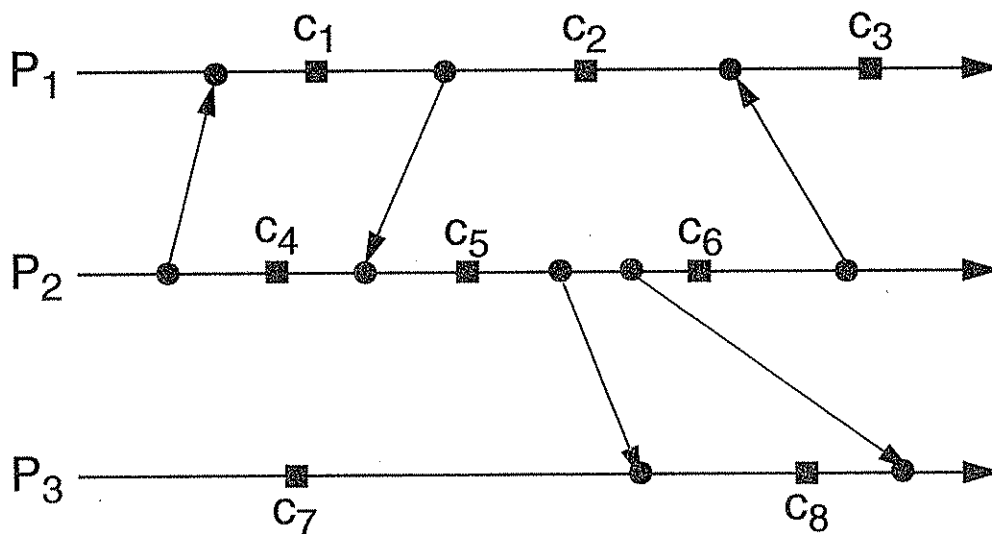   What can you say regarding the happened before relation between events a, b, c, d (consider each pair of events)?

    (3p)

5. What is a cut of a distributed computation? What means a consistent and a strongly consistent cut? Consider the following set of events:

Determine for each of the following cuts if it inconsistent, consistent or strongly consistent:
$\{c_2, c_6, c_8\}$, $\{c_1, c_4, c_7\}$, $\{c_1, c_5, c_7\}$, $\{c_1, c_6, c_8\}$, $\{c_1, c_6, c_7\}$, $\{c_3, c_6, c_8\}$, $\{c_2, c_5, c_8\}$.

(3p)

6. What are potential problems with client-server systems?
How are they solved with peer-to-peer systems?
What are key issues and problems with peer-to-peer systems?

(2p)

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

(3p)

8.
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)

9. 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)

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

    (3p)

12. 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?

    (2p)

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

    (2p)

14. Cristian's algorithm for clock synchronization. Describe how it works. How does it estimate the time at the receiver? What is the accuracy of this estimation?

    (3p)