Försättsblad till skriftlig tentamen vid Linköpings Universitet

Datum för tentamen	2011-06-09
Sal (1) Om tentan går i flera salar ska du bifoga ett försättsblad till varje sal och <u>ringa in</u> vilken sal som avses	T1
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	Sergiu Rafiliu
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Besöker salen ca kl.	16
Kursadministratör/kontaktperson (namn + tfnr + mailaddress)	Gunilla Mellheden, 282297, gunilla.mellheden@liu.se
Tillåtna hjälpmedel	Engelsk ordbok
Övrigt	
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

2011-06-09, kl. 14-18

Hjälpmedel:	**Supporting material:**
Engelsk ordbok.	English dictionary.

Poänggränser:	**Points:**
Maximal poäng är 40.	Maximum points: 40.
För godkänt krävs sammanlagt	In order to pass the exam you need a
21 poäng.	total of minimum 21 points.

Jourhavande lärare:

Sergiu Rafiliu, tel. 07037646876

Good luck !!!

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

(3p)

2. What is an Interface Definition Language. What is its function in the context of Middleware.

(2p)

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 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 to the first algorithm by Ricart-Agrawala (which is not using a token).

(3p)

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

(3p)

7.

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)

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. 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)

10. 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)

11. 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)

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

(3p)

13. Adjusting drifted clocks: T_{curr} is the time shown by the clock and T_{new} is the value we have to change the clock to.
    a) What is the main problem and how is it solved in principle?
    b) Concrete solution with mathematical discussion.

    (3p)

14. Compare the Ethernet protocol and the CAN protocol from the point of view of predictability. Explain.

    (2p)