TEKNISKA HÖGSKOLAN I LINKÖPING
Institutionen för datavetenskap
Petru Eles

# Tentamen i kursen

# Distribuerade System- TDDA 67, TDDB 67, TDDI78

# 1999-08-16, kl. 14-18

**Hjälpmedel:**

Inga.

**Poänggränser:**

Maximal poäng är 30.
För godkänt krävs sammanlagt 16 poäng.

**Resultat anslås:**

Senast 1999-08-31 på IDAs anslagstavla för tentamensresultat.

**Jourhavande lärare:**

Petru Eles, tel 28 13 96

## Good luck !!!

**Tentamen i kursen Distribuerade System - TDDA 67, TDDB 67, TDDI78, 1999-08-16, kl. 14-18**
**Du kan skriva på svenska eller engelska!**

1. Illustrate by a figure a typical software structure in a distributed system.
   What is typical for a microkernel, as used in a distributed operating system, compared to a traditional monolithic kernel?

   (2p)

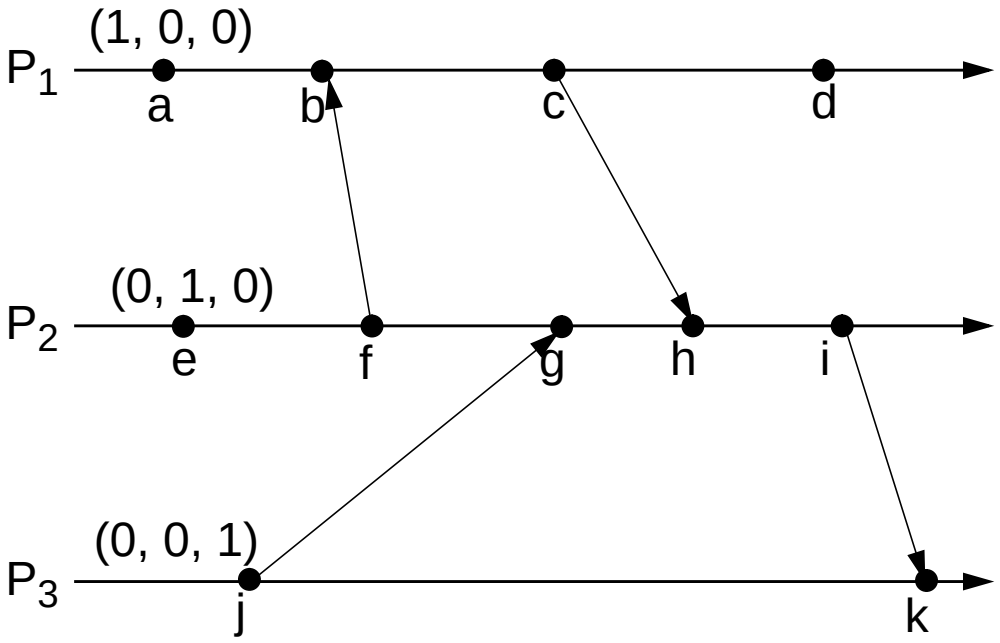
2. Group communication.
   a. What is it?
   b. Describe the two main features of group communication: atomicity and ordering.

   (2p)

3. Static and dynamic invocation in CORBA:
   How do they work? Compare.

   (3p)

4. Consider the following set of events:




Assign the missing vector clock values to the events.

(3p)

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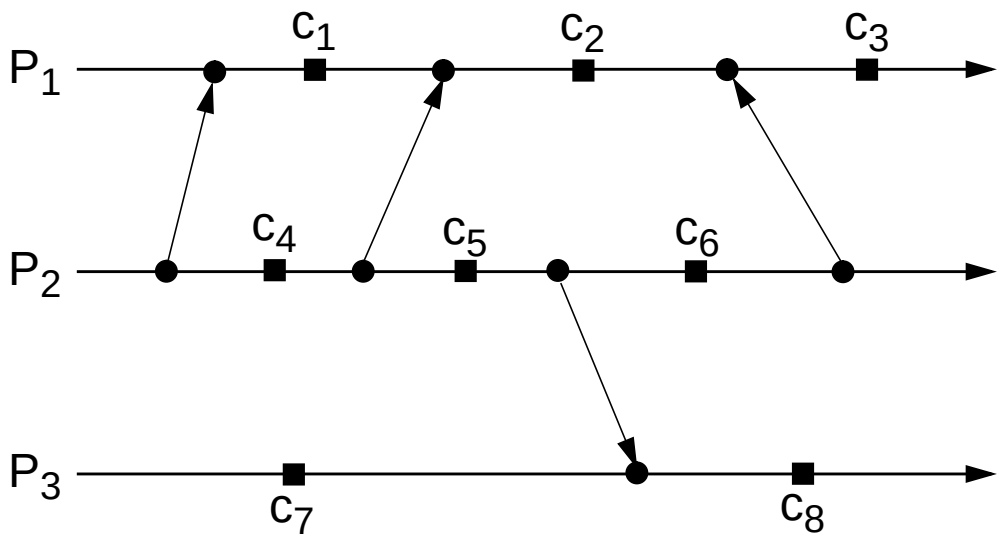
5. How can a total ordering of events be imposed, using Lamport's logical clocks? Illustrate by an example.

(2p)

6. 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:
$\{c_1, c_4, c_7\}$, $\{c_1, c_5, c_7\}$, $\{c_1, c_6, c_7\}$, $\{c_3, c_6, c_8\}$, $\{c_2, c_6, c_8\}$, $\{c_1, c_6, c_8\}$.

(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 (8, 1) and (7, 2) respectively. Illustrate the sequence of messages exchanged (use figures). Who gets the resource fist?

(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?

(2p)

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

   (2p)

10. Give a short description of how the following update protocols work and compare them: read-any - write-all protocol, available-copies protocol, primary-copy protocol.

    (3p)

11. Define a *k*-fault tolerant system.
    How many components do you need in order to achieve *k*-fault tolerance with byzantine faults:
    - for agreement?
    - with a majority voting scheme?

    (2p)

12. 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)