Försättsblad till skriftlig tentamen vid Linköpings universitet

Datum för tentamen	2016-08-25
Sal (1)	TER2
Tid	14-18
Kurskod	TDDD82
Provkod	TEN2
Kursnamn/benämning **Provnamn/benämning**	Projekttermin inklusive kandidatprojekt: Säkra, mobila system Systemprogramvara: Skriftlig tentamen
Institution	IDA
Antal uppgifter som ingår i tentamen	6
Jour/Kursansvarig Ange vem som besöker salen	Mikael Asplund
Telefon under skrivtiden	0700 895 827
Besöker salen ca klockan	15
Kursadministratör/kontaktperson (namn + tfnr + mailaddress)	Madeleine Häger Dahlqvist, madeleine.hager.dahlqvist@liu.se 013-282360
Tillåtna hjälpmedel	
Övrigt	
Antal exemplar i påsen	

Tentamen i TDDD82 Säkra mobila system (Systemprogramvara)

2016-08-25, kl. 14-18, Sal TER2

- Inga hjälpmedel är tillåtna.
- Kom ihåg att svaren på samtliga uppgifter måste MOTIVERAS, och att motiveringarna skall vara uppställda på ett sådant sätt att det går att följa hur Du tänkt. OMOTIVERADE SVAR GER 0 POÄNG OM INGET ANNAT SÄGS.
- Jour: Mikael Asplund (nåbar på tel. 0700-895827).
- Maxpoäng är 30 poäng. För betyg 3 krävs minst 15 poäng, för betyg 4 krävs 20 poäng och för betyg 5 krävs 25 poäng.

Lycka till!!!

1. A process can be considered to have five possible states out of which two relate to initialising (new) and terminating (terminated) a process. Draw a figure showing the remaining three states and the transitions between them. Indicate in the figure how each transition is enabled (i.e., when does the transition happen?).

   (6 points)

2. Assume that the programming environment provides a *mutex lock* construction, with the following operations:

   - acquire(l) is an atomic operation that acquires the lock l if it is available, and otherwise suspends the calling process and puts it in a waiting queue until the lock is available
   - release(l) is an atomic operation that releases the lock l, and wakes the first process in the queue waiting for the lock

   Use the lock to implement the *wait* and *signal* operations according to semaphore semantics.

   (6 points)

3. Consider a distributed web service that provides users with financial counseling. A core component in this service is the Bank Interface Module (BIM) that interfaces with customer bank accounts. BIM maintains a queue and a number of threads that respond to requests from the front-end services. The queue is implemented using the *monitor* construction, and has two operations:

   - enqueue: add a request to the queue
   - dequeue: remove the first request from the queue, if the queue is non-empty

   Provide pseudo-code for the implementation of the dequeue operation.

   (5 points)

4. Consider the following resource allocation problem in a system with 3 resources (R1-R3), and 4 processes (P1-P4). The table indicates the currently allocated resources and in parenthesis the maximum possible demand.

	R1	R2	R3
P1	1 (2)	0 (0)	1 (1)
P2	3 (4)	0 (0)	0 (0)
P3	0 (6)	1 (1)	0 (4)
P4	2 (3)	1 (2)	0 (5)

   The currently available resources are: [2, 0, 4]. Use Banker's algorithm to determine if the request [0, 0, 2] from Process P4 should be granted.

   (4 points)

5. Consider an instant messaging system running on a mobile device that connects to a server where availability (online, offline, ...) state for other users in the system is stored and can be retrieved. Decide which of the following properties is a functional property and which is an extra-functional property (also sometimes called a non-functional property), and motivate your answer!

   (a) An update about another user's state on the server should result in an update on the own device.

   (b) The maximum latency for an update of another user's state on the own device should be 5 seconds.

   (c) The application should make batch updates for consecutive messages (those that are produced by one user in a row with no reply from corresponding receiver).

   (d) The system should be scalable for up to 30 users, given a network bandwidth of 10Mb/s.

   (4 points)

6. It has been shown that in order to reach majority agreement in a set of replicas in a distributed system where some nodes might crash, one must assume the so called synchronous system model.

   (a) Explain the meaning of this model (2p)

   (b) Explain why it can be difficult to fulfil these assumptions for a system which is spread out across a wide area (e.g., multiple cities). (2p)

   (c) Give an example of when this system model is suitable (1p)

(5 points)