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Försättsblad Prov Original

Kurskod	Provkod	Tentamensdatum
DT030A	T101	2018-10-30

Kursnamn	Datateknik AV, Inbyggda datorsystem och realtidstillämpni...
Provnamn	Skriftlig tentamen
Ort	Sundsvall
Termin	H18
Ämne	Datateknik

Mid Sweden

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University
Department of Information- and communication system

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Networked embedded computer systems
with real-time applications

Written examination
DT030A, Networked embedded computer systems with real-time applications

Date: 2018-10-30

The written exam is planned to be checked and graded within 15 working days.

To achieve full score on the assignments you have to thoroughly explain every part of your solutions.

No aids allowed.

1. (3p)
Explain the main difference between hard, soft and firm real-time systems.

2. (2+2p)
Race conditions is something we want to avoid occurring in our solutions and especially in multi-threaded solutions.

a) What is a race condition?
b) Present a short program example describing this kind of condition.

3. (2p)
Explain the difference in solutions based on "lock variables" compared to "strict alternation" as a solution for mutual exclusion problems.

4. (2+2p)
When you want to avoid deadlock in a system the solution can be to use Banker's algorithm developed by Dijkstra 1965.
If you study the instance below, could we approve or do we have to disallow the questions asked.

	Has	Max
A	2	6
B	2	8
C	2	6
D	1	3

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Free=3

a) Process C want to allocate two (2) resources.
b) Process D want to allocate one (1) resource.

5. (5p)
Explain and discuss differences, similarities together with pros and cons when comparing embedded system solutions built on a SoC(=System on Chip) as the Raspberry Pi compared to a specifically dedicated system solutions like the microcontroller Arduino, ASICs(=Application Specific Integrated Circuit) or FPGA(=Field Programmable Gate Array) solutions.

6. (6p)
When we are studying some classical IPC problems we have found a problem named the ***The dining philosophers*** that was created by Dijkstra in 1965 and later on reformulated by Tony Hoare(developer of the algorithm *quicksort* in 1959 and inventor of the *null reference* in 1965).

Explain the basic idea of this classical IPC problem and a way to manage the mutual exclusion in such an system.

7. (8p)
Suppose that the following set of jobs is given:

Process	Ci (ms), worst case execution time	Ti(ms), period time
p1	1	8
p2	2	5
p3	2	10

(a) Can we assume that the processes in the set above are schedulable with Rate Monotonic Scheduling(RMS)?

(b) What is the resulting schedule (Gantt diagram) of the RMS scheduling policy with the set above?

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$$U = \sum_{i=1}^{n} \frac{ci}{ti} \qquad U_{RMA} = n\left(2^{\frac{1}{n}} - 1\right)$$