

Name	Signature	Student Id Nr	Points

Operating Systems, miniexam 3, 27.2.2017 (6p)

Write your answer on this exam paper in the space given. Please notice, that the exam paper is 2-sided.

- a) [2 p] Running track and monitor. Running track is 400m long. Ann and her friends Bill and Charlie come there often and run 4000m. Ann is social and waits after every lap that all boys have caught up with her (equal number of laps). The boys are competitive and do not wait for anybody. Solve the resulting synchronization problem with monitor Sync.

Ann

for (i=1 to 10)

< run lap >

Sync.Ann()

Bill

for (i=1 to 10)

< run lap >

Sync.Bill()

Charlie

for (i=1 to 10)

< run lap >

Sync.Charlie()

Give the pseudocode solution for monitor Sync and its methods init(), Ann(), Bill(), and Charlie().

- b) [2 p] Critical section problem for processes P and Q in a distributed system.
Why you cannot solve the problem with a lock variable and busy-wait loop?

Why you cannot solve the problem with a semaphore?

Give one method to solve this critical section problem. Show how it works with pseudocode.

- c) [2 p] Computational problem P is divided into 1600 separate smaller one-threaded tasks, each of which requires some 10 minutes on computational time. The solution is implemented with 1 control thread and 16 computational threads. The system has 16 cores. Any computational thread can compute any task. The threads are almost independent of each other, but every now and then they access shared data structures Tasks (T), Atoms (A), and Fields (F). Data structure T is used to manage computable tasks, whereas A and F are used in computations. Each data structure can be accessed by only one thread at a time, and they are protected with semaphores. However, when the system was tested, the computation often did not complete. A large part of the tasks were still undone, and all remaining computational tasks were waiting for access to data structures A or F. The computation stopped after 5 hours, in average.

How do you solve this deadlock problem? Give only one solution.