Informatics and Mathematical Modelling
Technical University of Denmark
Building 321
DK–2800 Lyngby
Denmark

HHL 2008–09–26

02152 CONCURRENT SYSTEMS FALL 2008

CP Exercise Class 4

Monday September 29

Semaphores

1. Do Andrews Ex. 4.24.

2. Consider Sema.3 (a). In particular, you should investigate what will happen, if the following variants of *binary semaphores* are used.

For a binary semaphore, a V-operation on a semaphore which is already 1 may be defined to have the following effect (cast in the coconut setting):

(i) "the new coconut just falls to the ground and rots away"

(ii) "the new cocunut makes the bowl tip over and both the old and the new nut fall to the ground"

(iii) "the V-operation waits until the old coconut has been taken"

Recall that for a general semaphore, the V operation on semaphore s can be modelled as the atomic action $\langle\, s := s + 1 \,\rangle$. In the same way, describe the effect of a V-operation for each of these three binary semaphore variants in terms of (conditional) atomic actions. For each variant, determine the effect of using that kind of binary semaphore in the given program.

[The most common variant in practice is (i) (eg. the Auto-Event mechanism in the Windows API).]

3. Do Exercise Sema.3 (b)

[Hint for the proof: Try to establish e.g. $\#\mathtt{V}(S_A) \leq \#\mathtt{P}(S_A) + 1$. How can that help you?]

4. Do Andrews Ex. 4.6.

Notice that *exactly* the processes blocked at `sleep()` when `wakeup()` is called should be woken up. This demands use of the passing-the-baton technique.

Monitor Construction

5. Write a monitor with two operations *sleep* and *wakeup* that implements the mechanism of Andrews Ex. 4.6. [Exercise Mon.4.]

6. Do Exercise Mon.1.

7. Do Exercise Mon.2.