Distributed Algorithmics – TD4
M2 IFI, Ubinet & CSSR, 2011-2012

Exercice 1

Set up a scenario for the 4 counters algorithm, in which you clearly shows that if the second wave starts too early, i.e., not waiting the complete execution of the preceding wave, then, a false termination is detected.

Exercice 2

Misra algorithm. Once the application is effectively globally terminated, prove that at most 2 token rounds along the ring are necessary in order to detect this global termination state.

Do you think that it is important to wait that all received applicative messages are treated before treating the token message ?

What about non FIFO channels?

Exercice 3

Dijkstra and al algorithm. Under certain circumstances, only one round will be necessary to detect the effective termination of the application. Explain

What small extension is needed in case message transmission is asynchronous but bounded with a delay, D ?

What do you think about this algorithm in case communications are asynchronous (and FIFO): explain why itwill not work.

So that it works : what about using (only) the ring for application message routing also (a process just transmits the message to the next process in case it is not for it, but this does not make it turn black nor active) ? What would be the (small) differences compared to Misra algorithm (Hint: Does the algorithm need to know the exact number of processes) ?

Exercice 4 : wrap-up of exercices 2 and 3

Taking exercices 2 and 3 as background, invent a quite similar algorithm for termination detection in which neither the total number of processes, nor a specific ordering of them on the ring are needed. Assume only that one arbitrary process is in charge of triggering the detection (say, the leader). Say clearly which kind of message transmission mode you need to assume (synchronous, bounded synchronous, or asynchronous).

Exercice 5 (from Ghosh' book, chapter 9)

In a resource sharing system, requests for resources by a process are represented as

(R1 and R2) or (R3 and R4) or ….

   (a) How will you represent the WFG to capture the semantics of resource request?
   (b) Examine if Chandy-Misra-Haas algorithm for deadlock detection can be applied to detect deadlock in this system. If your answer if yes, then prove it. Otherwise propose an alternative algorithm for the detection of deadlock in this case.

Exercice 6

Use Wikipedia or anything else to compare in details the two phase and three phase commit protocols. The aim is to understand in which sense 3PC is non blocking, compared to 2PC.