Nancy-Université
Université Henri Poincaré

2010 Final Exam – 2 h

SDR 3.6: P2P and Advanced Distributed Algorithms

Master 2

Only authorized document : A4 sheet written by your hand

★ **Lecture Quizz.** (9pts)

Remarque : You must argument your answers correctly. You are not asked to reproduce the lecture to the identical, but explain its content (and show that you understood it). Likewise, providing some examples is not enough and you must underline the concepts.

▷ **Question 1:** Characterize Distributed, Parallel and Concurrent algorithm (or system). What are the main differences between them ?

▷ **Question 2:** What are the 2 main theoritical difficulties to face when writting distributed algorithms ?

▷ **Question 3:** Which of these issues do logical clock try to solve ? Why wouldn't a global observer do the trick ? Give a counter-example showing the inability of global observer to achieve that goal.

▷ **Question 4:** What is called the CAP Theorem (or Brewer Theorem) ? What does it imply ?

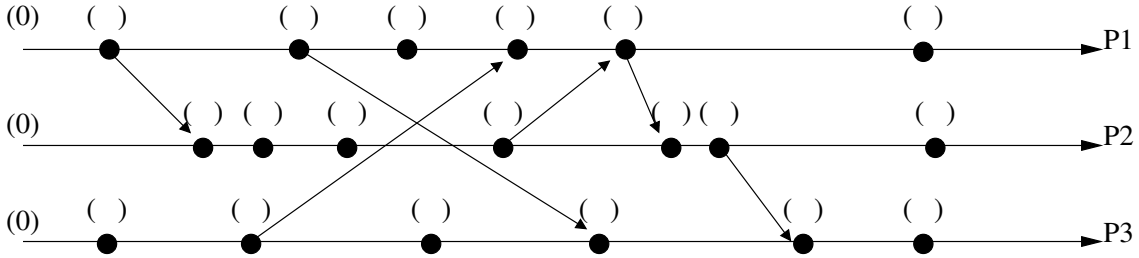
▷ **Question 5:** Give an example of fault tolerent approach or algorithm used on the Internet, and explain why it cannot be used in "classical" distributed algorithmic.

▷ **Question 6:** Present the Napster system. What was its goal ? How did it achieve it ? Why was it stopped ? Why was this possible, ie, what was the main flaw of its design ?

▷ **Question 7:** What are the three main issues remaining to be solved in P2P systems ? Why are they important ? Give some hints about how each of them could be overcomed.

★ **Exercice 1: Logical Clocks** (3pts)

▷ **Question 1:** Add the value of a logical clock to each events of the following figure. Use the Lamport's Clock algorithm to compute the values. Every events are depicted on the schema.

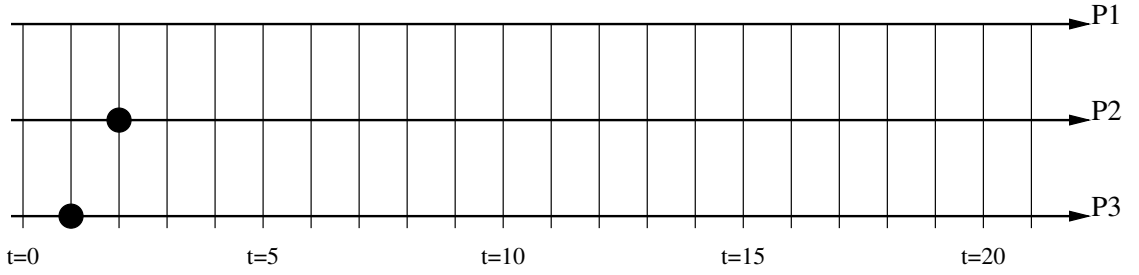


▷ **Question 2:** Using 3 events of the previous figure (that you must name on the sheet), show that event concurrency is not transitive. Ie, pick three events e_1, e_2 and e_3 so that $(e_1 \parallel e_2)$ and $(e_2 \parallel e_3)$ but $(e_1 \nparallel e_3)$. Justify each of these relations between the events you picked.

★ **Exercice 2: The Lamport protocol for Distributed Mutual Exclusion.** (2pts)

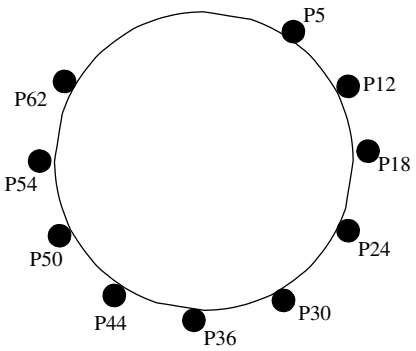
Depicts on following figure the behavior of this protocol when the process P3 requests the resource at t=1 and P2 does so at t=2 (the big circles on the figure), if any message takes two unit of time to reach its destination. For example, any message sent from P3 to P1 at t=1 would arrive on P1 at t=3.

For each message on your drawing, indicate its kind and the value of the lamport clock associated. The events induced by Lamport protocol are the only ones occuring (no extra local event).



★ **Exercice 3: The Chord protocol.** (6pts)

Consider the following CHORD network with 10 peers. Peer and resource keys are 6-bit identifiers.



▷ **Question 1:** How many nodes can this system host at most ?

▷ **Question 2:** Distribute resource keys K10, K23, K35, K36, K49, K55 and K63 to the network.

▷ **Question 3:** Write the finger tables of peers P62 and P36.

▷ **Question 4:** Assume that P18 wants to retrieve the key K10. List the exchanged messages.

▷ **Question 5:** Peer P2 joins the network. Write the finger table of P62 and P2 once the system stabilizes.

▷ **Question 6:** Peer P44 leaves the network. Explain concisely what happen (in particular concerning the key storage) and write the finger table of P36 once the system stabilizes.