Distributed Systems 07/09/2018
Corso di Laurea Magistrale in Ingegneria Informatica
Corso di Laurea Magistrale in Cyber Security

☐ **5 Credits** ☐ **6 out of 12 Credits (not passed CNS yet)**

☐ **6 Credits** ☐ **6 out of 12 Credits (passed CNS)**

(tick the appropriate box above – write clear below)

Family Name_____Name_____Student ID_____

Ex 1: Considering the problem of physical clock synchronization, provide the definitions of internal and external clock synchronization. In addition,

1. provide the description of an algorithm that can be used to synchronize clocks,
2. specify which type of synchronization it ensures and
3. details the necessary assumptions to let it work correctly.

Ex 2: Consider the FIFO, Causal and Total Order broadcast primitives. Describe the relations (equivalence, orthogonality, inclusion) that exist among them, providing examples (runs) as a motivation to your answer

Ex 3: Provide the specification of the uniform consensus problem, describe the behavior of a uniform consensus algorithm and discuss its performance in terms of message complexity (i.e., number of messages needed to reach consensus).

Ex 4: Consider a distributed system constituted by *n* processes $\prod=\{p_1, p_2 \ldots p_n\}$ with unique identifiers that exchange messages through perfect point-to-point links and are structured through a line (i.e., each process p_i can exchange messages only with processes p_{i-1} and p_{i+1} when they exists and stores their identifiers in two local variables `right` and `left`).
Each process p_i knows the initial number of processes in the system (i.e., every process p_i knows the value of *n*).

1. Assuming that processes are not going to fail, write the pseudo-code of an algorithm that implements a regular register
2. Discuss what happen to the proposed algorithm if processes may fail and discuss if it implements a CA, CP or AP system.

According to the Italian law 675 of the 31/12/96, I authorize the instructor of the course to publish on the web site of the course results of the exams.

Signature: _____