# Traffic Theory - Questions
## 11/02/2015

Comment the following statements providing a detailed explanation

1  Non irreducible Markov Chains can be ergodic

2  In Markov Chains the distribution of X(n), knowing only  X(n-k),X(n-k-1), … X(0), only depends on X(n-k)

3  In renewal arrivals the asimptotic probability of an arrival in t is zero.

4  The PASTA property holds for M/M/1 with finite population arrivals.

5  The average queuing  time in  an M/G/1 system  can be changed by means of Service Disciplines

6  In Jackson's networks we can have queues with LCFS service disciplines

7  In Jackson networks we can not have a mix of users that behave as in open networks and closed networks: why?

**Outline of the answers**

1  FALSE. Non irreducible chains  can have more asymptotic distributions, depending on initial conditions. Hence are not ergodic, which only have one.

2  TRUE. See property  1.53 in class notes

3  TRUE.  The probability of an arrival in Delta t is proportional to Delta t, and goes to zero as Delta t goes to zero.

4  FALSE.  In the finite population model arrivals are not Poisson and the PASTA property can not hold. WE have actually evaluated  distribution $q_i$, which is in fact different from distribution $pi_i$

5  TRUE, provided that we adopt policies that are not SERVICE INDEPENDENT, such as SJF, or preemptive, such as Processor Sharing…

6  TRUE. As long as the occupancy is concerned, the state diagram of a Markovian queueing system, alone or in a network,  is not changed by disciplines such as LCFS.