

Subject :	Level :	Exam :
Modeling, Simulation and Performance Evaluation	1 st Year Master (Distributed Architectures)	Resit
Documents are not authorized	Time : 01h 30mn	Scientific calculator allowed

Monday June 23, 2025

Answer clearly and succinctly

Exercise 01 (DATABASE MANAGEMENT SYSTEM : 08 Marks)

A database management system (DBMS) implemented on a powerful machine receives requests that arrive according to a Poisson process with an intensity of $\lambda = 14$ requests/second. The service provided is exponential with a rate of 17 requests/second. The DBMS can handle two requests at a time (in parallel).

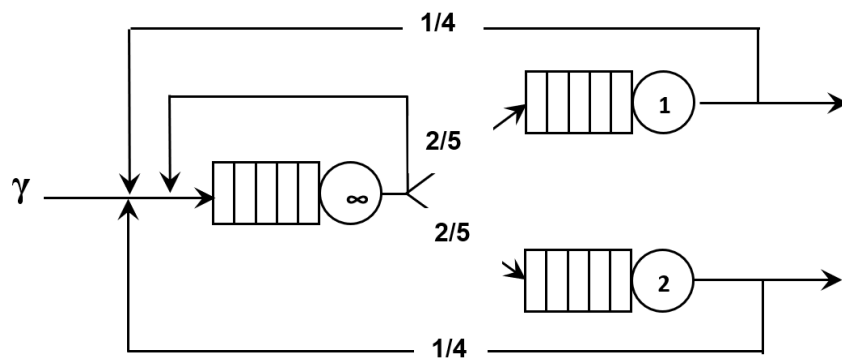
1. What is the queueing system that models adequately this system? Justify your answer.
2. What is the probability of finding this DBMS empty?
3. What is the probability that a request have to wait?
4. What is the average number of requests in this system?
5. What is the average residence time in this system?
6. What is the probability of finding less than 2 requests in this system at a given time?

Exercise 02 (QUEUEING NETWORK : 12 Marks)

Consider the following Jackson network, where $\gamma = 5, m_1 = +\infty, m_2 = 1, m_3 = 2, \mu_1 = \mu_2 = \mu_3 = \mu$.

1. Give the internal and external routing probability matrices.
2. Find the effective arrival rates λ_i .
3. Find the servers' utilization ρ_i as a function of μ .
4. Find the values of μ that ensure network stability.

Let's take $\mu = 4$. Find in this case :



4. The average number of waiting clients at each station and in the network.
5. The average number of clients at each station and in the network.
6. The average residence time in each station and in the network.
7. The average waiting time at each station and in the network.
8. The probability that the network is empty.

Note 1 : use at least 6 digits after the decimal point in all your calculations.