Subject :	Level :	Exam :
Modeling, Simulation and Performance Evaluation	1st Year Master (Artificial Vision)	Final
Unauthorized documents	Time : 01h 30mn	Scientific calculator allowed

Wednesday, May 15, 2024

Answer clearly and succinctly

Exercise 01 (Web server : 10 Marks)

A single-process web server can handle 6 requests per second. The service time is distributed exponentially. Requests arrive according to the Poisson process, in which the average time between two consecutive requests is 0.125 seconds.

1. What is the appropriate queuing model for this system ? Justify
2. What is the average server activity time in a day (24 hours) ?
3. What is the average number of requests on the web server ?
4. What is the average number of pending requests in the web server ?
5. What is the average waiting time on the web server ?
6. What is the average residence time on the web server ?
7. What is the probability that the server receives 5 requests in a second ?
8. What is the probability that the server does not receive any requests for 1.5 seconds ?
9. What is the probability that the server becomes idle between the arrival of two requests, knowing that it was unoccupied when the first of the two arrived ?
10. What is the average number of daily processed requests ?

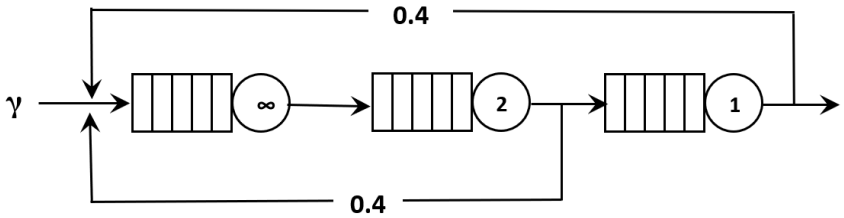
We want to lower the utilization rate to 35% (maximum) :

11. How many parallel processes should be executed on the server side ?
12. In this case, what is the average number of requests being served ?

Exercise 02 (Queueing network : 10 Marks)

Consider the following Jackson network, where $\gamma = 3, m_1 = +\infty, m_2 = 2, m_3 = 1, \mu_1 = 1, \mu_2 = 5, \mu_3 = 10$

1. Give the internal and external routing probability matrices.
2. Find the effective arrival rates λ_i.



1. What is the average number of clients waiting at each station and in the network.
2. What is the average number of clients at each station and in the network.
3. What is the average residence time in each station and in the network.
4. What is the average waiting time at each station and in the network.
5. What is the probability that the network is empty.

Note 1 : use at least 6 digits after the decimal point in all your calculations.
Note 2 : $e = 2.7182818$