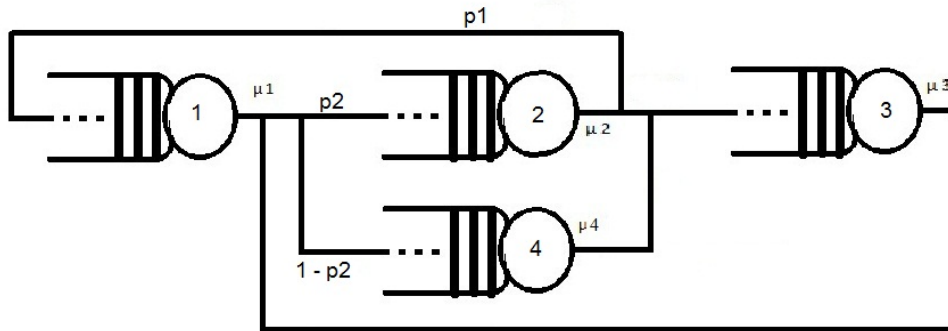


Closed Queuing Network

A queuing network refers to a system where there are several stations of service (identical or non-identical) and a customer undergoes service at all or few service stations. A closed queuing network is one in which the flow of customers does not enter from outside, but is fixed within the network and keeps moving within the network.

The queuing network illustrated here is:



Let λ_i be the arrival rate at node $i, i=1,2,3,4$. Then we obtain the following relations:

$$\lambda_1 = p_1 \lambda_2, \lambda_2 = p_2 \lambda_1 + \lambda_3, \lambda_3 = (1-p_1) \lambda_2 + \lambda_4, \lambda_4 = (1-p_2) \lambda_1$$

The using these relations we obtain:

$$\lambda_1 = p_1 \lambda_2, \lambda_3 = (1-p_1 p_2) \lambda_2, \lambda_4 = p_1 (1-p_2) \lambda_2$$

Here we have obtained the arrival rates λ_1, λ_3 and λ_4 in terms of λ_2 . However, they may be obtained in any one of the variables. With these arrival rates and the results of $M/M/1$ queue at each node i together with Jackson's theorem, we obtain the desired results for the queuing network.