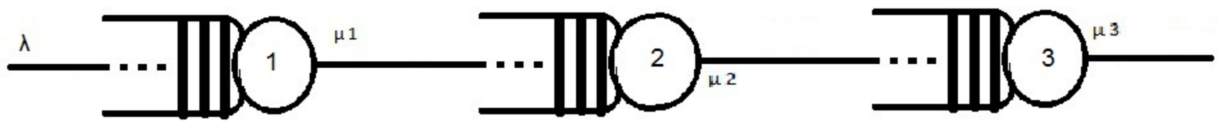
Tandem Queues:

The word 'Tandem' refers to an arrangement of objects in which the objects are lined up one behind the other, all facing in the same direction. In a Tandem queuing network there are multiple job classes, one after the other and an arriving customer undergoes each job class before leaving the system. In the discussed experiments, we consider a 3-stage tandem queuing network, with and without feedback. Each stage of service is assumed to behave as an $M/M/1$ queuing network.



The arrival rate of customers is λ and the service rate at node i is μ_i. Let $\rho_i = \dfrac{\lambda}{mu_i}$. Hence steady state measures are:

- $p(k_1, k_2, k_3) = P(k_i$ customers at node $i, i = 1,2,3) = \Pi_{i=1}^{3} \rho_i^{k_i} (1-\rho_i)$
- Average number of customers at Node i: $\dfrac{\rho_i}{1-\rho_i}, i = 1,2,3$
- Average number of customers in the system: $\sum_{i=1}^{3} \dfrac{\rho_i}{1-\rho_i}$
- Average number of customers in the queue of Node i: $\dfrac{\rho_1^2}{1-\rho_i}, i = 1,2,3$
- Total average number of customers in the queue: $\sum_{i=1}^{3} \dfrac{\rho_i^2}{1-\rho_i}$
- Average waiting time of a customer in the queue of node i: $\dfrac{\rho_i}{\mu_i - \lambda}$
- Average waiting time of a customer at node i: $\dfrac{1}{\mu_i - \lambda}$
- Average waiting of a customer in the system: $\sum_{i=1}^{3} \dfrac{1}{\mu_i - \lambda}$
- Utilization of node i: $\dfrac{\lambda}{\mu_i}$
- Throughput of node i: λ, $i = 1,2,3$