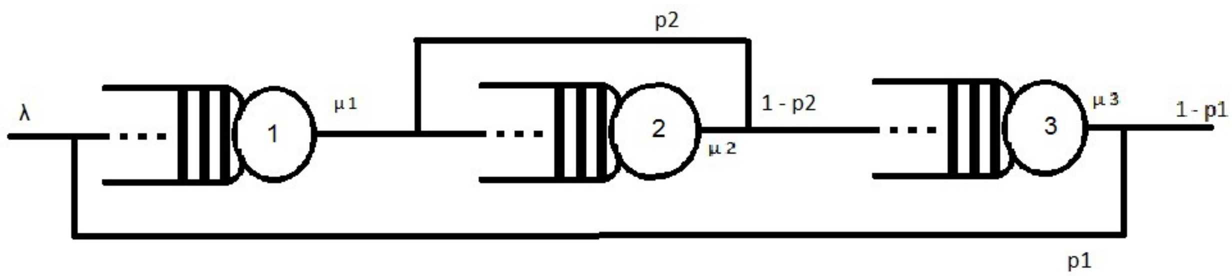
Analytical Results for Tandem Queue with feedback: (Model 1)



Let the arrival rate from an external source be λ. Let the arrival rate at node i be λ_i. Then with the property that the arrival rate equals the departure rate we get the following relations:

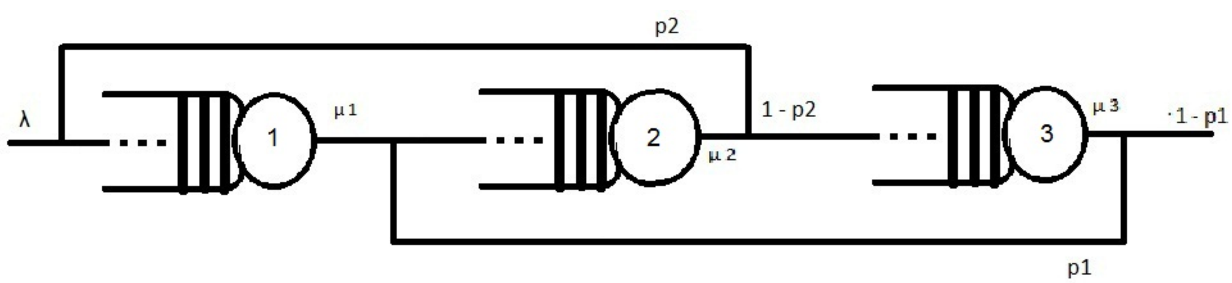
$$\lambda_1 = \lambda + p_1\lambda_3, \lambda_2 = \lambda_1 + p_2\lambda_2, \lambda_3 = (1 - p_2)\lambda_2$$

Simplifying we obtain:

$$\lambda_1 = \lambda_3 = \frac{\lambda(1-p_2)}{(1-p_1)(1-p_2)}$$

With the arrival rate at each node given above and service rate μ_i at node i, using the results of $M/M/1$ queue we obtain the desired results.

Analytical Results for Tandem Queue with feedback: (Model 2)



Let the arrival rate from an external source be λ. Let the arrival rate at node i be λ_i. Then with the property that the arrival rate equals the departure rate we get the following relations:

$$\lambda_1 = \lambda + p_2\lambda_2, \lambda_2 = \lambda_1 + p_3\lambda_3, \lambda_3 = (1 - p_2)\lambda_2$$

Simplifying, we obtain:

$$\lambda_1 = \frac{\lambda[1-p_1(1-p_2)]}{(1-p_1)(1-p_2)}, \lambda_2 = \frac{\lambda}{(1-p_1)(1-p_2)}, \lambda_3 = \frac{\lambda}{1-p_1}$$

Using the results of $M/M/1$ queue at each node i, we obtain the desired results.