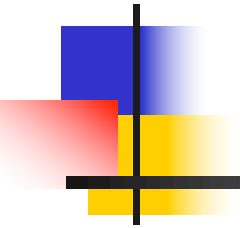

Lab4: Queueing networks

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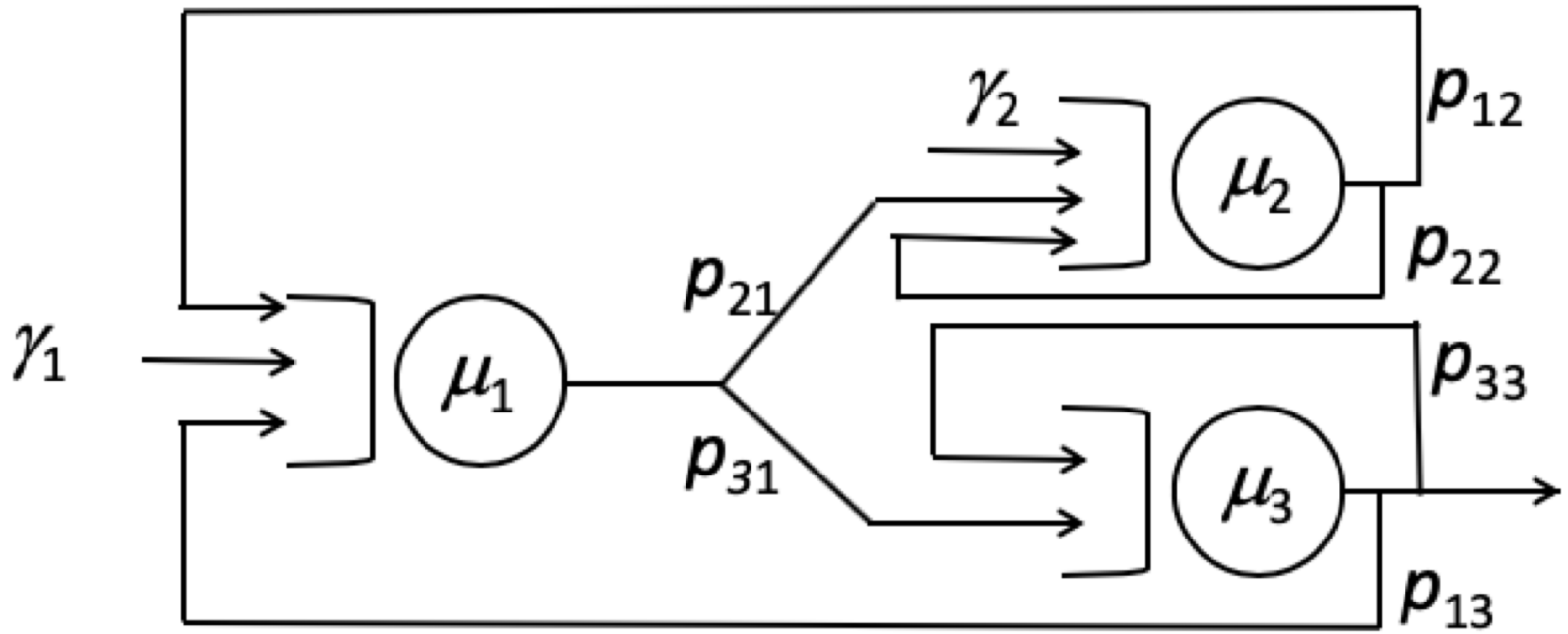
Queueing network

1. Implement in Simulink the following network, where all the queues are M/M/1



Queueing network

2. Simulate from $t = 0$ to $t = 10000$ the system with the values:
   - $\gamma_1 = 0.5$, $\gamma_2 = 0.5$ [customers/s]
   - $\mu_1 = 4$, $\mu_2 = 12$, $\mu_3 = 4$ [customers/s]
   - $p_{21} = 0.4$, $p_{31} = 1\text{-}p_{21}$, $p_{12} = 0.3$, $p_{22} = 1\text{-}p_{12}$, $p_{13} = 0.4$, $p_{33} = 0.2$

   and compare with the theoretical values:
   - the utilization at each node
   - the average queue length at each node

Queueing network

3. Now simulate the system with the same parameters as in point 2, except γ_1 = 1 cust./s
   - What do you observe? Why?

4. With the same parameters as in point 3, add a server to the first node, thus transforming it to a M/M/2, simulate it and compare with theoretical results

Queueing network

5. With the same parameters as in point 4, now set for all queues a finite capacity *k*
   - Uncheck the flag “Overwrite the oldest element if the queue is full” for all queues
   - Simulate the system for *k* = 25, 50, 100. What do you observe? Why?
   - If you check the flag and run the system for *k* = 25, which utilization do you observe for the three nodes?