EE 679, Queueing Systems (2000-01F)
Test -6, November 21, 2000

Max. Marks = 25   **Time = 60 minutes**
Attempt all problems

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1. Consider the open network of single-server, FCFS, exponential service queues shown in the figure.
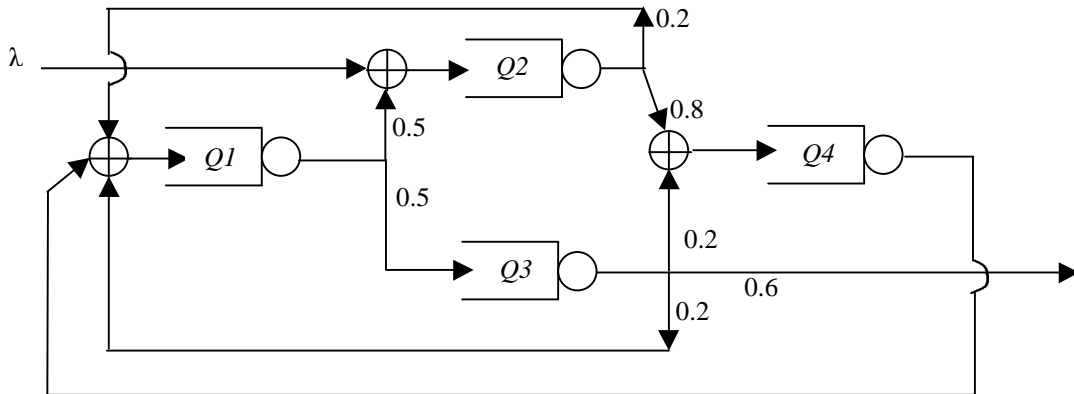
The external arrivals are at Q2 from a Poisson process with average arrival rate λ. The mean service rates are $\mu_1 = \mu_3 = \mu$ and $\mu_2 = \mu_4 = 0.5\mu$.

(a) What will be the maximum value of λ for which the system will be stable? [3]
Do the following for $\lambda=0.1$ and $\mu=1$
(b) Give the state distribution of the system. [2]
(c) Give the mean number in each queue. [3]
(d) Give the mean time spent in system by a customer entering the system. [2]

2. Consider the closed queuing network of single server queues with exponentially distributed service times, as shown in the figure below.
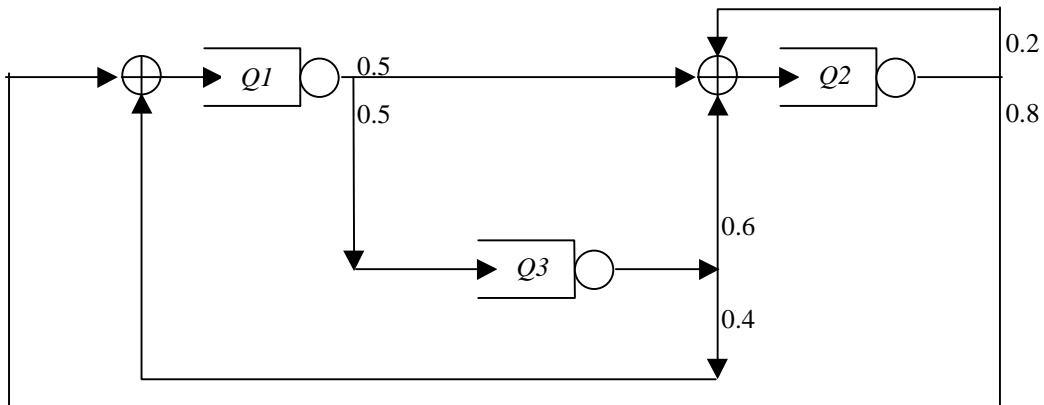
The average service rates of Q1, Q2 and Q3 are respectively $\mu_1 = 1$, $\mu_2 = 0.5$, and $\mu_3 = 0.5$. The system has a total user population of 4. **Using the convolution approach,** obtain the following –

(a) The Normalization Constant [5]
(b) The state probability distribution for the queuing network [2]
(c) The actual throughput of each queue [3]
(d) The mean number in each queue [5]