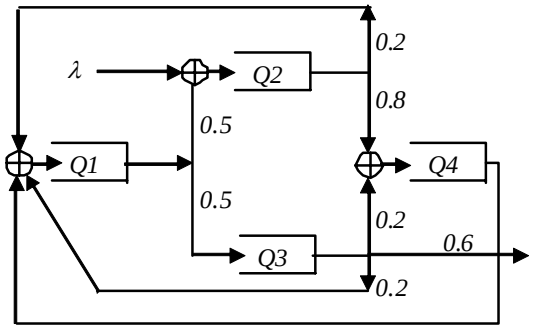
EC 633, Queueing Systems
Home Assignment No. 7

Date/Place of Submission: Lecture of 02-NOV-2009 (*This will be the last home assignment for this course*.)

1. Consider the open network of single-server, FCFS, exponential service time queues shown. The external arrivals are at Q_2 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?

(b) For $\lambda=0.1$ and $\mu=1$, give the state distribution of the system, the mean number in each queue and the mean time spent in the queueing network by a new customer entering the system.

(*Please consider similar problems on your own, with one or more arrival/departure points and the behaviour of the arrivals/departures from different flows.*)

2. Consider the following closed network of single server queues, Q_1, Q_2 and Q_3, with service rates *36*, *3* and *1*, respectively. The Routing Probabilities are -

$p_{11} = 1/2$	$p_{12} = 1/6$	$p_{13} = 1/3$
$p_{21} = 1$	$p_{22} = 0$	$p_{23} = 0$
$p_{31} = 1$	$p_{32} = 0$	$p_{33} = 0$

Assuming that there are four customers (M=4) in the network, find the performance parameters of each queue.

3. Analyze the closed network of four FCFS single-server, infinite-capacity queues, Q_1 - Q_4. The mean service times (exponentially distributed) for Q_1, Q_2, Q_3 and Q_4 are respectively *0.35, 0.25, 1.50* and *2.0*. The routing probabilities between the queues are given to be -

To	Q_1	Q_2	Q_3	Q_4
From				
Q_1	*0.1*	*0.5*	*0.1*	*0.3*
Q_2	*0.0*	*0.0*	*0.5*	*0.5*
Q_3	*0.2*	*0.2*	*0.3*	*0.3*
Q_4	*0.8*	*0.0*	*0.0*	*0.2*

Assume that there are six jobs in the system (i.e. M=6).