EE 679, Queueing Systems (2000-01F)
Test -3, October 3, 2001

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

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1. Consider a M/-/1/2 queue where the service facility is modeled as shown below. After finishing service at Stage 1, the job either exits the system with probability 0.5 or moves to Stage 2 with probability 0.5, as shown. Note that a job entering the service facility always gets served at *Stage 1* first.
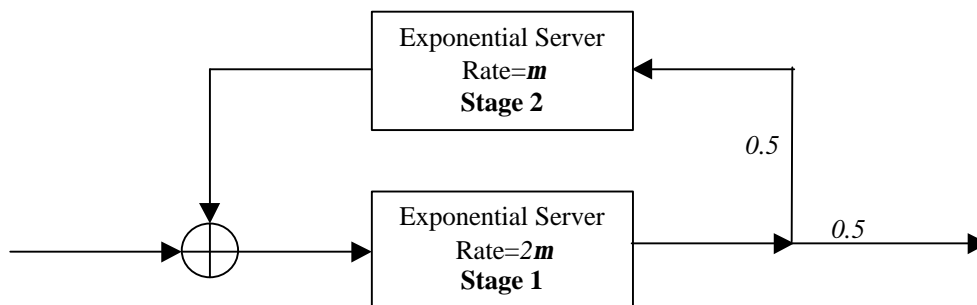
Assume that the arrival rate to the queue is *l*.

(a) Draw an appropriate state transition diagram for the system.   *(4)*
(b) Write the balance equations and solve these for the state probabilities using *r=l/m*
                                                                                     (5)
(c) What is the mean queueing delay seen by an arrival entering the system?   *(4)*
(d) What is the effective service time distribution of the server?   *(2)*

2. Consider the same system as in Problem 1 except that the arrivals come in batches of size *1 or 2* with probabilities 0.5 each and with *l* as the batch arrival rate. Assume that a *whole batch acceptance strategy* is being followed.

(a) Draw an appropriate state transition diagram for the system.   *(3)*
(b) Write the balance equations and solve for the state probabilities using *r=l/m*   *(4)*
(c) What is the probability that an arriving job will actually be allowed to enter the system?   *(3)*
   [**Note:** *For 2(c), you may leave the final answer in terms of the state probabilities. Further simplification is not needed.*]