EE 679, Queueing Systems (2000-01F)
Test -3, September 29, 2000

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

Note: **[A]** *Use* $r = \lambda/\mu$ *for convenient notation in both problems*

[B] *Use calculator for numerical answers in Problem 2(b)*

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1. A $M/-/1/2$ queue has a service time distribution given by $\frac{0.5\mu}{s+\mu}+\frac{0.5\mu^2}{(s+\mu)^2}$. The average arrival rate is λ. Note that the queue is limited to a maximum state of 2. Use the *method of stages* to solve this queue and obtain the following -

(a) State Transition Diagram (with a proper definition of system states) *[3]*
(b) Obtain the state probability distribution *[6]*
(c) What will be the average departure rate from this queue? *[3]*

2. Consider a $M^{[X]}/-/1/3$ queue where the batch arrival rate is λ and the *generating function* of the batch sizes is given by $(0.25+0.25z+0.5z^2)$. Note that the queue is limited to a maximum state of 3 and follows the *WBAS* strategy

(a) If the service time distribution is $\frac{0.5\mu}{s+\mu}+\frac{0.5\mu^2}{(s+\mu)^2}$, draw the state transition diagram of the queue with an appropriately defined system state. *[3]*

(b) For a service time distribution of $\frac{\mu}{s+\mu}$, do the following -

i. Draw the state transition diagram. *[3]*
ii. Find the state probabilities of the queue. *[5]*
iii. What is the probability that a batch is refused entry into the queue? *[2]*