

TCS 455: Quiz 1

Name	ID
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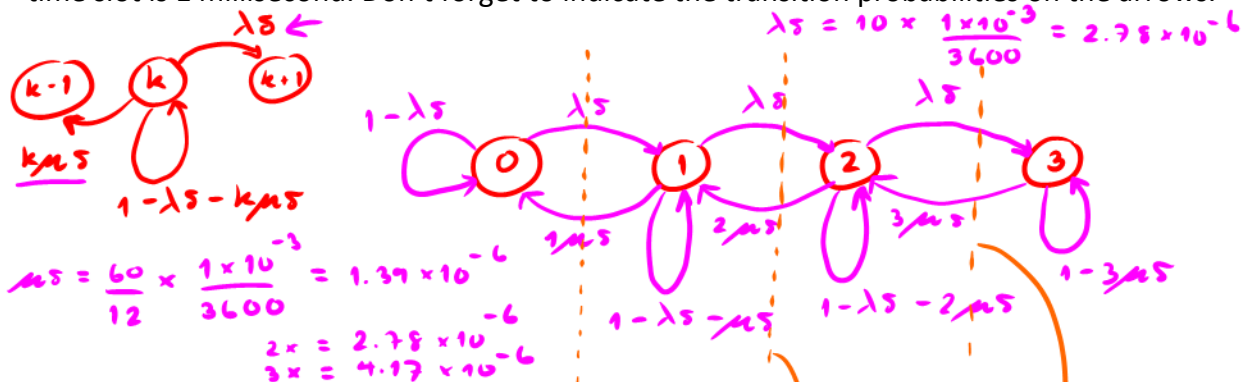
Semester/Year: 2/2009
 Course Title: Mobile Communications
 Instructor: Dr. Prapun Suksompong

Instructions

1. Separate into groups of no more than three persons.
2. Only one submission is needed for each group. Late submission will not be accepted.
3. **Write down all the steps** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
4. **Do not panic.**

Consider a system which has **3 channels**. We would like to find the blocking probability via the Markov chain method. Assume that the total call request rate is 10 calls per hour and the average call duration is 12 mins. $\lambda = 10 \text{ calls/hr} = \frac{10}{60} \text{ calls/min} = \frac{1}{6} \text{ calls/min}$. $\mu = \frac{1}{12} \text{ min}^{-1}$. $A = \frac{\lambda}{\mu} = 10 \times \frac{12}{60} = 2$

1. **Draw the Markov chain** via discrete time approximation. Assume that the duration of each time slot is 1 millisecond. Don't forget to indicate the transition probabilities on the arrows.



2. Find the long-term blocking probability **from the Markov chain**.

Handwritten equations for finding blocking probability:

$$P_0, P_1, P_2, P_3$$

$$P_0 \times \lambda\delta = P_1 \times \mu\delta \quad P_1 \times \lambda\delta = 2\mu\delta \times P_2 \quad P_2 \times \lambda\delta = 3\mu\delta \times P_3$$

$$P_0 + P_1 + P_2 + P_3 = 1$$

$$P_0 = \frac{1}{1 + A + \frac{A^2}{2} + \frac{A^3}{6}}, P_1 = A P_0, P_2 = \frac{1}{2} A^2 P_0, P_3 = \frac{1}{6} A^3 P_0 = \boxed{\frac{4}{19}}$$

3. **Use Erlang B formula**, find the blocking probability.

$$\frac{\frac{A^m}{m!}}{\sum_{i=0}^m \frac{A^i}{i!}} = \boxed{\frac{4}{19}}$$