

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm Examination: Semester II
Date: Dec 24, 2009
Subject: 210-463 Telecommunication Engineering

Academic Year: 2009
Time: 9.00-12.00
Room: A401

Instructions:

- a. Allow a student to bring his/her own note (**one A4-size paper**) into a room during the exam
- b. Allow the student to use his/her own calculator and dictionary

Do all problems

1. On average, during the busy hour, a company makes 120 outgoing calls of average duration 2 min. It receives 200 incoming calls of average duration 3 min. Find

- (a) outgoing traffic
- (b) incoming traffic
- (c) total traffic

(3 points)

2. Consider phone calls in a long distance telephone network, the length of calls are exponentially distributed with mean 4 minutes.

- (a) What is the percentage of the calls are longer than 10 minutes?

(3 points)

- (b) What percentage of the calls are between 2 and 5 minutes?

(3 points)

- (c) What length of time are 95% of the calls less than?

(3 points)

3. The number of database queries processed by a computer in any 10-second interval is a Poisson random variable, K , with $\alpha = 5$ queries.

- (a) What is the probability that there will be no queries processed in a 10-second interval?

(3 points)

- (b) What is the probability that at least two queries will be processed in a 2-second interval?

(3 points)

4. Prove (*mathematically*) that if the arrival process is Poisson, an associated random variable defined as the time between successive arrivals (interarrival time) follows the exponential distribution.

(4 points)

5. The International Telecommunication Union (ITU) group has set benchmark performance values for mobile phone database systems. For the Visitor Location Register (VLR) database the benchmark value is

“Mean Delay in response to a query - 1000msec (1 sec)”

Assuming a M/M/1 queue can be used to model the database system and that the mean time to process a query is 50 msec determine the following

(a) Determine the maximum database utilization that can occur and still satisfy the benchmark value above.

(3 points)

(b) At the maximum database utilization that can occur, what is the average number in the system and the mean interarrival time of queries?

(3 points)

6. Let's consider connecting 100 incoming trunks to 100 outgoing trunks using multiple stages of 10*10 switches.

(a) Find the total number of crosspoints for

- i. a two-stage network
- ii. a three-stage network

(3 points)

(b) Discuss the advantage and disadvantage of using a two-stage network compared to a single-stage network.

(2 points)