KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
COLLEGE OF COMPUTER SCIENCES & ENGINEERING

COMPUTER ENGINEERING DEPARTMENT

COE 540 – Computer Networks
Assignment 3 – Due Date Jan 11th, 2010 - Solution Key

Problem	Points	
1	40	
2	20	
3	20	
4	20	
5	20	
6	20	
Total	140	

Problem 1 (40 points): On the subject of Delay and Queueing Models (1)

Assume a small enterprise is installing a PBX telephony system with c outgoing phone lines connecting the enterprise with the PSTN. If the population and calling behavior of the enterprise employees are such that calls are generated according to a Poisson arrival process with rate of one calls every minute. The mean call duration is 3 minutes. Assume that calls arriving to the PBX while the c outgoing lines are busy are blocked. Let $c = 6$.

(1) The offered load from the enterprise.

(2) The probability that a call originating from the enterprise is blocked.

(3) If it is desired to provide a quality of service (QoS) equal to 1% blocking for originating calls, what would be the minimum size (i.e. value of c) for the PBX achieving this QoS?

(4) Define the carried load as the fraction of offered load (computed in (1)) that gets service. The carried load reflects the average number of simultaneous calls that are handled by the system. Dividing the carried load by the number of servers produces a trunking efficiency number. For a given QoS equal to 1% blocking, it is desired to plot the trunking efficiency versus the number of channels c (x-axis). Plot another curve on the same figure for QoS equal to 10% blocking. State your comments. Let the number of channels c vary from 2 to 10.

Hint: Use the M/M/c/c model.

Problem 2 (20 points): Textbook Chapter 1 - Problems P9 and P10 (pages 97 and 98).

Problem 3 (20 points): Textbook Chapter 1 Problem P13 (page 98).

Problem 4 (20 points): Textbook Chapter 2 - Problem P8 (page 208)

Problem 5 (20 points): Textbook Chapter 2 - Problem P9 (page 208 and 209)

Problem 6 (20 points): Textbook Chapter 3 - Problem P18 (page 324 and 325)