

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

***COMPUTER ENGINEERING DEPARTMENT***

**CSE 642 – Computer Systems Performance**

**Assignment 3 – Due date Jan 3<sup>rd</sup>, 2010**

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**Problem 1 (20 points):** Textbook problem 4.2.

**Problem 2 (20 points):** Textbook problem 4.12.

**Problem 3 (20 points):** Textbook problem 4.16.

**Problem 4 (40 points):** Textbook Example 4.11. It is required to rework the example showing all needed steps (formulas) and calculations. Refer to the excel sheet (produced by the textbook authors) to obtain the needed values for the problem inputs: number of input lines and number of output lines, the input line flows, the routings to the output lines, the retransmission probabilities, the processing times, message length, line rates, and propagation delay. For this question, you need to submit an electronic copy (i.e. word file or LaTeX) (in addition to the hardcopy) containing the solution.

Compute:

- a) Draw the network of queues topology.
- b) The means and variances of the number of messages residing in each component.
- c) Compute the joint probability distribution of  $n_j$  messages in the output buffer and  $l_j$  messages in the timeout and ACK boxes of the  $j^{\text{th}}$  branch for all  $j$ .
- d) The average message delay through every node and the total delay message delay.
- e) (bonus 10 points) In a manner similar to that done in slides, compare the exact distribution (PMF and CDF) of the total number of messages (output buffers and timeout boxes) to that approximated by the Gaussian distribution. Produce a plot similar to that on slide 52 for Example 4.3 in textbook.