SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Spring 2015
ENSC 427: COMMUNICATION NETWORKS
ENSC 894 SPECIAL TOPICS II: COMMUNICATION NETWORKS

Midterm No. 2
Monday, March 16, 2015

Duration: 50 minutes. Attempt all problems. Questions are not equally weighted. Closed book and closed notes.
Simple calculators (with no graphing/programming functions) are permitted. PDAs, laptops, and wireless phones are not permitted. Please provide brief and concise answers and include diagrams, graphs, and tables, as needed. Expand all acronyms. Please write legibly. Illegible text will not be graded. Please use a pen (no pencils, please).

1. **Circuit Switching Networks (35 points)**:

   (a) List three types of circuit switching architectures.

   (b) Draw the architecture of a crossbar switch with N inputs and N outputs.

   (c) Is this switch blocking or non-blocking? Justify your answer. What is its complexity?

   (d) Consider a Clos switch with N inputs and N outputs, where the N inputs are grouped into N/n groups of n input lines. Draw the general architecture of the three-stage Clos non-blocking switching fabric.

   (e) Find the smallest number of intermediate stages k for a non-blocking switch. Justify your answer.

2. **Peer-to-Peer Protocols and Data Link Layer (40 points)**:

   (a) Describe three ARQ protocols using the flowing sequence of events diagrams. Consider the case when one frame is lost. Clearly identify frame numbers and ACK/NACK numbers.

   (b) Assume that n_f is the number of bits in a frame and n_a is the number of bits in an acknowledgement frame. Channel bit rate is R. Calculate the time t_0 to send a frame and receive an ACK in case of the Stop-and-Wait ARQ protocol.

   (c) Calculate the efficiency of the Stop-and-Wait ARQ protocol in case of no frame loss.

   (d) Calculate the efficiency if the probability of frame loss is P_f.

3. **Medium Access Control Protocols and Local Area Networks (25 points)**:

   (a) What is medium access control?

   (b) List the two main categories of dynamic medium access control.

   (c) Consider a two-station example. What is the "quiet time"?

   (d) What is CSMA? What is its "vulnerable period"?

   (e) Describe the p-persistent CSMA.