

SIMON FRASER UNIVERSITY  
SCHOOL OF ENGINEERING SCIENCE

Spring 2012  
ENSC 427: COMMUNICATION NETWORKS  
ENSC 894 SPECIAL TOPICS II: COMMUNICATION NETWORKS

Final Examination  
Wednesday, April 18, 2012

*Duration: 180 minutes. Attempt all problems. Questions may not be equally weighted, Please provide detailed answers and include diagrams and tables, as needed. Expand all acronyms. Closed book and closed notes. Simple calculators (with no graphing/programming functions) are permitted. PDAs, laptops, and wireless phones are not permitted. Use a ball-point pen for writing the exam (no pencils, please).*

**1. Circuits-Switching Networks (20 points):**

- (a) What is multiplexing? Describe three main multiplexing techniques.
- (b) List two main types of circuit switches and provide an example for each switch type.
- (c) Describe the Clos multistage switch architecture. What is its main characteristic?

**2. Peer-to-Peer Protocols (20 points)**

- (a) Describe major functions and list three types of ARQ protocols.
- (b) Use *the flowing sequence of events diagrams* to describe details of each protocol. Clearly identify both the frame and ACK numbers. What is the maximum window size in each case?

**3. Medium Access Control Protocols (20 points)**

- (a) Describe the ALOHA random access scheme.
- (b) Describe the CSMA algorithm. Show a typical throughput vs. load graph.
- (c) Describe the CSMA-CD algorithm and the CSMA-CD back-off mechanism.
- (d) What is the maximum probability of success in the CSMA-CD scheme?

**4. TCP/IP (30 points):**

- (a) Describe the TCP connection establishment and termination.
- (b) List main phases of the TCP congestion control algorithm. Indicate each phase on a plot of *TCP window size vs. time*.
- (c) Name and describe the TCP feedback mechanism in case of packet loss. How is the packet loss detected by TCP? How does TCP react to each type of packet loss?

- (d) What is *round-trip time* and how is it estimated?
- (e) What is *timeout* and how is its value set in TCP?

5. **ns-2 Tutorials (10 points):**

- (a) List two main internal components of ns-2. What do they control?
- (b) How do you run an ns-2 simulation? What do you need to specify in order to run ns-2?
- (c) What is the result from an ns-2 simulation run?