

**SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE**

**Spring 2016
ENSC 427: COMMUNICATION NETWORKS**

**Midterm
Monday, March 7, 2016**

Duration: 110 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. Applications and Layered Architecture (15 points):

- (a) List the layers of the OSI (expand the acronym) reference model.
- (b) List the layers of the data network reference model.
- (c) Consider the data network reference model:
 - i. List the names of data units for each layer.
 - ii. Provide examples of two protocols used in each layer.
 - iii. List the layers responsible for providing end-to-end and hop-to-hop communications between network elements.

2. Digital Transmission Fundamentals (15 points):

- (a) What is a spectrum of a signal? How is it calculated. Provide example of a fast varying and example of a slow varying signal and their spectrums.
- (b) What is the bandwidth of a signal? How is it calculated?
- (c) What is the bandwidth of a communication channel? List two models of communication channels and list all model parameters.

3. Digital Transmission Fundamentals (25 points):

- (a) Plot the code for the sequence 01100101 using:
 - i. Unipolar NRZ
 - ii. Bipolar
 - iii. Manchesterencodings.

- (b) Show the graph for power spectra density of the NRZ, Bipolar, and Manchester encodings.
- (c) Briefly describe their differences.
- (d) List well-known standards that employ the Manchester encoding.

4. Circuit Switching Networks (15 points)

- (a) Write the Erlang B formula. Explain all variables.
- (b) Use a graph to illustrate the usage of the formula.
- (c) Write the expression to calculate trunk utilization.

5. ns-2 Tutorial (15 points):

Write the ns-2 TCL command to:

- (a) Define a TCP agent named *tcp0*.
- (b) Define a sink node named *tcpsink0*.
- (c) Define an application that generates CBR traffic named *cbr0*.

6. Riverbed Modeler Tutorial: M/M/1/Queue (15 points):

- (a) Describe the M/M/1 queue, show the system diagram, and describe its components.
- (b) List the main model parameters.
- (c) List the process model attributes of the processor module.
- (d) List the process model attributes of the queue module.
- (e) List the statistics that you collected in the Riverbed Modeler M/M/1 queue tutorial. Show graphs illustrating typical simulation results.