

**SIMON FRASER UNIVERSITY  
SCHOOL OF ENGINEERING SCIENCE**

**Fall 2021**

**ENSC 427: COMMUNICATION NETWORKS  
ENSC 894: SPECIAL TOPICS II COMMUNICATION NETWORKS**

**Midterm No. 2**

**Monday, November 22, 2021**

*Duration: 60 minutes. Attempt all problems. Questions are not equally weighted. Please provide detailed answers and include diagrams, graphs, 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. Please write legibly. Illegible text will not be graded. Please use a pen (no pencils, please).*

**1. Chapter 4 The Network Layer: Data Plane (30 points):**

- (a) The network layer functionality may be broadly divided into data plane functionality and control plane functionality. Describe:
  - i. The main function of the data plane. (5 points)
  - ii. The main function of the control plane. (5 points)
  - iii. Key differences between these functions. (5 points)
- (b) List and briefly describe four packet scheduling disciplines. (10 points)
- (c) Which queueing disciplines ensure that all packets depart in the order in which they arrived? (5 points)

**2. Chapter 5: The Network Layer: Control Plane (20 points):**

- (a) Illustrate configuration of forwarding tables in case of per-router and software-defined networking. (10 points)
- (b) Compare and contrast link-state and distance-vector routing algorithms. (10 points)

**3. Chapter 6: The Link Layer and LANs (20 points):**

Derive the derivation of the efficiency of slotted ALOHA. Recall that when there are  $N$  active nodes, the efficiency of slotted ALOHA is  $Np(1-p)^{N-1}$ .

- (a) Find the value of  $p$  that maximizes this expression. (10 points)
- (b) Using the value of  $p$  found in (a), find the efficiency of slotted ALOHA by letting  $N$  approach infinity. (10 points)

**4. Case Study: M-TCP<sup>+</sup>: using disconnection feedback to improve performance of TCP in wired/wireless networks (30 points):**

- (a) What are M-TCP and M-TCP<sup>+</sup> protocols? (5 points)
- (b) List TCP delayed acknowledgement options. (2.5 points)
- (c) Describe TCP persist state. (2.5 points)
- (d) Describe TCP behavior in wireless networks. (5 points)
- (e) Describe M-TCP network elements. (2.5 points)
- (f) Describe M-TCP algorithm. (2.5 points)
- (g) List main characteristics of the M-TCP<sup>+</sup> algorithm. (5 points)
- (h) Briefly describe the simulation scenarios and give overview of simulation results. (5 points)