

**SIMON FRASER UNIVERSITY  
SCHOOL OF ENGINEERING SCIENCE**

**Spring 2021**

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

**Midterm No. 2  
Wednesday, April 07, 2021**

*Duration: 110 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 (20 points):**

- (a) List and briefly describe three types of switching fabrics. (3 points)
- (b) What is a non-blocking switching fabrics? (2 points)
- (c) What is HOL blocking? Does it occur in input ports or output ports? (2 points)
- (d) Briefly describe FIFO, Priority, Round Robin (RR), and Weighted Fair Queuing (WFQ) packet scheduling disciplines. Which of these queuing disciplines ensure that all packets depart in the order in which they arrived? (9 points)
- (e) Do routers have IP addresses? If so, how many? (2 points)
- (f) It has been said that when IPv6 tunnels through IPv4 routers, IPv6 treats the IPv4 tunnels as link-layer protocols. Do you agree with this statement? Why or why not? (2 points)

**2. Chapter 5: The Network Layer: Control Plane (25 points):**

- (a) Is it necessary that every autonomous system use the same intra-AS routing algorithm? Why or why not? (3 points)
- (b) Why are different inter-AS and intra-AS protocols used in the Internet? (3 points)
- (c) List two families of routing algorithms. Name the best-known algorithm in each family. (4 points)
- (d) Write the pseudo code for each algorithm. (10 points)
- (e) What is the count to infinity problem in distance vector routing? (3 points)
- (f) Consider the count-to-infinity problem in the distance vector routing. Will the count-to-infinity problem occur if we decrease the cost of a link? Why? How about if we connect two nodes which do not have a link? (2 points)

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

- (a) Describe CSMA, CSMA/CD, and CSMA/CA random access algorithms. Expand all acronyms. (7 points)
- (b) Provide details of the binary exponential backoff. (7 points)
- (c) In CSMA/CD, after the fifth collision, what is the probability that a node chooses  $K = 4$ ? The result  $K = 4$  corresponds to a delay of how many seconds on a 10 Mbps Ethernet? (6 points)

**4. Chapter 7: Wireless and Mobile Networks (20 points):**

- (a) What are the differences between the following types of wireless channel impairments: path loss, multipath propagation, interference from other sources? (9 points)
- (b) What is meant by a visited network and a home network in 4G/5G cellular architecture? (6 points)
- (c) What is meant by hand over of a network device? (5 points)

**5. Case Study: Implementation of BGP in a network simulator (15 points):**

- (a) What are eBGP and iBGP protocols? (2 points)
- (b) What are BGP peers and what is a BGP session? (2 points)
- (c) List four types of BGP messages. (4 points)
- (d) Show network topology and types of nodes used in the simulated network. (3 points)
- (e) Describe the goal of the study and the simulation scenario. (4 points)