SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Spring 2019
ENSC 427: COMMUNICATION NETWORKS

Final Examination
Thursday, April 18, 2019

Duration: 180 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 ballpoint pen (no pencils, please).

1. **Transport Layer (20 points):**
   (a) **What is reliable data transfer (rdt)?**
   (b) **List the mechanisms employed by reliable data transfer to deal with:**
      i. **Channel with bit errors. How to recover from errors?**
      ii. **Duplicate packets. How to handle duplicates?**
      iii. **Channel with errors and loss. What is the sender's approach?**

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

   Consider the network shown in Fig. 1. Assume that node 1 is the source node and that node 6 is the destination node. Find the shortest path from source node to the destination node. Use tables to show and explain each step of the two algorithms:

   (a) **Dijkstra algorithm. Draw the shortest path tree.**
   (b) **Bellman-Ford algorithm. Draw the shortest path tree.**

3. **The Link Layer and LANs (20 points):**
   (a) **Describe ALOHA and slotted ALOHA algorithms.**
   (b) **Expand the acronym and describe the CSMA/CD algorithm.**
   (c) **Provide details of the binary exponential backoff.**

4. **Wireless and Mobile Networks (15 points):**
   (a) **List components of a cellular network.**
   (b) **Show a typical cellular network topology.**
   (c) **List main differences between 2G, 3G, and 4G network architectures.**

5. **Case Study: Implementation of BGP in a network simulator (20 points):**

   (a) **What are eBGP and iBGP protocols?**

   (b) **What are BGP peers and what is a BGP session?**

   (c) **Show network topology and types of nodes used in the simulated network.**

   (d) **Describe the goal of the study and the simulation scenario.**

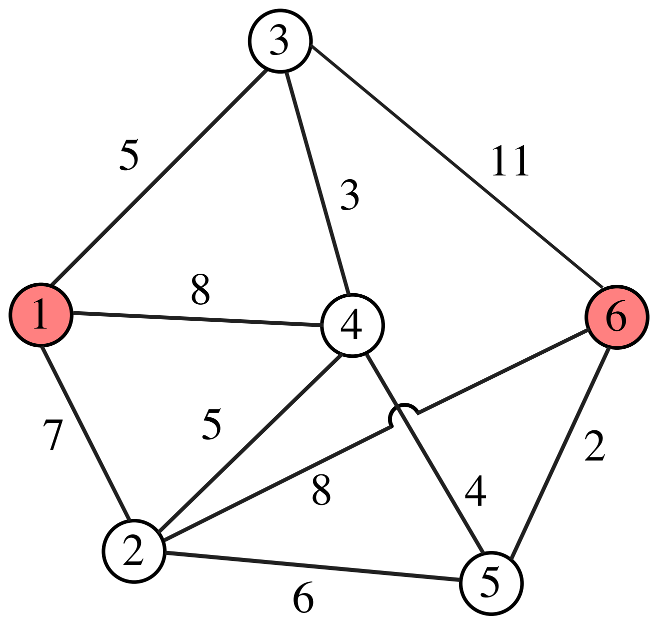

Figure 1: Apply Dijkstra and Bellman-Ford algorithms to find the shortest path in this network with six nodes. Assume that nodes 1 and 6 are the starting and destination nodes, respectively.