SIMON FRASER UNIVERSITY
SCHOOL OF ENGINEERING SCIENCE

Spring 2019
ENSC 427: COMMUNICATION NETWORKS

Midterm No. 2
Wednesday, March 20, 2019

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. **Transport Layer (15 points):**

   Consider the TCP connection management. Use detailed diagrams to illustrate:

   (a) **Establishing a connection.**

   (b) **Closing a connection.**

2. **Transport Layer (25 points):**

   (a) **List main phases of the TCP congestion control algorithm. Indicate each phase on a plot of TCP window size vs. time.**

   (b) **Describe the TCP feedback mechanism in case of packet loss.**

      i. **List TCP mechanisms used to detect packet loss.**

      ii. **How does TCP react to each type of detected packet loss?**

   (c) **Give the expression for calculating average TCP throughput.**

3. **The Network Layer: Data Plane (15 points):**

   (a) **Describe the role of network layer and its data and control planes.**

   (b) **What are main differences between IPv4 and IPv6?**

   (c) **Describe the mechanism used to transition from IPv4 to IPv6.**

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

   (a) **List two families of routing algorithms. Write the pseudo code for:**

      i. **Dijkstra algorithm.**

      ii. **Bellman-Ford algorithm.**

(b) **Derive a table showing each step of the Dijkstra algorithm using the network shown in Figure 1. Assume that nodes 1 and 6 are the starting and destination nodes, respectively.**

(c) **Draw the shortest path tree found by the algorithm.**

5. **Case Study: Sunshine: a broadband packet switch architecture (20 points):**

   (a) **Consider a generic network router:**

      i. **Describe three types of switching fabrics.**

      ii. **What is a non-blocking switching fabrics?**

      iii. **Describe "head-of-line" blocking.**

   (b) **Describe the main elements of the Sunshine architecture.**

   (c) **List traffic models used in simulation scenarios.**

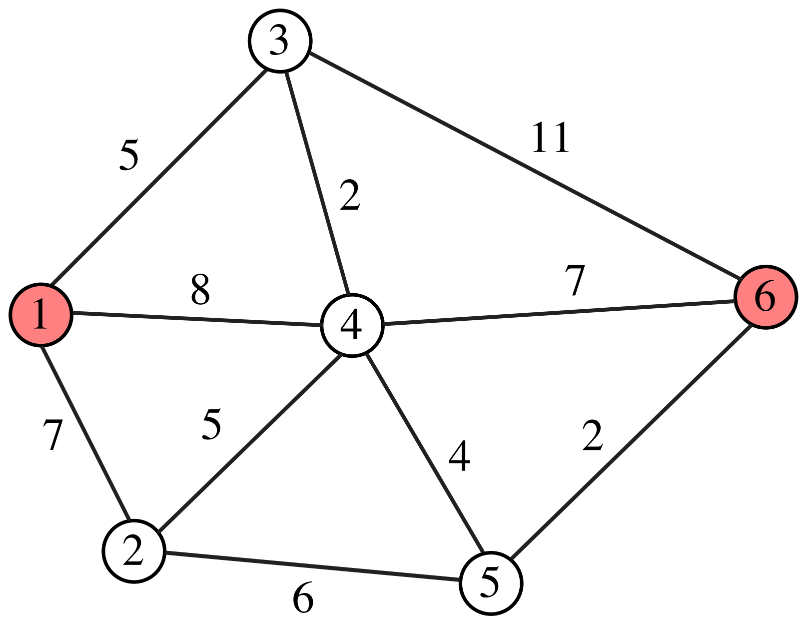

Figure 1: Apply Dijkstra algorithm to find the shortest path in this network with six nodes. Assume that nodes 1 and 6 are the starting and destination nodes, respectively.