**CS 3840 Computer Networking**

**Homework 1**

Please refer to the syllabus for expectations of homework professionalism and appearance. Your homework is expected to be an individual effort. It is also expected to be neat and clearly organized. The University provides access to many software applications. Use them. Handwritten papers and poorly drawn diagrams are not acceptable. You must submit the softcopy of your homework, in one Word or PDF file, by the specified due date and time. You can find the link for your softcopy submission in Blackboard.

**Total points: 24**

The cover page of your homework will contain only the following information in the format given below:

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**Course #: CS 3840**

**Homework #: Homework 1**

1. [20 pts] Suppose two hosts, A and B are separated by 10,000 kilometers and are connected by a direct link of R = 2 Mbps. Suppose the propagation speed over the link is 2×108 meters/sec. Consider sending a file of 80,000 bits from Host A to Host B.

Must show intermediate steps and final answers for full credit.

* 1. [4 pts] Suppose the file is sent continuously as one big message. Calculate the transmission delay and the propagation delay, respectively. How long does it take to send the file?

Transmission Delay = 80,000/2,000,000 = 40ms

Propagation Delay = 10,000,000/200,000,000 = 50ms

Total delay = 40 + 50 = 90ms

* 1. [4 pts] Suppose now the file is broken up into 20 packets with each packet containing 4,000 bits. Calculate the transmission delay and the propagation delay of one packet, respectively.

Propagation Delay is still 50ms

Transmission delay = 4,000/2,000,000 = 2ms

Total delay = 52ms

* 1. [4 pts] Continue Q1.b, suppose that each packet is acknowledged by the receiver and the transmission time of an acknowledgement packet is negligible. Finally, assume that the sender cannot send a packet until the preceding one is acknowledged. How long does it take to send the file? (Hint: need to consider the propagation delay of the acknowledgement packets)

Total transmission time = 20 packets \* 2ms = 40ms

Total propagation time = 20 \* 50ms = 1000ms

Total Ack transmission time = 20 \* 2ms = 40ms

Total Ack Propagation time = 20 \* 50ms = 1000ms

Total time = 2080ms (2.08 seconds)

* 1. [4 pts] If there are two routers between Host A and B (i.e., three links rather than a direct link, but the change of the distance between two hosts is negligible), how long does it take to send the file? (Assume all links have 2 Mbps transmission rate, and the file is sent as Q1.a)

Total Transmission delay = 40ms \* 3 (links) = 120ms

Total propagation delay = 50ms (assuming no change in distance)

Total time = 170ms

* 1. [4 pts] If there are two routers between Host A and B, how long does it take to send the file? (Assume all links have 2 Mbps transmission rate and the file is sent as Q1.b&c)

Total propagation delay = 20 \* 50ms = 1000ms (assuming no change in distance)

Total transmission delay = 20 packets \* 2ms \* 3 (links) = 120ms

Total time = 1120ms (1.12 seconds)

1. [4 pts] Explore ‘ping’ and ‘traceroute’ (or ‘tracert’ on Windows) which are basic tools used to measure network performance and retrieve network status.
   1. Install Wireshark and use Wireshark capturing packets. Using proper display filter and take screenshots for ‘ping’ and ‘traceroute’ commands for the host in Q2.b, respectively (start a new capture for each command).

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

* 1. Run 'ping' and 'traceroute' with one host (suggest one host at east/west coast or on a different continent).

A screenshot of a computer

Description automatically generated

A screenshot of a computer

Description automatically generated

* 1. Submission: for each command, one screenshot of the command and its output, and another screenshot of Wireshark results.