

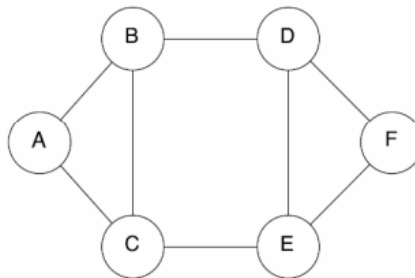
Homework 1

Please email your answers/report in **PDF format** to Mr. Jafari “mjafari@ce.sharif.edu” and CC me at “kharrazi@sharif.edu”. The HW file name should be “**Your Lastname-693-HW-1**”. It should be used as the subject of your email, too. In order for us not to miss your homework please follow the formatting. This homework is due by **Mehr 27th, 11:59 PM**. You are also supposed to have a face-to-face delivery, the time of which will be announced later.

Part I ¹

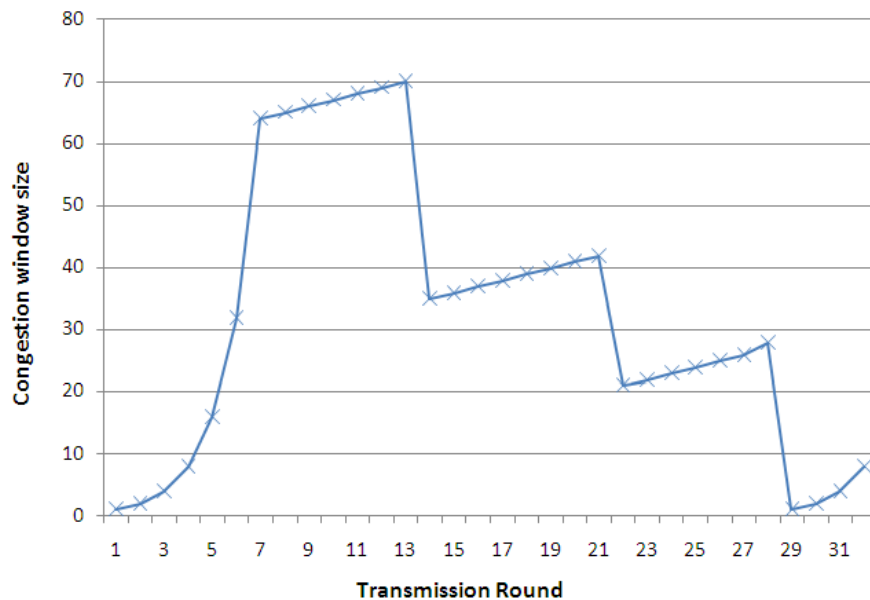
Answer the following question in detail: (20 Point)

1. A certain satellite channel has the following characteristics. The channel has a 350-ms propagation delay in either direction. The channel is full duplex with 1 Mbps raw bandwidth in both directions. A sliding window protocol for this channel uses 1000-bit frames with a send window size of 400. Suppose, at time $t = 0$, one endpoint of the channel starts to send a very large amount of data. At what time later does the sending station receive an ACK for the 450-th frame? (Assume the transmission time for an ACK is 0 because it is very small).
2. For this question, assume that the routers use RIP to calculate their forwarding tables.



- (a) Fill in the routing table for node **A**, after convergence.
 - (b) After convergence, node **D** goes down. Fill in the final routing table for **C**, after re-convergence.
3. Consider the following plot of TCP window size as a function of time. Assuming TCP is the protocol experiencing the behavior shown above, answer the following questions. In all case, you should provide a few sentences justifying your answer.

¹Some of the problems in this section are obtained from multiple sources, acknowledgments are available on the course website.



- What is the value of threshold at the 16th transmission round?
- What is the value of threshold at the 25th transmission round?
- Identify the intervals of time when TCP slow start is operation.
- Assuming a packet loss is detected after the 33th round by the receipt of a triple duplicate ACK, what will be the values of the congestion window size and of threshold?
- After the 13th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
- After the 28nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?
- Identify the intervals of time when TCP congestion avoidance is operating.
- What is the initial value of threshold at the first transmission round?
- During what transmission round is the 565th segment sent?

Part II ²

Unix/Linux provides a series of useful utilities to configure, analyze and debug networks. This section is designed for you to gain an understanding of what these tools are and what you can use them for. You should find commands then execute them from an *Unix/Linux* machine in order to answer the following questions.(20 Point)

- What are your IP address and MAC address?
- What are the IP address and MAC address of your Gateway?
- Find the RTT of your gateway and compare it to an arbitrary website's RTT.
- Find the IP addresses and their RTT between you and an arbitrary website.
- Which hop is the shortest one in the previous question?

²Obtained from an assignment given in CS744 computer networks at Carnegie Mellon by Srinivasan Seshan.

Part III

In this part of the assignment, the goal is to become familiar with network traces and be able to write simple scripts to process such data. Please follow the below steps: (60 Point)

- Get familiar with a sniffing program such as *tcpdump* (found on most *nix distributions) or *wireshark*, specially with the filtering options for data collection.
- While connected through an Ethernet connection, download a file from the web, and collect the network traffic. You should make this download from a server with low RTT values.
- While connected through an Ethernet connection, download a file from the web, and collect the network traffic. You should make this download from a server with high RTT values. (Perhaps downloading a file from New Zealand, Australia, South America, etc)

Locate the TCP stream for the file you downloaded, and obtain the following information from that TCP stream. To answer some of the question below, you should write a simple script with perl or python or the scripting language of your choice:

1. What are the source and destination ports?
2. What ISN is used from your side (i.e. the client)?
3. What ISN is the server providing?
4. What is the total number of packets sent and received?
5. What is the window size advertised by the receiver?
6. Did you observe any fragmented packets? Report on them.
7. Do you observe any packet losses? How about retransmissions? Report on them.
8. Plot the RTT for the connection as a function of time.
9. Plot the IP ID as a function of time.
10. Plot the congestion window for the connection as a function of time. How accurate is your plot?