**Homework 2: HTTP, TCP, and Wireshark**

**Part B Congestion control:**

1. Congestion window for flow: (43498, 80)

1 congest window size: 2

2 congest window size: 4

3 congest window size: 8

4 congest window size: 14

5 congest window size: 15

6 congest window size: 16

7 congest window size: 17

8 congest window size: 18

9 congest window size: 19

10 congest window size: 20

Congestion window for flow: (43502, 80)

1 congest window size: 2

2 congest window size: 4

3 congest window size: 8

4 congest window size: 14

5 congest window size: 15

6 congest window size: 16

7 congest window size: 17

8 congest window size: 18

9 congest window size: 19

10 congest window size: 20

Congestion window for flow: (43500, 80)

1 congest window size: 2

2 congest window size: 4

3 congest window size: 8

4 congest window size: 14

5 congest window size: 15

6 congest window size: 16

7 congest window size: 17

8 congest window size: 18

9 congest window size: 19

10 congest window size: 20

The CWND is initialized to value 1 MSS, where MSS = 1460 bytes. Whenever we receive an acknowledge we double the CWND till it reaches threshold value. We have initialized threshold value to half of receiver window size. Once the threshold is reached CWND is increased linearly by 1 MSS. If there is a loss detected due to time out, we set the CWND value to initial value and divide the threshold value by 2. In case of loss detected due to triple duplicate acknowledgement, we set divide CWND by 2 and set this value to CWND and threshold.

1. **Retransmission:**

Retransmissions due to triple duplicate acks

{(43498, 80): 2, (43502, 80): 0, (43500, 80): 4}

Retransmissions due to time out

{(43498, 80): 1, (43502, 80): 0, (43500, 80): 90}

We keep counting the acknowledgement packets corresponding to the acknowledgement numbers. If there is ack number with count equal to three, this means the packet is lost with the ack number byte. This is how we detect retransmission due to triple duplicate ack.

In case of time out, we check the count sequence number in sent packets and if there is a sequence number with count equal to 2 and acknowledge number count for that byte number is less than 3, we consider it as retransmission due to time out.