For each TCP flow:

(1) Print the first 10 congestion window sizes (or till the end of the flow if there are less than five congestion windows). You need to decide whether the congestion window should be estimated at the sender or the receiver and explain your choice. Mention the size of the initial congestion window. You need to estimate the congestion window size empirically since the information is not available in the packet. Comment on how the congestion window size grows. Remember that your estimation may not be perfect, but that is ok. Congestion window sizes are typically estimated per RTT.

I am calculating congestion window per RTT, as congestion window is RTT clocked. I am checking how many packets are sent from sender to receiver in an RTT which is approximately 73 ms for all 3 connections.

---------- Connection 1 ----------
Triple Acknowledgement Loss = 2
Timeout Loss = 2
Congestion Window = 18980
Congestion Window = 29200
Congestion Window = 59860
Congestion Window = 70080
Congestion Window = 102200
Congestion Window = 154760
Congestion Window = 210240
Congestion Window = 292000
Congestion Window = 410260
Congestion Window = 614660
Congestion Window = **316820**

The initial congestion window size is 18980. Seems that the first ten size grows multiplicatively but not exactly by a factor 2. The first 10 growth rate = [1.53, 2.05, 1.17, 1.45, 1.51, 1.35, 1.38, 1.40, 1.49, 0.51], we observed a packet loss during the 10^{th} congestion window hence 11^{th} congestion window size is approximately half of 10^{th} congestion window.

---------- Connection 2 ----------
Triple Acknowledgement Loss = 36
Timeout Loss = 59
Congestion Window = 16060
Congestion Window = 42340
Congestion Window = 64240
Congestion Window = 71540
Congestion Window = 106580
Congestion Window = 143080
Congestion Window = 223380
Congestion Window = 292000
Congestion Window = 439460

Congestion Window = 610280
Congestion Window = **297840**

The initial congestion window size is 16060. Seems that the first ten size grows multiplicatively but not exactly by a factor 2. The first 10 growth rate = [2.63, 1.51, 1.11, 1.48, 1.51, 1.34, 1.55, 1.30, 1.39, 0.48], we observed a packet loss during the 10th congestion window hence 11th congestion window size is approximately half of 10th congestion window.

---------- Connection 3 ----------
Triple Acknowledgement Loss = 0
Timeout Loss = 1
Congestion Window = 18980
Congestion Window = 37960
Congestion Window = 54020
Congestion Window = 74460
Congestion Window = 110960
Congestion Window = 124100
Congestion Window = 211700
Congestion Window = 343100
Congestion Window = 86140

The initial congestion window size is 18980. Seems that the size grows multiplicatively but not exactly by a factor 2. The first 10 growth rate = [2.00, 1.42, 1.37, 1.48, 1.12, 1.70, 1.62, 0.25], we observed a packet loss during the 8th congestion window hence 9th congestion window size is reduced drastically.

(2) Compute the number of times a retransmission occurred due to triple duplicate ack and the number of times a retransmission occurred due to timeout (as before, determine if you need to do it at the sender or the receiver).

We use two dictionaries to calculate all the retransmissions which occurred due to triple duplicate acknowledgment, one is used to calculate the number of packets with same sequence number and the other is used to calculate the number of packets with the same ack number for each seq number in the seq dictionary we find if it is also present in acknowledge Dictionary and if it is received more than 2 times.

Total loss is calculated in Part A. Total loss is calculated as done in Part A i.e., count the number of packets whose sequence number is repeated. Therefore, the total loss due to timeout is total loss - loss due to triple duplicate ack.

---------- Connection 1 ----------
Triple Acknowledgement Loss = 2
Timeout Loss = 2
---------- Connection 2 ----------
Triple Acknowledgement Loss = 36
Timeout Loss = 59
---------- Connection 3 ----------

Triple Acknowledgement Loss = 0
Timeout Loss = 1