# Assignment 4 Part A
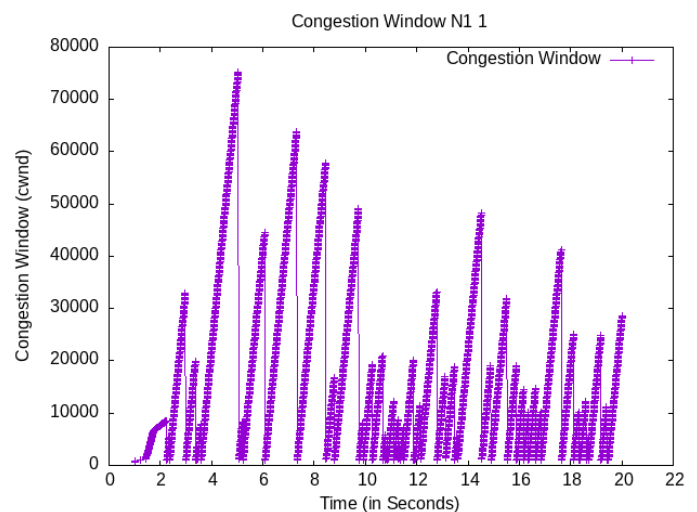## Shreyansh Singh
2020CS10385

Description of files:

1) TcpNewRenoPlus.h : Header file for TcpNewRenoPlus.cc, this is derived class of TcpNewReno.

2) TcpNewRenoPlus.cc : This file contains function description for new TCP protocol. The functions defined are "GetTypeId", "SlowStart", "CongestionAvoidance", "GetName", constructor and destructor.

3) First.cc: This file tests both the protocol on the topology.

4) congestion1/2/3/4/5/6.plt: These files uses ".cwnd" and plot the congestion window graph for Connection 1/2/3/4/5/6.

5) runA.sh: To run type "sh runA.sh". This file runs both the protocols and create all the graphs.
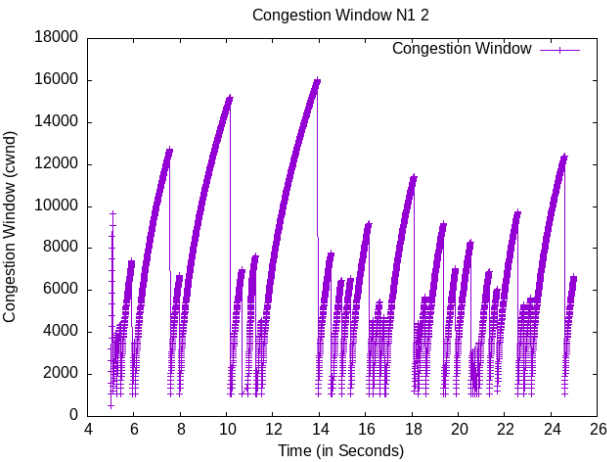
Question 1:
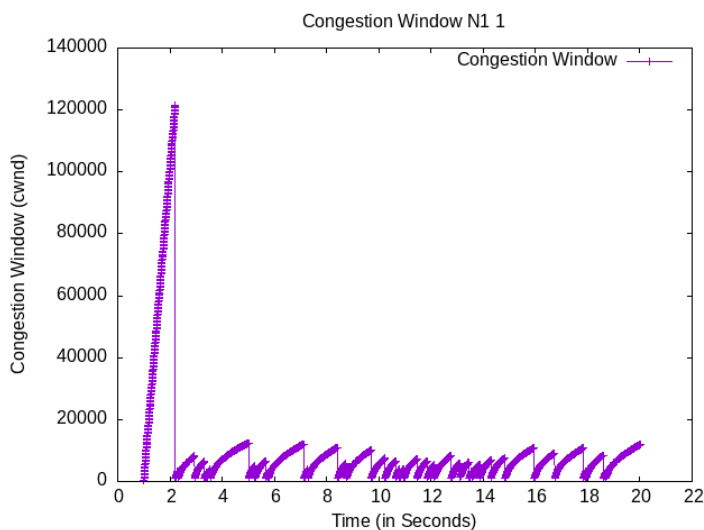
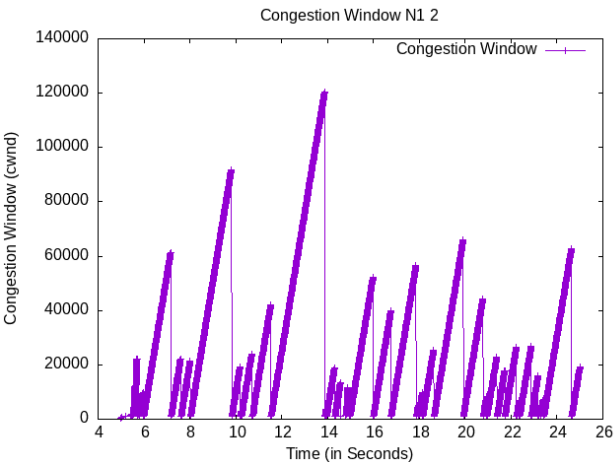### TCP NewReno   TCP NewRenoPlus
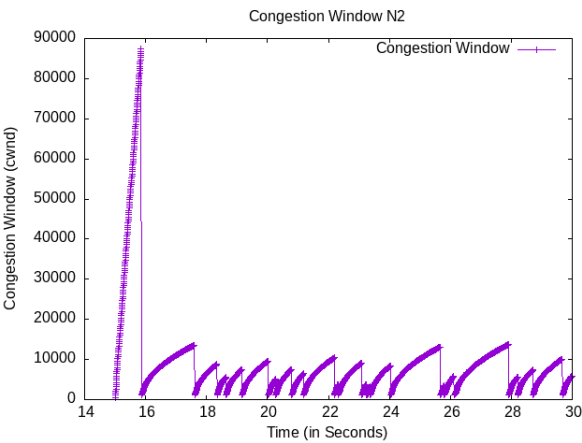

Connection 1

TCP NewReno

Congestion Window N1 2

TCP NewRenoPlus

Congestion Window N1 2

Connection 2

TCP NewReno

Congestion Window N2

TCP NewRenoPlus

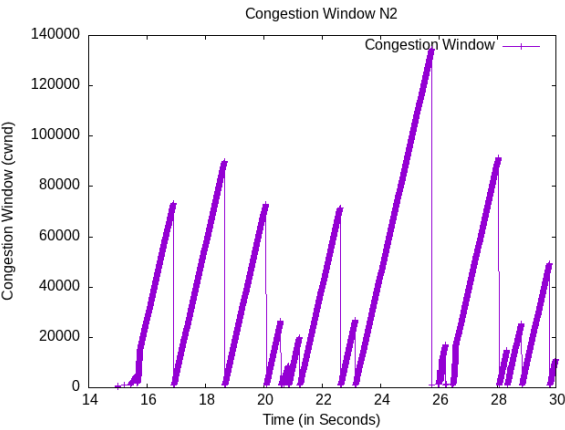### Congestion Window N2

Connection 3

Question 2: How does the congestion avoidance phase vary on the same sender when using TCPNewRenoPlus vs TCPNewReno? Explain the observed trends. How does it impact the entire network?

Answer:

The congestion avoidance phase in TCP NewReno is :
$$Cwnd = Cwnd + max(1, (SegmentSize)^2 / Cwnd)$$
The congestion avoidance phase in TCP NewRenoPlus is :
$$Cwnd = Cwnd + 0.51 * SegmentSize$$

The congestion avoidance in NewRenoPlus is linear with a constant increase of 273 whereas in NewReno it is sublinear, the rate of increase decreases very quickly (it moves near it's saturation). This explains the shape in the graph during congestion avoidance phase. Since after a packet drop the congestion window mostly drops to 1072 thus the increase in NewReno is 268 ($536^2/1072$) and then the rate of increase decreases.
The congestion window reaches much higher values in NewRenoPlus instead of NewReno and the average is also very high. This is beacuse, the rate of increase in NewRenoPlus is much more than in NewReno.
In all three connections the congestion avoidance phase starts after first packet drop and then it remains in congestion avoidance for all the time.

In the TCP NewRenoPlus the average congestion window size is much larger than in TCP NewReno thus it facilitates faster data transfer and the throughput in case of NewRenoPlus is higher than NewReno.