Computer Networks Assignment 3

Q1.

(A) Theoretically the maximum throughput would be 7Mbps. This is because the 2 bandwidths given are 10Mbps and 7Mbps. So the bandwidth bottleneck out of the two would be the minimum of the two bandwidths min{N0-N1,N1-N2} which is 7Mbps.

(B) Bandwidth Delay Product calculation between N0 - N2

BDP is the bandwidth in bits per second multiplied by the round trip time in seconds.

Bottleneck Bandwidth is 7Mbps

One way delay = 100+10 = 110ms so the 2 way delay = 220ms

Bandwidth Delay Product = Bottleneck Bandwidth * total round trip delay

=> 7 x 10^6 bits per second x 220 x 10^-3 = 1.54 x 10^6

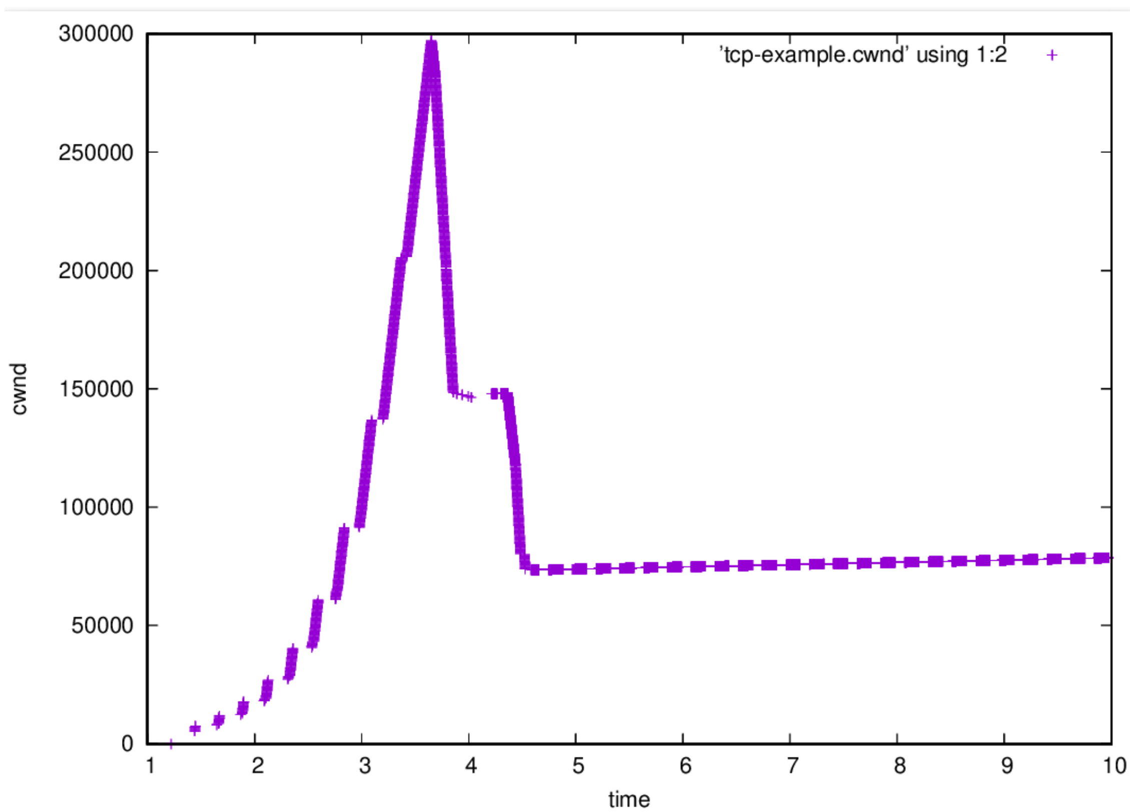
The number of packets being packets is = 1460 bytes = 1460*8 bits -> 1 packet

In terms of packets = 1.54 x 10 ^6/1460 x 8 = 131.8 packets is the BDP. although the thing is a packet is sent as a whole packet so yeah it would be 131 packets.

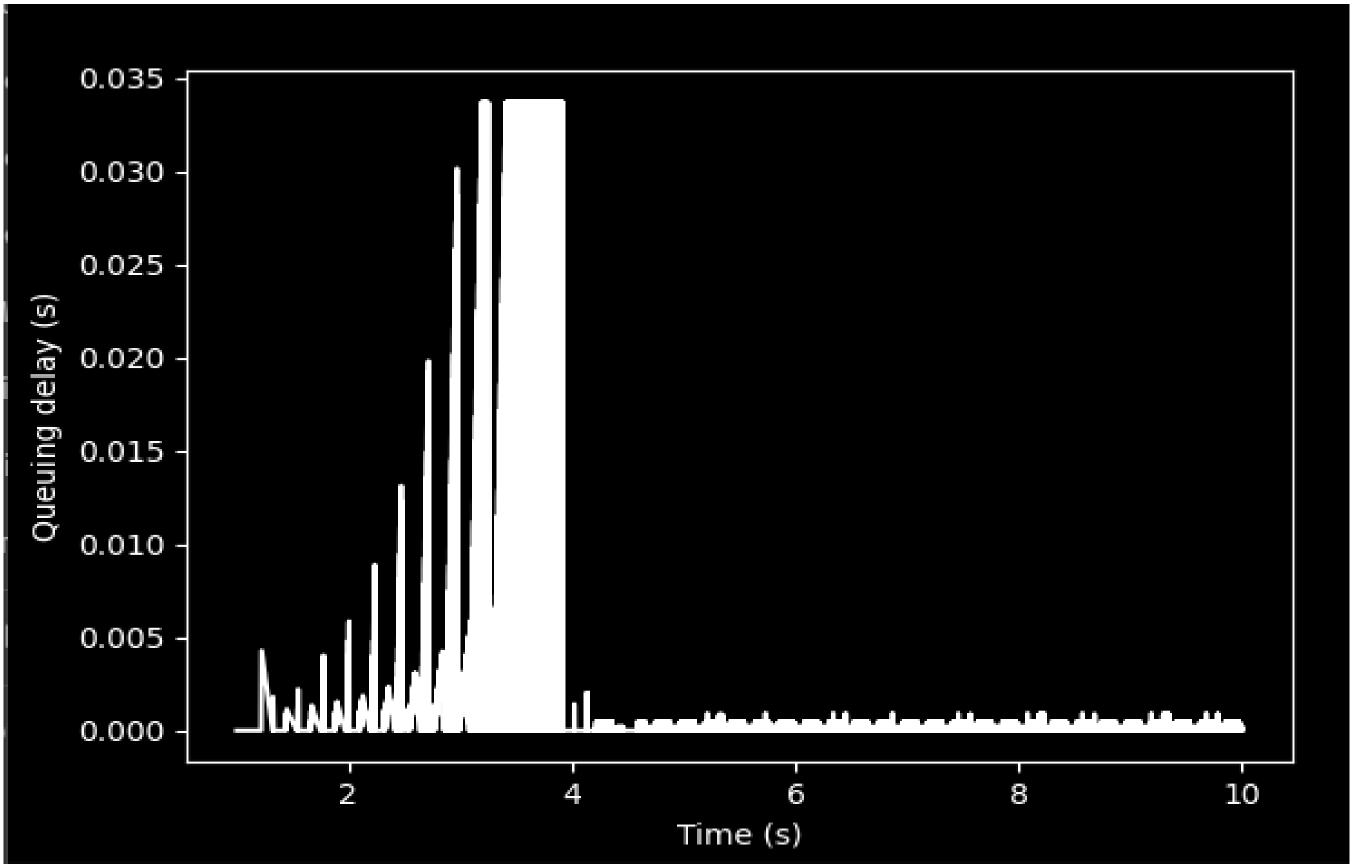
(C) Bits transferred from 3081k/s (from N0 to N2) + 180k/s (from N2 to N0) = 3261k/s bits this when converted to Mbps comes out to be 3.261Mbps

(D) Actual throughput any day would be much lesser than the theoretical throughput due to many practical reasons such as packets dropped which are reprocessed and sent to the receiver again and this in hand would increase the time taken which would really screw up the throughput.

(E)



(F)

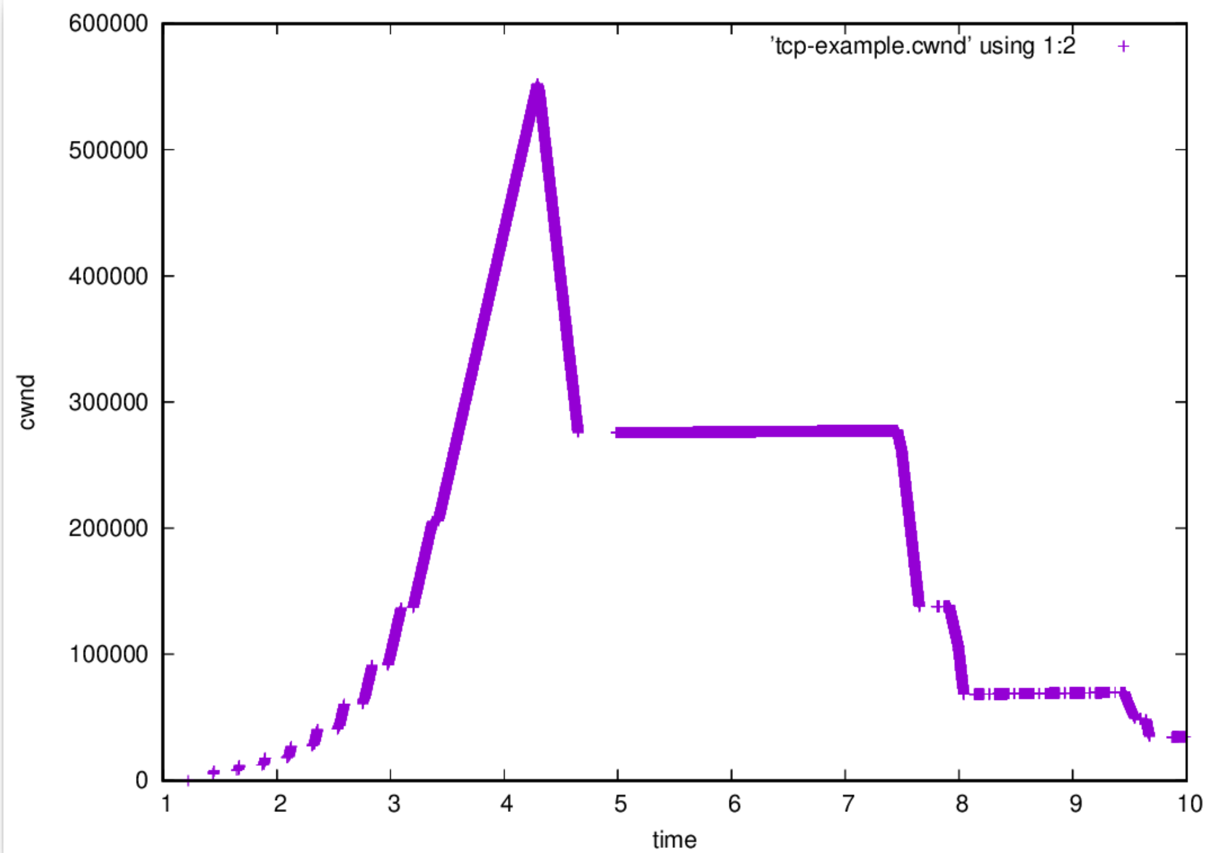


(G)

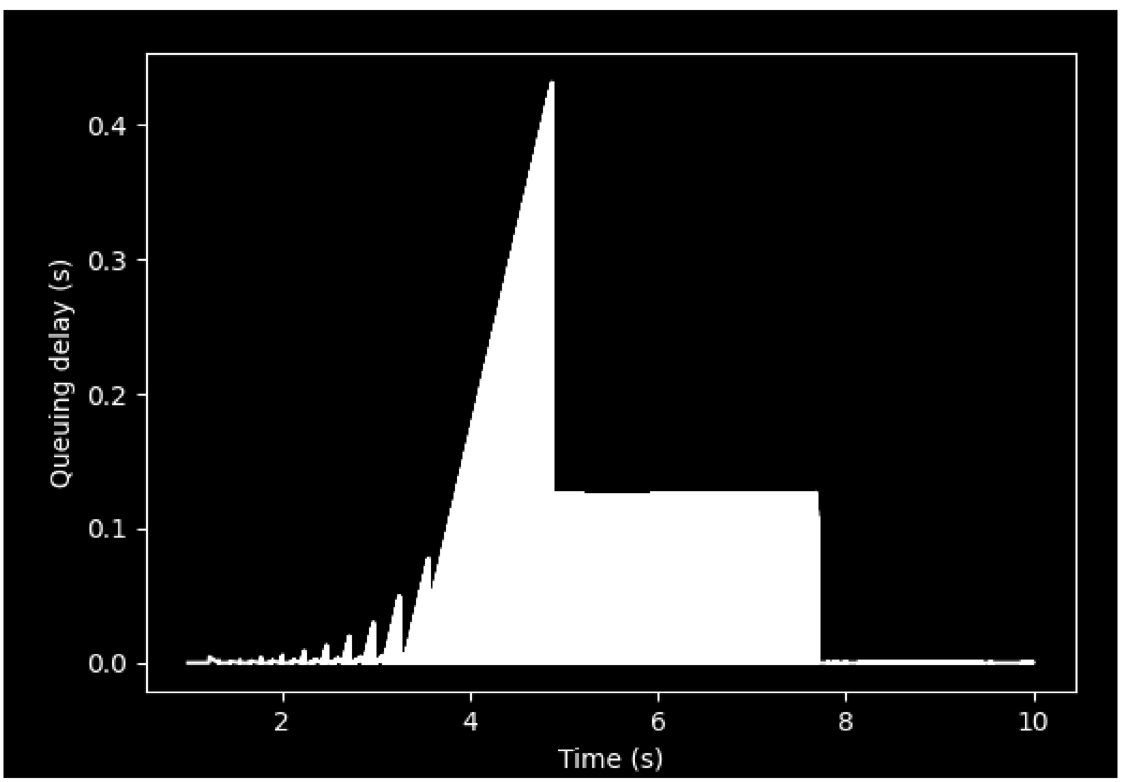
Yes, both these graphs are correlated as when the congestion window increases the queueing delay automatically increases which we can observe in the graphs above. They follow the same trend!

Q2.

(A) Bits transferred from 4563k/s (from N0 to N2) + 271k/s (from N2 to N0) = 4834k/s bits this when converted to Mbps comes out to be 4.834Mbps


'tcp-example.cwnd' using 1:2
cwnd
time
600000
500000
400000
300000
200000
100000
0
1
2
3
4
5
6
7
8
9
10

(B)

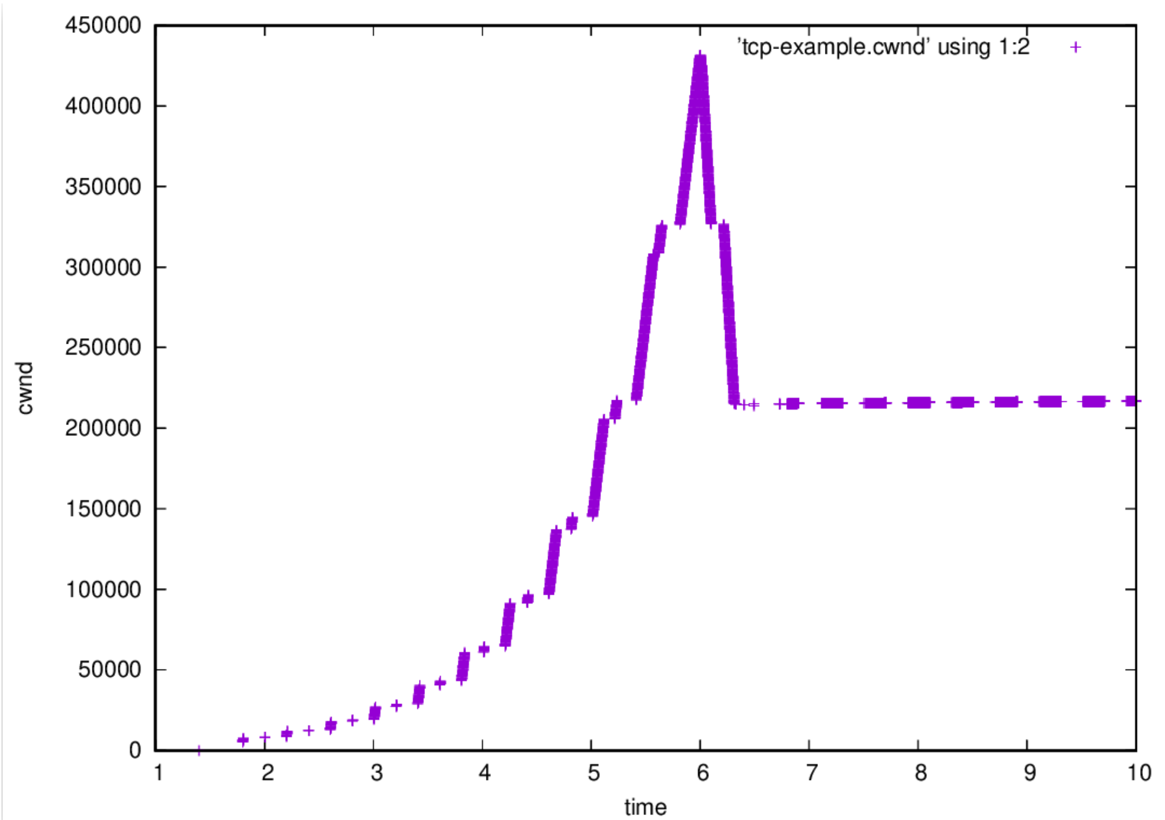

Queuing delay (s)
Time (s)
0.4
0.3
0.2
0.1
0.0
2
4
6
8
10

(C)

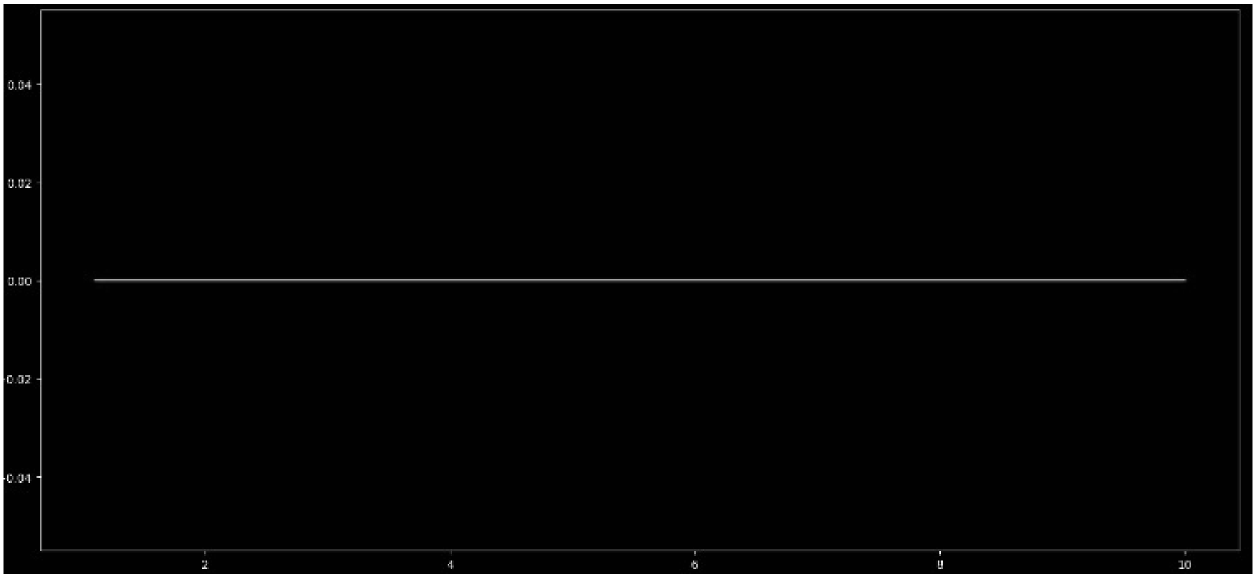
(D) Here in this case when we increase the queuing size to 1000 we can see that the congestion window becomes a little bit tolerant. That is when we compare q1 and q2 graphs we can see that the congestion window is much more tolerant and reaches a peak at a different and much later time. These packets in these queues take a longer time to be processed and when compared to the first case with the lower queue size.

Q3.

(A) Bits transferred from 3264k/s (from N0 to N2) + 186k/s (from N2 to N0) = 3450k/s bits this when converted to Mbps comes out to be 3.45Mbps.



(B)

(C) 

(D) Here there'd obviously be congestion in the process as the packets from the receiver are sent out at a much faster rate than they're being received at, although the catch here is when it comes to queuing delay here the packets arrive at the same rate they're pushed out at so as we can see theres no queuing delay as we can see!