Lab5

Exercise1

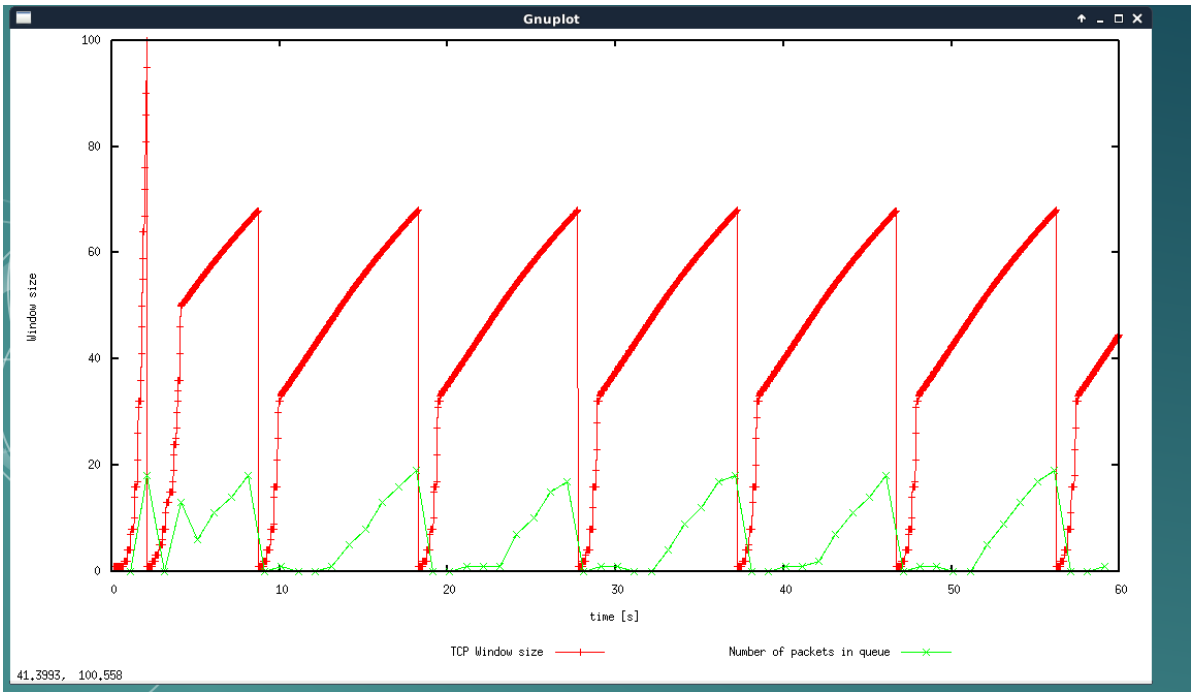
Question1

What is the maximum size of the congestion window that the TCP flow reaches in this case? What does the TCP flow do when the congestion window reaches this value? Why? What happens next? Include the graph in your submission report.

Max size of the congestion window: `100`.

When the congestion window reaches this value, TCP flow will reduce window to 1 then set the threshold to half of the current congestion window.

It causes by packet loss or time out, sending 150 packets but at the maximum size of the congestion window, there are only about 20 packets in the queue.

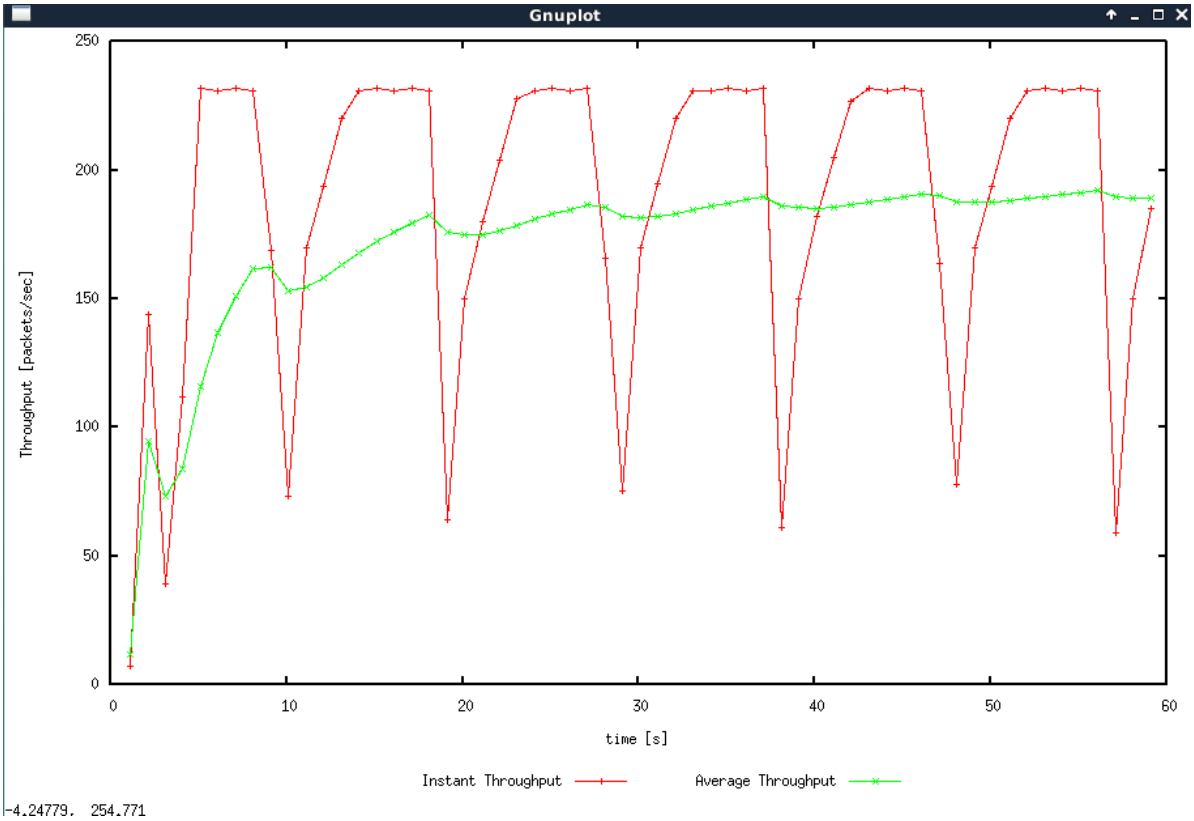


Question 2

From the simulation script we used, we know that the payload of the packet is 500 Bytes. Keep in mind that the size of the IP and TCP headers is 20 Bytes, each. Neglect any other headers. What is the average throughput of TCP in this case? (both in number of packets per second and bps)

From the graph, we can say the average throughput of TCP is around 190 packets/sec.

in bps: `190 * (500 + 20*2) * 8 = 820800 bps`



Question 3:

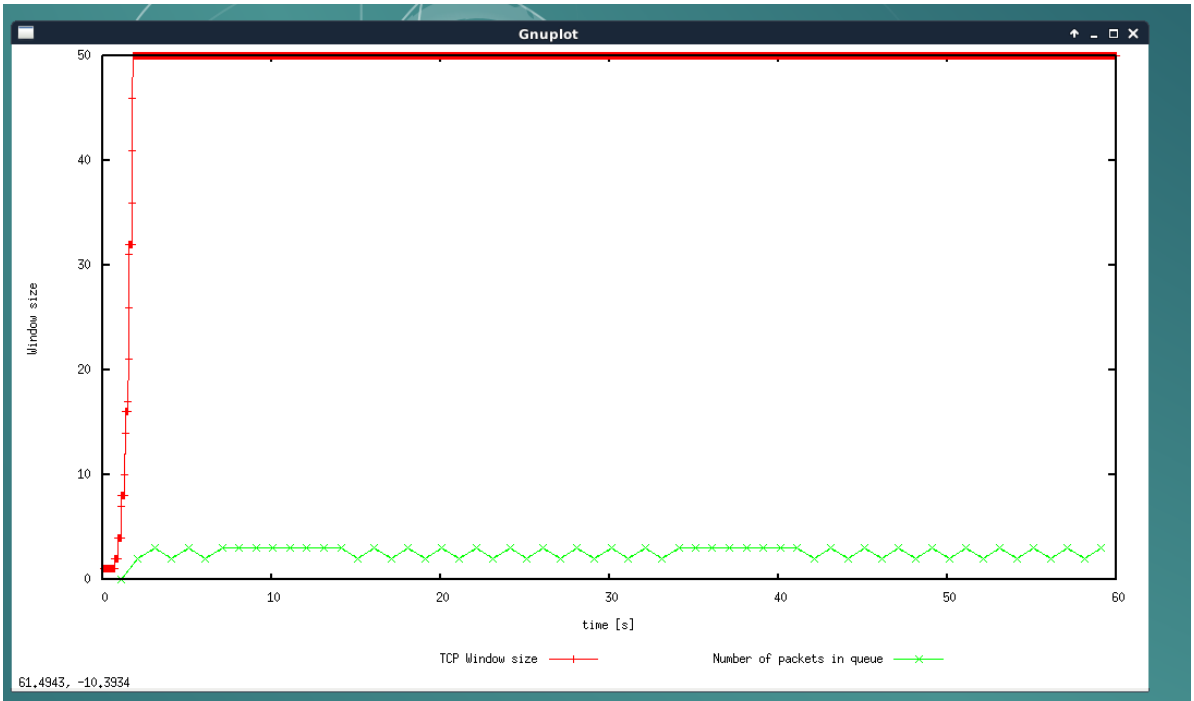
Rerun the above script, each time with different values for the max congestion window size but the same RTT (i.e. 100ms). How does TCP respond to the variation of this parameter? Find the value of the maximum congestion window at which TCP stops oscillating (i.e., does not move up and down again) to reach a stable behaviour. What is the average throughput (in packets and bps) at this point? How does the actual average throughput compare to the link capacity (1Mbps)?

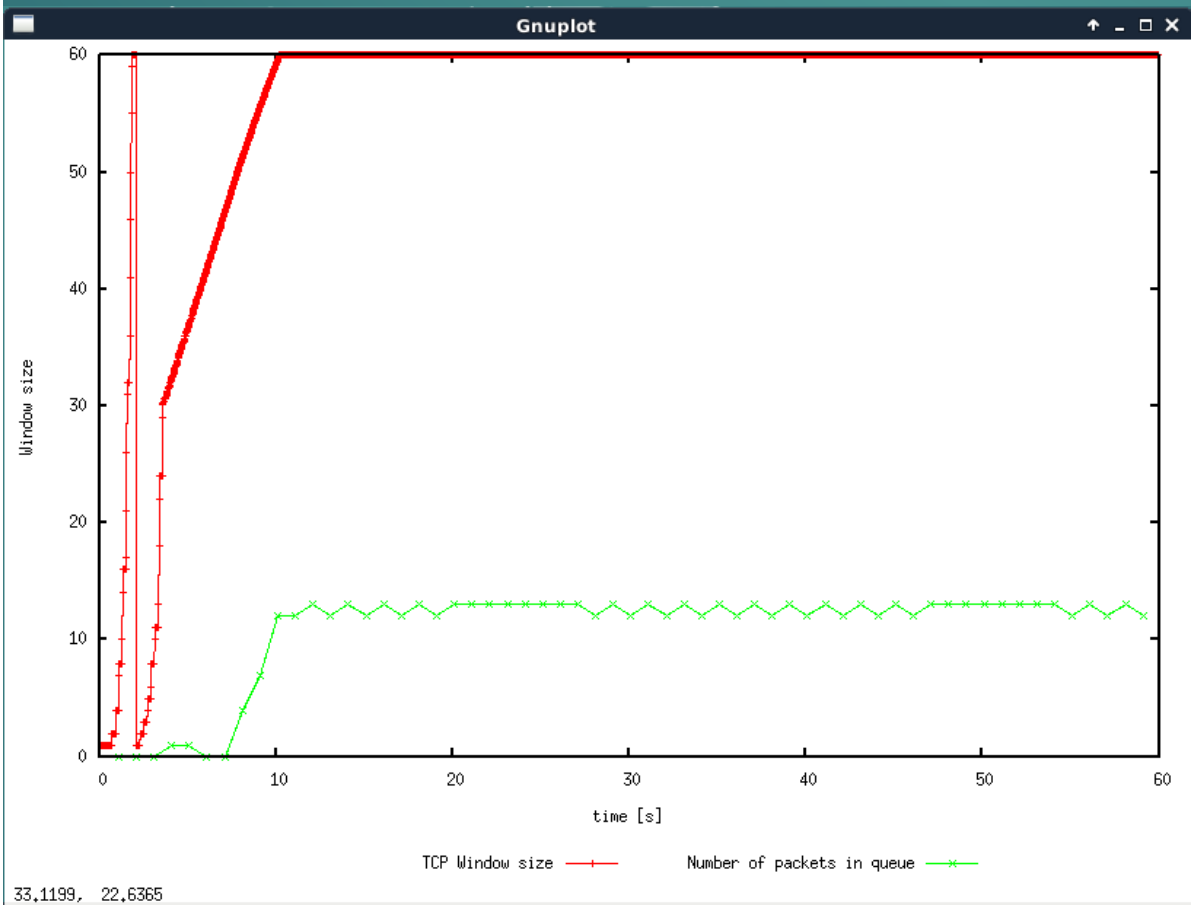
We can see if windows size is smaller than 50, the oscillation doesn't happen, so maximum congestion window is `50`

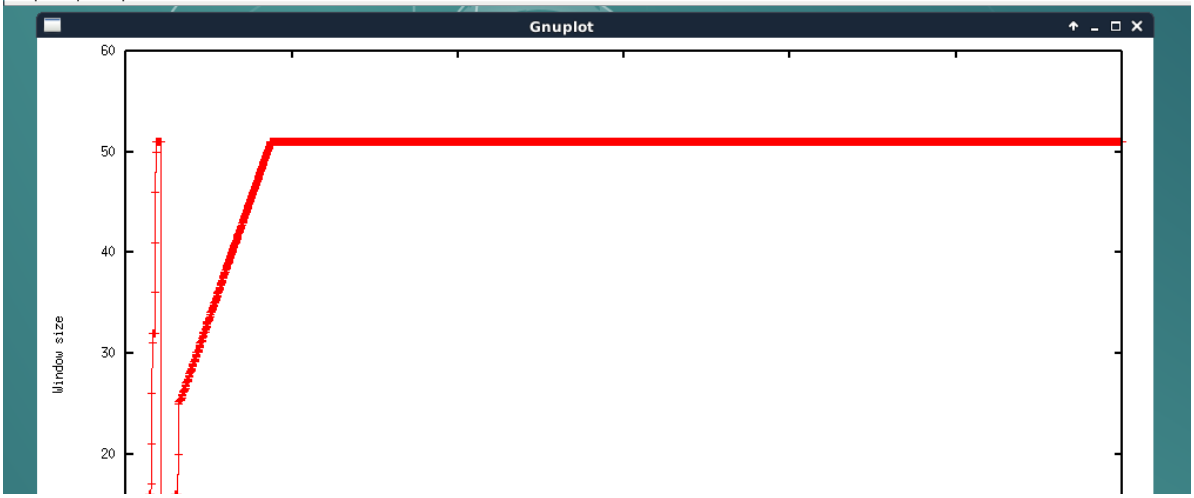
From the last graph, we can get the average throughput is about 225 packets/sec

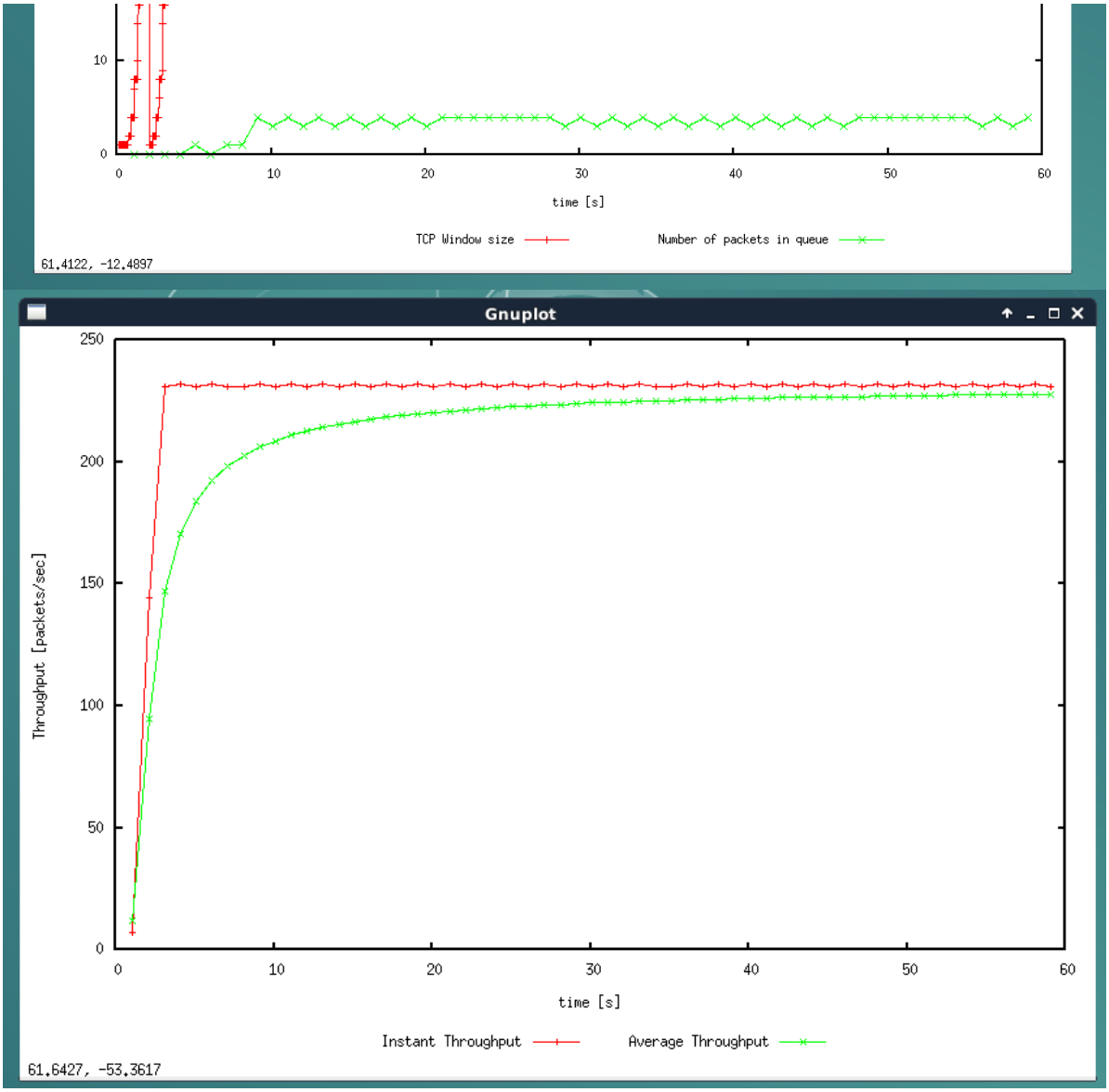
in bps: `225 * (500 + 20*2) * 8 = 97200 bps`

Actual average throughput is close to link capacity(1Mbps)


Gnuplot
Window size
time [s]
TCP Window size
Number of packets in queue
61.4943, -10.3934


Gnuplot
Window size
time [s]
TCP Window size
Number of packets in queue
33.1199, 22.6365


Gnuplot
Window size



Question 4

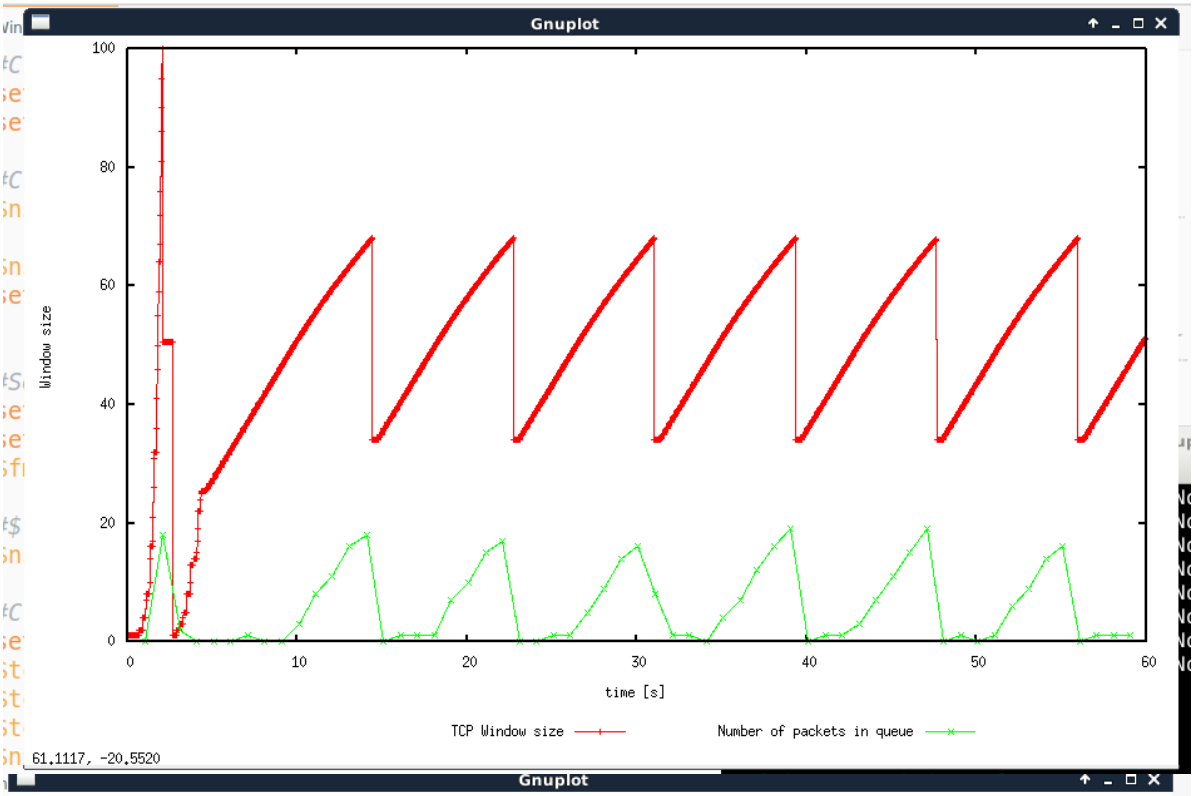
Repeat the steps outlined in Question 1 and 2 (NOT Question 3) but for TCP Reno. Compare the graphs for the two implementations and explain the differences. (Hint: compare the number of times the congestion window goes back to zero in each case). How does the average throughput differ in both implementations?

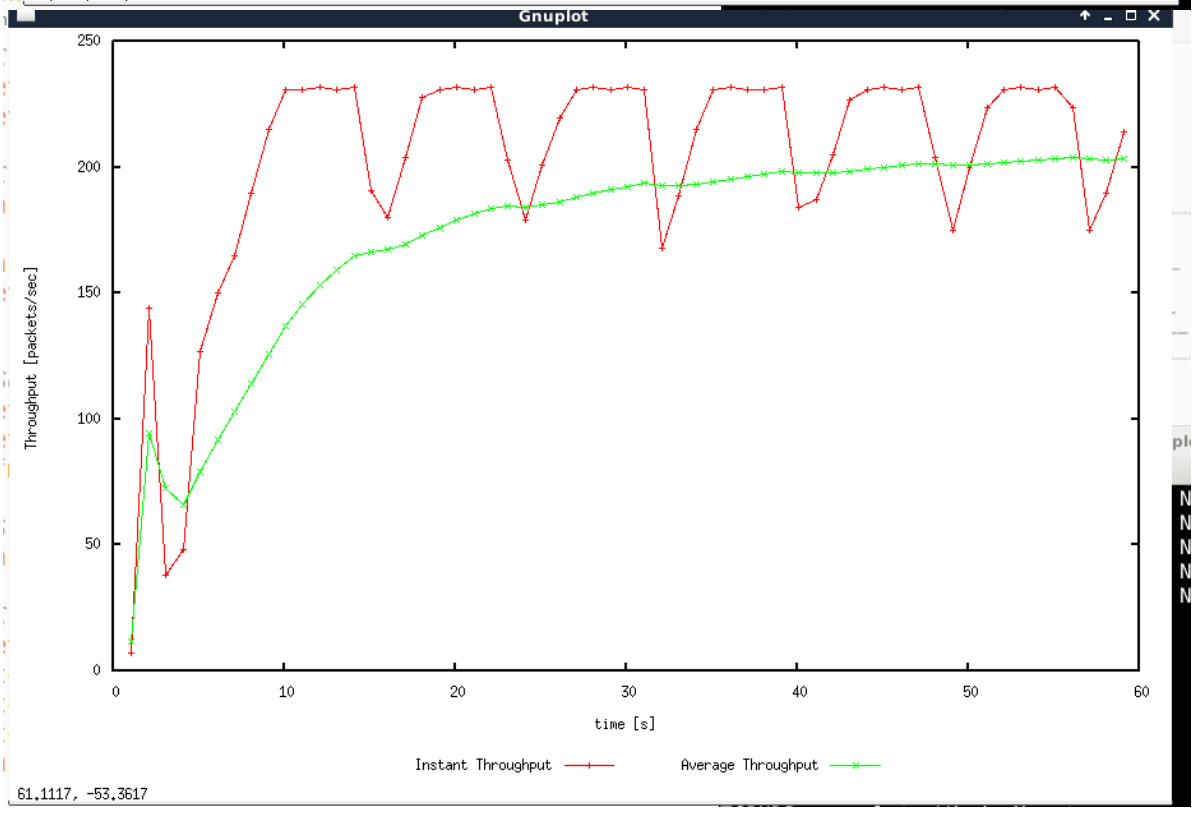
If three ACK are received, TCP Reno will not slow start, it will skip slow start and do a fast retransmit.

Tahoe will half the congestion window.

In addition, Tahoe goes back to zero 7 times while Reno only goes back to zero 1 times.

	average throughput(packet/sec)	average throughput(bps)
Tahoe	190	820800
Reno	200	864000





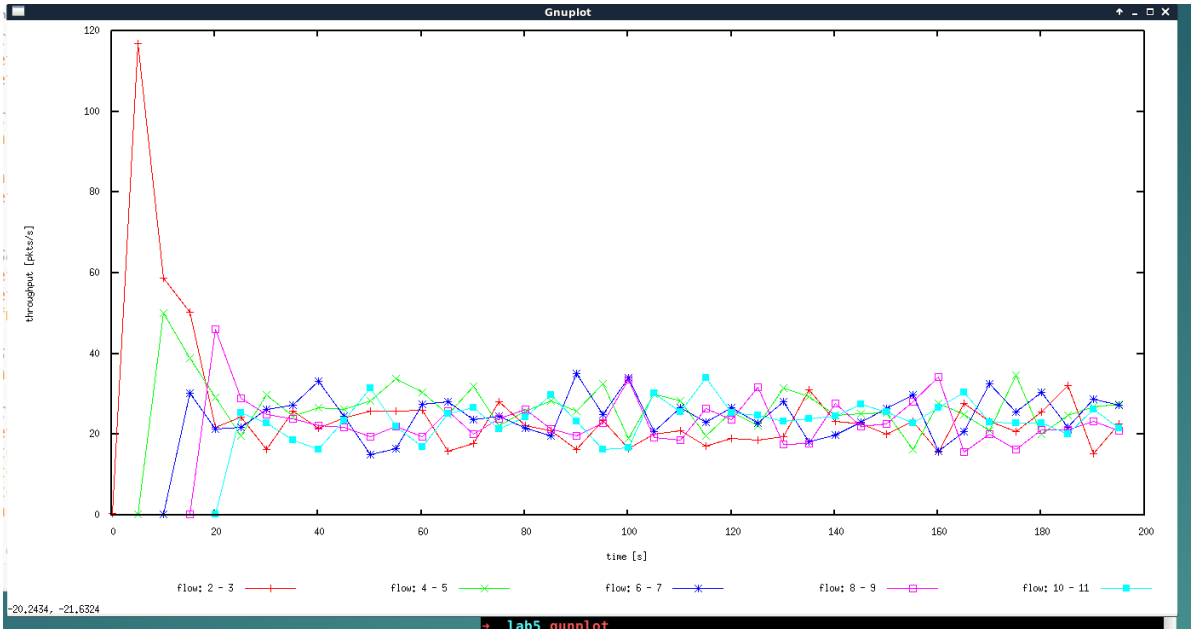
Exercise2

Question 1

Does each flow get an equal share of the capacity of the common link (i.e., is TCP fair) ? Explain which observations lead you to this conclusion.

Yes.

At first, there is only 2-3 flow, then the other flow join in and the 2-3 throughput decreased. At last, all the flows has similar throughput.



Question 2

What happens to the throughput of the pre-existing TCP flows when a new flow is created? Explain the mechanisms of TCP which contribute to this behaviour. Argue about whether you consider this behaviour to be fair or unfair.

the throughput will decrease of the pre-existing TCP flows when a new flow is created. Once a new flow is created, the other flows will adjust accordingly.

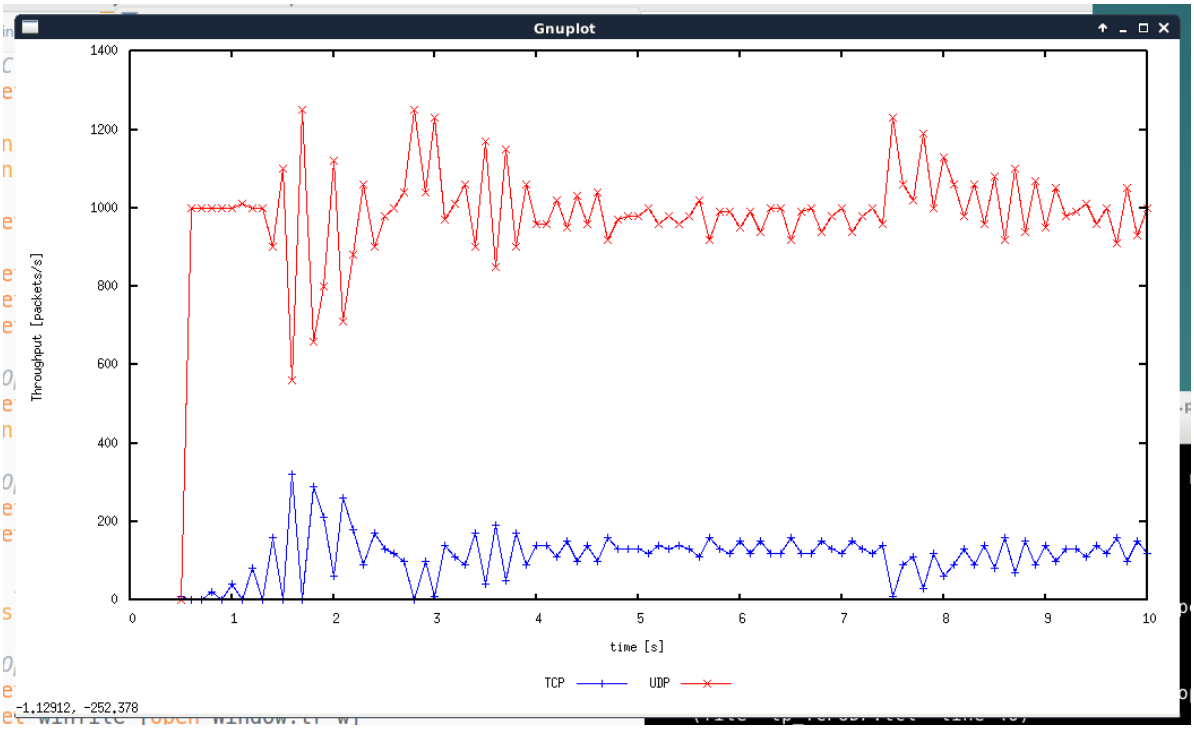
Exercise 3

Question1

How do you expect the TCP flow and the UDP flow to behave if the capacity of the link is 5 Mbps ?

The red is UDP and blue is TCP

UDP have higher throughtput. UDP will try max speed while TCP will try slow start and window congestion to reduce the speed.



Question 2:

Why does one flow achieve higher throughput than the other? Try to explain what mechanisms force the two flows to stabilise to the observed throughput.

UDP does not have congestion control, therefore it sends packet at a constant higher speed. However, TCP has congestion control, it will care packet loss, if more packet loss, TCP will reduce the throughput.

Question 3:

List the advantages and the disadvantages of using UDP instead of TCP for a file transfer, when our connection has to compete with other flows for the same link. What would happen if everybody started using UDP instead of TCP for that same reason?

Advantage:

- faster transmission speed
- Don't need establish connection

Disadvantage:

- Does not have congestion control, maybe lead lots congestion
- packet loss and does not resend

if everybody using UDP instead of TCP, there are lots of congestion, like traffic jam in our daily live.
And the different kinds of data will lose due to packet loss.