1. Stop and Wait Protocol

Question 1 – Number of retransmissions and throughput with different retransmission timeout values with stop-and-wait protocol. For each value of retransmission timeout, run the experiments for **5 times** and write down the average **number of retransmissions** and **average throughput**.

Retransmission timeout (ms)	Average number of re-transmissions	Average throughput (Kilobytes per second)
5	149	136.790
10	151	80.766
15	164	56.109
20	130	47.445
25	135	36.894
30	149	30.988
40	145	21.887
50	140	17.564
75	137	13.887
100	127	9.766

Question 2 – Discuss the impact of retransmission timeout value on number of retransmissions and throughput. Indicate the optimal timeout value from communication efficiency viewpoint (i.e., the timeout that minimizes the number of retransmissions and keeps the throughput as high as possible).

As receiving time grows with timeout, the number of retransmissions ought to decrease. However, because retransmissions are not always necessary, timeout is only one factor. In addition, there are other factors including loss and delay. In light of this, we see that the number of retransmissions and timeouts is not strictly decreasing. However, there is a practically flat line on the graph between the number of retransmissions and throughput.

Because of the combined effects of throughput and retransmission rate, we find that timeout values should be in the range of 15-30.
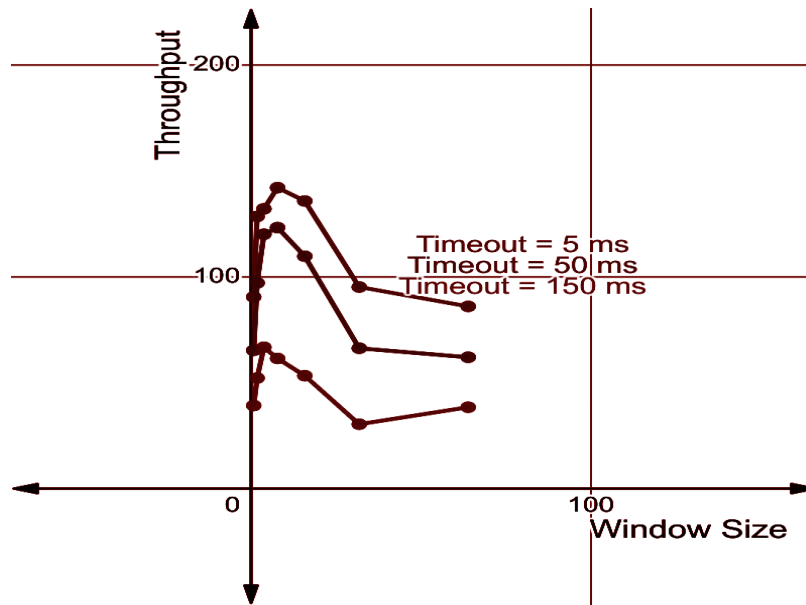
Retransmissions:
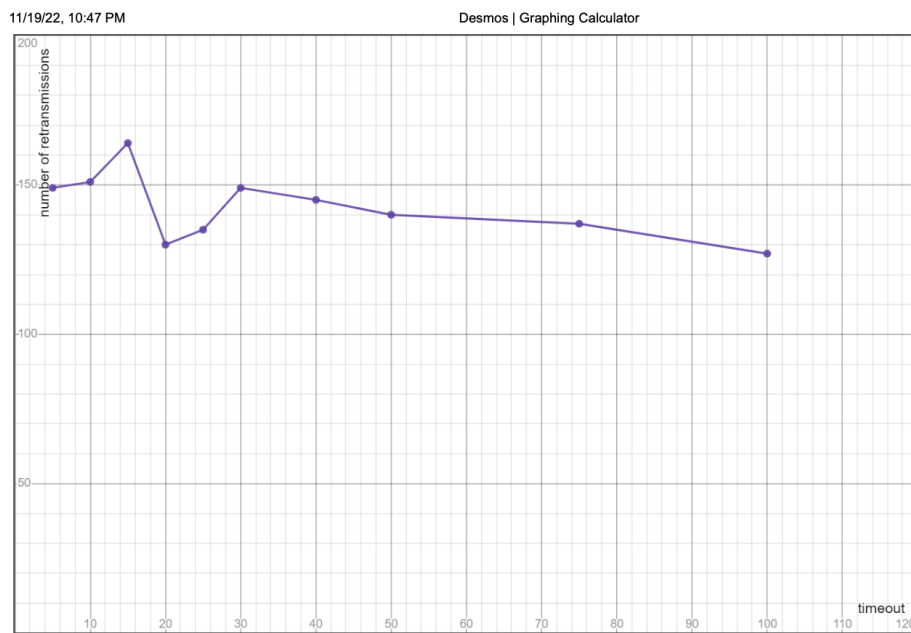
Throughput:
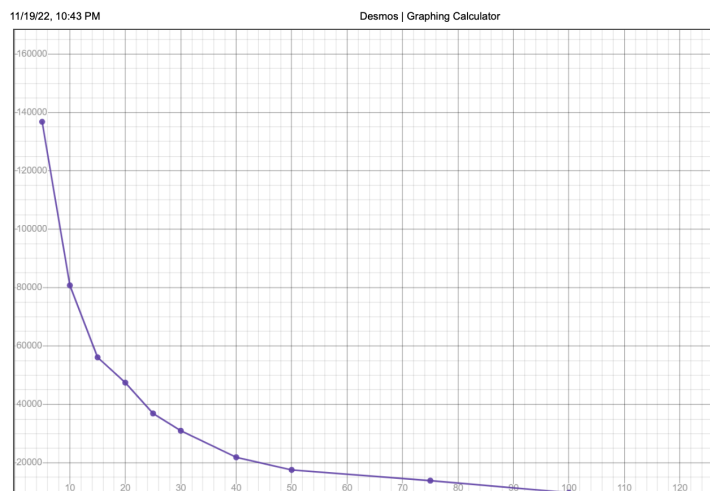
2. Go back N Protocol

Question 1 – Experimentation with Go-Back-N. For each value of window size, run the experiments **5 times** and write down the **average throughput**.

Window Size	Average throughput (Kilobytes per second)		
	Delay = 5ms	Delay = 50ms	Delay = 150ms
1	90.381	64.258	39.162
2	124.987	96.012	54.478
4	132.547	114.254	63.789
8	141.335	121.558	60.456
16	136.844	106.589	57.148
32	86.027	68.058	32.458
64	74.124	66.789	41.541

Question 2 – Discuss your results from Question 1.

We observe that throughput decreases with increasing propagation delay values. For a given propagation delay value, throughput increases with increasing window size for a certain limit and acheives a peak and then decreases accordingly.

Throughput

200

Timeout = 5 ms
Timeout = 50 ms
Timeout = 150 ms

100

0   100
Window Size

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