

# CS 252: Networks Lab 4

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## Exercise 2

1. For delay = 10ms and data link rate = 8mbps

Window Size	Observed Throughput (in Kbps)
15000	5756.74
20000	7739.2
30000	7739.2
45000	6826.55

Figure 1

Hence, maximum observed throughput value is **7739.2 Kbps**.

2. Theoretically calculated window size = RTT \* Obs throughput  
RTT = 2 \* delay = 20ms  
Window size = 20ms \* 7739.2 Kbps = 154.784 Kb = 154784 bits = **19348 bytes**
3. Experimental window size = **19300 bytes** (approx)
4. Raw data rate provided is 8Mbps = 8000 Kbps and observed throughput is 7739.2 Kbps, so it is smaller but quite comparable.
5. (a) i. For delay = 5ms and data link rate = 8mbps

Window Size	Observed Throughput (in Kbps)
10000	7338.96
15000	7762.56
25000	7762.56
30000	7488.39

Figure 2

Hence, maximum observed throughput value is **7762.56 Kbps**.

- ii. Theoretically calculated window size = RTT \* Obs throughput  
RTT = 2 \* delay = 10ms  
Window size = 10ms \* 7762.56 Kbps = 77.625 Kb = 77625 bits = **9703.125 bytes**
- iii. Experimental window size = **10750 bytes** (approx)
- iv. Raw data rate provided is 8Mbps = 8000 Kbps and observed throughput is 7762.56 Kbps, so it is smaller but quite comparable.
- (b) i. For delay = 20ms and data link rate = 8mbps

Window Size	Observed Throughput (in Kbps)
30000	6037.37
40000	7692.48
50000	7692.48
60000	3948.28

Figure 3

Hence, maximum observed throughput value is **7692.48 Kbps**.

ii. Theoretically calculated window size = RTT \* Obs throughput

RTT = 2 \* delay = 40ms

Window size = 40ms \* 7692.48 Kbps = 307.699 Kb = 307699 bits = **38462.4 bytes**

iii. Experimental window size = **37600 bytes** (approx)

iv. Raw data rate provided is 8Mbps = 8000 Kbps and observed throughput is 7692.48 Kbps, so it is smaller but quite comparable.

We can clearly see that on increasing delay, the maximum observed throughput value decreases and vice versa

### Exercise 3

1. CBR rate and observed throughput values:-

CBR data rate(in Kbps)	Observed Throughput (in Kbps)	Mean delay(in ms)
500	514.742	10.54
2000	2056.44	10.54
4000	4112.03	10.54
6000	6167.63	10.54
7000	7195.43	10.54
8000	7768.12	57.65
9000	7768.12	317.5

Figure 4

2. The maximum observed throughput value is **7768.12 Kbps**.

3. Raw data rate is set to be **8 Mbps = 8000Kbps**, and maximum, throughput observed is 7768.12 Kbps. It is clearly less than maximum possible rate, because of transmission delays and packet losses.