**Assignment 1: CS 335**

**1. Read Chapters 1-2 and answer review questions. (0 point)**

Ans: Done☺♥

**2. (P2 on page 70) Equation 1.1 (page 24) gives a formula for the end-to-end delay of**

**sending one packet of length L over N links of transmission rate R. Generalize this**

**formula for sending P such packets back-to-back over the N links. (10 points)**

Ans: end-to-end delay (**D**) of one packet is equal to the ratio of length of (**L**) over the rate of transmission (**R**) times number of links (**N**) which it might travel.

i.e. D = N \* (L / R)

Now for P such packets Dp = D \* P

i.e. Dp = N \* (L / R) \* P

So the generalized formula will be Dp = NP(L/R)

The first packet has reached the destination N\*(L/R), the second packet is stored in the last router, the third packet is stored in the next-to-last router, etc. Similarly, At time N\*(L/R)+ L/R, the second packet has reached the destination. Continuing with this logic P packet will reach the destination at time N\*(L/R) + (P-1)\*(L/R) = (N+P-1)\*(L/R) which is when all packets have reached the destination.

**3. (P5 on page 71). Review the car-caravan analogy in Section 1.4. Assume a propagation speed of 100 km/hour.**

**a) Suppose the caravan travels 150 km, beginning in front of one tollbooth, passing through a second tollbooth, and finishing just after a third tollbooth. What is the end-to-end delay?**

**b) Repeat (a), now assuming that there are eight cars in the caravan instead of ten.(10 points)**

Ans:

1. So given that,

propagation speed **S** = 100km/hr

distance **d** = 150km

therefor Transmission delay **Dt** = d / S

i.e. Dt = 150 / 100

So Dt = 1.5 hr

Now time taken to reach 10 cars by each tollbooth **T** = 10 \* 12 (as 1 car takes 12 seconds)

Therefor T = 120 sec

So, time taken to reach 10 cars by 5(suppose) tollbooths will be T \* 5 = 600 sec

= 600 / 3600 = 0.17 hr

Therefor, end-to-end delay D = N(processing delay + transmission delay + propagation delay)

i.e. D = 5 \* (0 + 1.5 + 0.17)

D = 5 \* 1.67 = 8.35 hr

1. Now number of cars are 8 instead of 10,

The transmission delay **Dt** will remain the same.

But time taken to reach 8 cars by single tollbooth will be **T** = 8 \* 12 = 96 sec

Now for N = 5 propagation delay would be T \* 5 = 96 \* 5 = 480 sec = 0.13 hr

Therefor end-to-end delay D = N(processing delay + transmission delay + propagation delay)

i.e. D = 5 \* (0 + 1.5 + 0.13)

D = 5 \* 1.63 = 8.15 hr

**4. (P20 on page 74) Consider the throughput example corresponding to Figure 1.20(b)**

**(Page 46). Now suppose that there are M client-server pairs rather than 10. Denote**

**Rs, and Rc, and R for the rates of the server links, client links, and network link.**

**Assume all other links have abundant capacity and that there is no other traffic in the**

**network besides the traffic generated by the M client-server pairs. Derive a general**

**expression for throughput in terms of Rs, Rc, R and M. (10 points)**

Ans: Considering everything in bits per second,

Also we know that the rate at which bits are transferred through the links by the server is at max Rs and the maximum rate of transfer for the router is Rc.

i.e. if any of these bit transferring devices has less rate than the other, the bit transferring rate will be equal to the minimum transfer rate among them.

To better understand it, if Rc < Rs which is router rate is less than server rate, then the throughput will be of rate equal to Rc. Vice versa for Rs < Rc.

therefor For two-linked network, the rate is min {Rc, Rs}

The rate in network link for M clients will be min{R1, R2, Rm}

So, general expression for throughput in terms of Rs, Rc, R and M will be min{Rc, Rs, R/M}

**5. (P28 on page 69) Suppose Alice and Bob are sending packets to each other over a**

**computer network. Suppose Trudy positions herself in the network so that she can**

**capture all the packets sent by Alice and send whatever she wants to Bob, she can**

**also capture all the packets sent by Bob and send whatever she wants to Alice. List**

**some of the malicious things Trudy can do from this position. (5 points)**

Ans:

1. She is performing a ‘man in the middle’ attack where none of the involved party knows their information is being tracked.
2. If some confidential information is being transferred, Trudy can also perform a ransomware attack where she will agree to the confidential contract in return of money or any other asset.
3. She might leak this information to an unknown source and pretend she might get away without ever being involved.
4. She can change the content of the information and can mislead the receiving party.
5. She can prevent the flow of information through this connection.

**6. Create some review questions in the format of multiple choice, true or false, concept matching, filling blanks, etc. that are suitable for quizzes. (option, bonus up to 5 points)**

Ans: I’ll pass on this one.

**7. Practise with Wireshark labs (0 point)**

Ans: I’ve tried this but the requests were so confusing like http vs https. Found something new, the ESPN website is very vulnerable.