Network Architectures 3329 **Name:** _____
Fall 2018 **Homework 2**
09/20/2018 **Due 09/25/2018**

- **Print** your name.
- Homework submitted in class in a timely fashion. Check `https://cis.temple.edu/~tug29203/teaching/fall2018-3329/index.html` for late policy.

Problem	Points	Score
1	4	
2	6	
Total:	10	

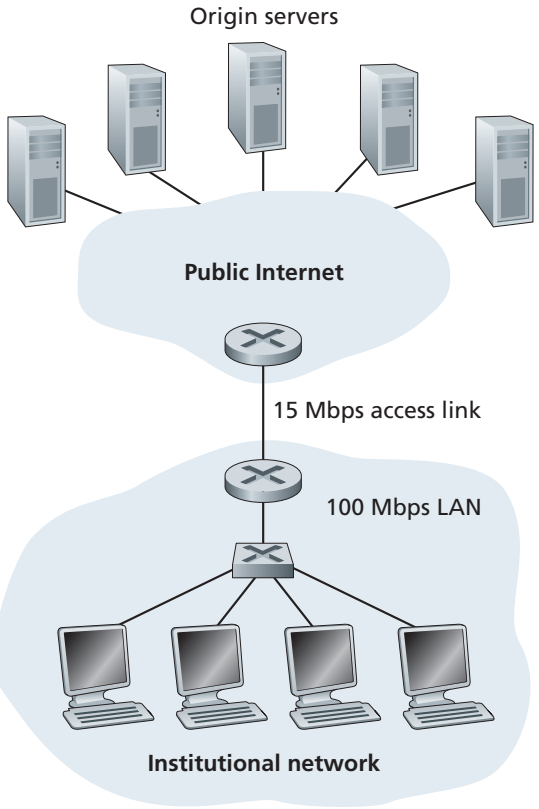

Figure 1: TCP window size as a funtion of time

1. Consider the Figure in the above, for which there is an institutional network connected to the Internet. Suppose that the average object size is 850,000 bits and that the average request rate from the institutions browsers to the origin servers is 16 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is 3 seconds on average. Model the total average response time as the sum of the average access delay (that is, the delay from Internet router to institution router) and the average Internet delay. For the average access

delay, use $\Delta/(1-\Delta\beta)$, where Δ is the average time required to send an object over the access link and β is the arrival rate of objects to the access link.

(a) (2 points) Find the total average response time.

(b) (2 points) Now suppose a cache is installed in the institutional LAN. Supposethe the miss rate is 0.4. Find the total response time.

2. **Written questions (essay, computational)** Consider distributing a file of $F = 15Gbits$ to N peers. The server has an upload rate of $u_s = 30Mbps$, and each peer has a download rate of $d_i = 2Mbps$ and an upload rate of u.

(a) (2 points) For $N = 100$ and $u = 700Kbps$, find the minimum distribution time for client-server distribution.

(b) (2 points) For $N = 100$ and $u = 700Kbps$, find the minimum distribution time for client-server distribution, find the minimum distribution time for P2P distribution

(c) (2 points) Suppose the number of peers increases to $N = 1000$, find the minimum distribution time for both client-server and P2P distribution.