Homework 2

CST 311, Introduction to Computer Networks, Spring 2020

READ INSTRUCTIONS CAREFULLY BEFORE YOU START THE HOMEWORK.

This homework is due on Sunday, February 16, 2020.

Homework must be submitted electronically through iLearn on https://ilearn.csumb.edu by 11:55 pm on the due date. Late homeworks will not be accepted.

Homework must in pdf format only. Any other formats will not be accepted. You must submit a single file for the entire homework. The naming convention of the file should be HW2_yourlastname.pdf. **Put your name in the document as well.** Your homework submission should present the problems in the original order and be properly labeled.

This homework is worth 50 points. Each part of a question carries equal weight unless specified otherwise.

Name (2 points): Adam Ayala____

Application Layer

This section contains problem solving questions.
(Problems 9 & 10 from Chapter 2 of the 7th Edition)

1. (28 points) (P9.) Consider Figure 2.12, 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 institution's 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 three seconds on average (see Section 2.2.5). 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. Find the total average response time.

response time = LAN delay + access delay + internet delay

= L/R (LAN) + $\Delta/(1-\Delta\beta)$ (access) + 3 sec (internet)

=(850kb/100Mbps) + (850kb/15Mbps)/(1-[(850kb/15Mbps)(16req/sec)]) + 3 sec

= 0.0085 sec + 0.6071 sec + 3 sec

= 3.6156 sec

b. Now suppose a cache is installed in the institutional LAN. Suppose the miss rate is 0.4. Find the total response time.

response time = 3.6156 sec * 0.4 = 1.4463 sec

2. (20 points) (P10.) Consider a short, 10-meter link, over which a sender can transmit at a rate of 150 bits/sec in both directions. Suppose that packets containing data are 100,000 bits long, and packets containing only control (e.g., ACK or hand-shaking) are 200 bits long. Assume that N parallel connections each get 1/N of the link bandwidth. Now consider the HTTP protocol, and suppose that each downloaded object is 100 Kbits long, and that the initial downloaded object contains 10 referenced objects from the same sender. Would parallel downloads via parallel instances of non-persistent HTTP make sense in this case? Now consider persistent HTTP. Do you expect significant gains over the non-persistent case? Justify and explain your answer.

If we consider the parallel connections: 10 connections making 10 handshakes and each downloading 1 of 10 packets and each connection would have only 15bps speed.

= HS + Trans = (200b)/(15bps) + (100kb)/(15bps) = 13.3 sec + 6,666.6 sec = 6,680 sec
= 1.856

If we consider the persistent connection: 1 connection does 1 handshake but needs to download all 10 packages, essentially making it a 1Mb packet, however, at the full 150bps.

= HS + Trans = (200b)/(150bps) + (1Mb)/(150bps) = 1.33 sec + 6,666.6 sec = 6,668 sec
= 1.852 hours

So, the consistent connection is 12 seconds faster, however, both are about 1.85 hours.