Computer Networks
SPRING 2024
Assignment#2 (6A)

Due Date: Thursday, 22nd February, 2024
Submission Mode & Time: Handwritten solutions to be submitted during the lecture.

Please note the following:

1. No exceptions to the above date and time will be allowed. Inability to submit the assignment by the required time will result in zero marks.

2. To ensure self-completion of assignments and discourage plagiarism, the instructor or the relevant TA may randomly contact you and ask for an explanation of your answers. Where plagiarism and/or cheating is evident, you will be referred to the departmental disciplinary committee. In extreme cases of plagiarism an F may be awarded immediately with further referral to university disciplinary committee.

3. All solutions must be **hand-written.**

4. **Assignment Solution Submission**: In case of **in person / physical lectures at the campus**, hard copy of the hand-written assignment's solutions will be submitted by **hand** by each student to the Instructor / TA directly during the lecture on the due date.

PART-1

Use the following text for completion of this part of the assignment:
Computer Networking - A Top-Down Approach 8th Edition by Kurose & Ross.

Solve the following problems from the back of **Chapter 2**. Every Question has equal marks i.e.

Review Questions: **(3*6 = 18 marks)** **[CLO 2]**

R4, R5, R6, R11, R13, R19

Problems: **(4*4 = 16 marks)** **[CLO 2]**

P3, P7, P8, P13

PART - 2

Question 1 (5 + 5 Marks) **[CLO 2]**

A user in Beirut, connected to the internet via a 2 Mbps connection retrieves a 25 Kbytes web page from a web server in Paris, where the page references 3 images of 200 Kbytes each. Assume that the one-way propagation delay is 20 ms.

a) How long does it take for the page (including images) to appear on the user's screen, assuming non-persistent HTTP using a single connection at a time?
b) What would become the time for the page (including images) to appear on the user's screen if he used persistent HTTP without pipelining in place of non-persistent HTTP?

Question2 (2 + 4 Marks) **[CLO 2]**

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. 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.

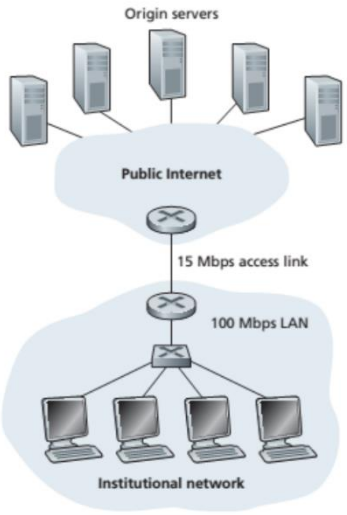

Figure 2.12 ♦ Bottleneck between an institutional network and the Internet

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