National University of Computing and Emerging Sciences - CFD Campus

Computer Networks Spring

2025

Assignment # 03

Submission Guidelines:

1. Submit your assignment as hardcopy in class as well as in soft copy on Google Classroom. Please submit your file in this format **23F_XXXX_A1**
2. The assignment should be on A4 pages.
3. Do not submit your assignment after the deadline. Late submission will not be accepted.
4. Plagiarism from the internet (ChatGPT) or any peer is strictly prohibited.
5. In case of plagiarism zero marks will be awarded.

Question 1 (10)

We notice an increase in the total delay (time) for requests that encounter a web cache (a penalty due to the involvement of the cache). Let LD be the average LAN delay, ALD be the access link delay, ID be the Internet delay, and RT be the total response time. Moreover, assume that ACP is the average cache penalty delay. The following values are given LD = 10ms, ALD = 50ms, ID = 100ms, and ACP = 20ms.

(A) Find the average response delay (time) when a cache is used, and the hit ratio is 80%?

Question 2 (10)

A user located in Karachi requests a 125 KB web page from a server located in Rawalpindi. The received page references are 5 image files, each 250 KB in size. The user is connected to the Internet via a 10 Mbps access link. Assume that it takes 50 ms for a small HTTP message to travel from the client to the server (and vice versa).

(A) How long would it take to display the same web page with persistent HTTP (single connection)?

Question 3 (10)

An email client sends 10,000 bits of email using SMTP. The email is divided into 20 packets, and 2 packets are lost during transmission. Each retransmission takes an additional RTT of 100 ms. The transmission rate is 5 Mbps. Calculate the total time to transmit the email.

Question 4 (10)

Consider an HTTP client requesting 5 objects from a server under the following conditions:

- The Round-Trip Time (RTT) for each request is **100 ms**.
- The transmission time for each object is **20 ms**.

Compare the total time taken for **non-persistent** vs. **persistent** HTTP.

Question 5 (10)

Draw the format for UDP header. Briefly explain each option. Explain the goal of UDP checksum & explain with the help of 24bit example in which you have four message words each of 24bits each. Assume your word values yourself.

Question 6: **(10)**

Draw the FSMs for sender and receiver fragments for rdt2.0, rdt2.1, rdt2.2 and rdt3.0.

Question 7: **(10)**

- A sender is transmitting packets using a **pipelining protocol** with a **window size of 5**. The **round-trip time (RTT)** between sender and receiver is **80 ms**, and the **transmission time for one packet** is **20 ms**.
- **Calculate the link utilization** (efficiency) when using the pipelined protocol.
- Compare it with the utilization when using the **Stop-and-Wait** protocol.