Homework Instructions

Submission Deadline: The homework must be submitted within the next two weeks.

Grading Criteria:

• Your assignment will be graded as either **1 (Pass)** or **0 (Fail)**.

• To receive a passing grade, you must solve **75% or more** of the assignment correctly.

• **Feedback Policy**: Detailed feedback on individual solutions will not be provided. After the submission deadline, a complete solution will be published, allowing you to compare your work with the ideal solution. Use this to evaluate your approach and understand any mistakes.

Important:

• Please make sure to submit your work on time. Late submissions will not be accepted.

• Make sure to clearly explain your calculations and reasoning.

• **Solution Steps and Clarifications**: Be prepared! The lecturer may ask any student in your group during class or online to explain the solution steps and reasoning for any problem. Make sure that everyone in your group understands the approach and can explain why the problem was solved in that particular way.

• **Group Contribution**: For each homework problem, list the name(s) of the student(s) from your group who worked on that specific problem. This will help in tracking contributions and ensuring everyone participates.

• **Language**: You may write your answers in **German, English, or a mix of both**. Choose the language you feel most comfortable with.

Homework Problem 1: Throughput Calculation. (5 Points)

You are tasked with calculating the throughput of a network connection.

Scenario: A file of size 500 MB needs to be transmitted over a network. The network connection has a bandwidth of 50 Mbps (Megabits per second).

Questions:

1. How long will it take to transmit the entire file over this network connection? Show your calculations step by step.
2. Calculate the throughput of the network in MBps (Megabytes per second).

Note: Assume no packet loss or delays due to network congestion.

Homework Problem 2: Throughput and Propagation Delay. (5 Points)

In this exercise, you will calculate both the transmission time and the propagation delay for a network connection.

Scenario: A 500 MB file needs to be sent from Berlin to Munich. The network has:

- Bandwidth: 50 Mbps (Megabits per second)
- Distance between Berlin and Munich: 600 kilometers
- Propagation speed of the signal: 200,000 kilometers per second

Questions:

1. Calculate the transmission time for the file. Show all steps.
2. Calculate the propagation delay based on the distance and signal speed. Show all steps.
3. Calculate the total time for the file to reach its destination, considering both transmission time and propagation delay.

Hint: Remember that the transmission time depends on the file size and bandwidth, while the propagation delay depends on the distance and signal speed.

Homework Problem 3: Circuit-Switched Network with TDM. (10 Points)

In this exercise, you will work with a circuit-switched network using Time Division Multiplexing (TDM) with frames and slots.

Scenario: Consider a circuit-switched network that uses TDM to allocate bandwidth to users. In this setup:

- Each TDM frame is divided into 8 slots.
- Each slot allows transmission of 1 MB of data.
- The network operates at 16 frames per second.

Three users, A, B, and C, are connected to this network and each has been assigned 2 slots per frame.

Questions:

1. Calculate the data rate (in MBps) for each user, given their assigned slots and the frame rate of the network. Show all steps.
2. Calculate the total data rate of the network. Show your calculations.
3. If user A needs to send a 32 MB file, calculate how long it will take to send the entire file using their assigned slots. Show all steps.

Hint: Remember that the data rate for each user depends on the number of slots they are assigned and the frame rate of the network.

Homework Problem 4: Data Stored on the Transmission Medium. (10 Points)

In this exercise, you will calculate the amount of data "stored" on the transmission medium (either a wire or in the air) during the transmission process.

Scenario: A 1 Gbps (Gigabit per second) network link is transmitting data from Frankfurt to Hamburg, has a distance of 500 kilometers. The signal propagation speed on this link is 200,000 kilometers per second.

Questions:

1. Calculate the propagation delay for the data to travel from Frankfurt to Hamburg. Show all steps.
2. Calculate the amount of data (in Megabytes) that would be on the wire (or in the air) at any given moment while the data is in transit. Show all steps.

Hint: Remember that the amount of data in flight „Stored data in the Medium" can be calculated using the propagation delay and the network's data rate.

Homework Problem 5: Communication Methods Through History. (10 Points)

In this assignment, you will explore a historical method of communication used by humans since the beginning of civilization. This could include early or ancient methods, technological advancements, or even modern techniques.

Instructions:

1. Choose a Communication Method: Select one of the following topics, or suggest a different method with approval:
    ○ Early written scripts or pictograms (e.g., cuneiform, hieroglyphs)
    ○ Smoke signals
    ○ Drum signaling
    ○ Carrier pigeons
    ○ Semaphore signaling
    ○ The printing press
    ○ The telegraph
    ○ Morse code
    ○ Radio broadcasting
    ○ The internet (early development stages)
2. Research: Investigate the chosen method's history, development, and significance in human communication. Focus on how it worked, its historical context, and why it was important.
3. Write: Summarize your findings in half a page (approximately 200-300 words), explaining the origins and evolution of the chosen method, as well as its impact on society.

Homework Problem 6: Communication Patterns and Modes. (10 Points)

In this assignment, you will explore and explain different communication patterns and transmission modes commonly used in networking.

1. Describe Communication Patterns: Write a short explanation (2-3 sentences) for each of the following communication patterns:
    a. Unicast
    b. Broadcast
    c. Multicast
    d. Anycast
2. Describe Transmission Modes: Write a short explanation (2-3 sentences) for each of the following transmission modes:
    a. Simplex
    b. Half-Duplex
    c. Full-Duplex
3. Explain the Use Cases: For each communication pattern and transmission mode, provide a real-world example where it is commonly used.

Homework Problem 7: Multiple choice. (14 Points)

Solve the multiple choice questions (1-7) of chapter-1 on the companion website of the book. Show all steps in detail.
https://media.pearsoncmg.com/ph/esm/ecs_kurose_compnetwork_8/cw/content/self-assessment-mc/self-assessment-mc.php#self-assessment-mc-1.

Homework Problem 8: True or False. (16 Points)

Solve the true or false questions (1, 2, 3, 6, 7, 8, 9, 11) of chapter-1 on the companion website of the book. Reason your answers in detail
https://media.pearsoncmg.com/ph/esm/ecs_kurose_compnetwork_8/cw/content/self-assessment-tf/self-assessment-tf.php#self-assessment-tf-1. Reason your answers in detail.

Homework Problem 9: Transmission versus Propagation Delay. (10 Points)

Start the animation on the companion website with at least 10 different combinations of settings and write down your observations regarding the differences between Transmission and propagation delays. Attach screenshots to your solution.
https://media.pearsoncmg.com/ph/esm/ecs_kurose_compnetwork_8/cw/content/interactiveanimations/transmission-vs-propogation-delay/transmission-propagation-delay-ch1/index.html.

Homework Problem 10: Queuing and Loss. (10 Points)

Start the animation on the companion website with the 6 different combinations of settings and write down your observations. When does overflow take place and why? Attach screenshots to your solution.
https://media.pearsoncmg.com/ph/esm/ecs_kurose_compnetwork_8/cw/content/interactiveanimations/queuing-loss-applet/index.html.

Good Luck