Exercise Sheet 6

Exercise 1 (Applications and Transport Layer Protocols)

1. Select the most appropriate transport layer protocol for each of the following applications or application scenarios and explain your choice.
   a) File transfer (exchange file between two hosts over the network)
   b) Video conferencing
   c) Instant messaging
   d) Retrieving sensor information (e.g., temperature) from a sensor network
   e) Accessing a complex web page
   f) Accessing a simple web page
   g) Clock synchronization
   h) Video streaming
2. Many IoT applications rather use UDP as a transport layer protocol. Why?
3. CoAP is an application layer protocol designed to be used on top of UDP. However, it specifies certain features one would rather expect from a transport layer protocol. Explain the reason why no new transport layer protocol was specified instead.
4. CoAP offers four different message types. Name them and describe what their meaning.

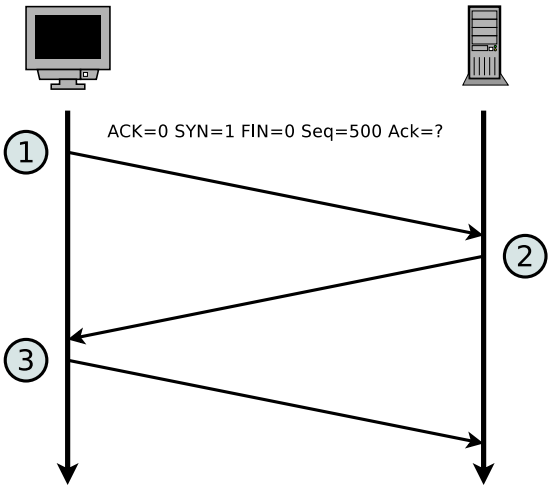
Exercise 2 (TCP and UDP)

1. Explain the **differences** between TCP and UDP.
2. Describe **two examples**, where using the Transport Layer protocol TCP makes sense.
3. Describe **two examples**, where using the Transport Layer protocol UDP makes sense.
4. Describe what a socket is.

5. Describe what the Seq number in an TCP segment specifies.
6. Describe what the ACK number in an TCP segment specifies
7. Describe the **silly window syndrome** and its effect.
8. Describe the functioning of **silly window syndrome avoidance**.
9. Which two possible **reasons** for the occurrence of congestion in computer networks exist?
10. Why does the sender maintain **two windows** when using TCP and not just a single one?
11. Describe what the slow-start phase is.

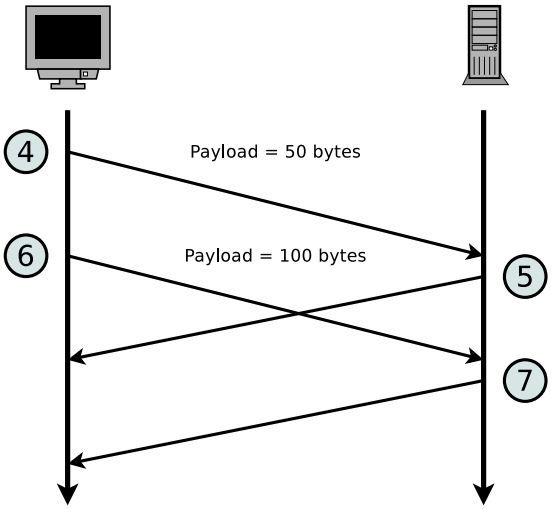
Exercise 3 (TCP Connections)

1. The diagram shows the establishment of a TCP connection. Complete the information in the table for TCP messages 2 and 3 according to TCP messages 1.



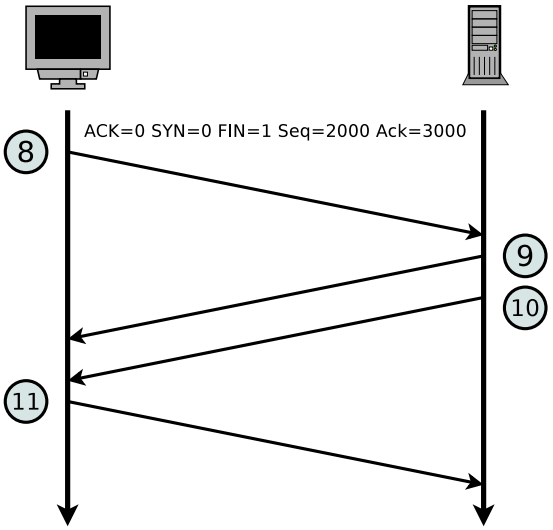
Message	ACK	SYN	FIN	Payload length	Seq number	ACK number
1	0	1	0	0	500	
2					1000	
3						

2. The diagram shows an excerpt of the transmission phase of a TCP connection. Complete the table.



Message	ACK	SYN	FIN	Payload length	Seq number	ACK number
4	0			50	501	1001
5	1			0		
6	0			100		
7	1			0		

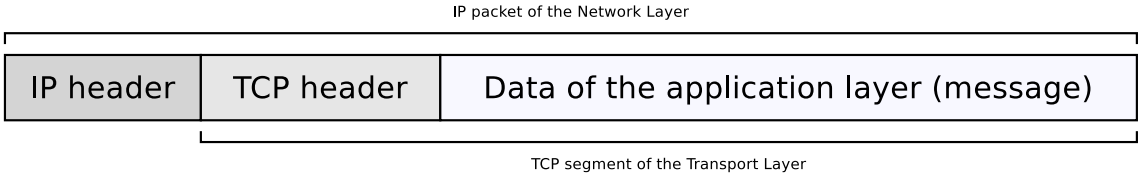
3. The diagram shows the termination of a TCP connection. Complete the table.



Message	ACK	SYN	FIN	Payload length	Seq number	ACK number
8	0	0	1	0	2000	3000
9				0		
10				0		
11				0		

Exercise 4 (Header and Payload)

An application generates 40 bytes payload which is first packed into a single TCP segment, and then packed into a single IP packet. What is the percentage of header data in the IP packet and what is the percentage of application generated payload?



Exercise 5 (Do some research)

1. The checksum in UDP is optional, i.e., it can be used to protect the integrity of the entire datagram or not. Is there also a way to *partially* protect the payload against transmission errors?

2. The original congestion control algorithm in TCP was called Tahoe. Many other algorithms were introduced over the last decades. Name two of them that can be used without any knowledge about the TCP implementation on the receiver side and two that requires information about the receiver's TCP implementation.

3. You have learned that **sockets** can be either **stream sockets** or **datagram sockets**. However, during one of the exercises we have used a third type of socket. Explain where and why.

4. Name an API that has been designed as an alternative to the **BSD socket API**.