Written examination in Computer Networks

May 16th 2014

Last name: _____

First name: _____

Student number: _____

I confirm with my signature that I will process the written examination alone
and that I feel healthy and capable to participate this examination.
I am aware, that from the moment, when I receive the written examination, I
am a participant of this examination and I will be graded.

Signature: _____

- Provide on all sheets (including the cover sheet) your *last name*, *first name* and *student number*.

- Use the provided sheets. Own paper must *not* be used.

- Place your *ID card* and your *student ID card* on your table.

- You are allowed to use a *self prepared, single sided DIN-A4 sheet* in the exam. Only *handwritten originals* are allowed, but no copies.

- You are allowed to use a non-programmable calculator.

- Answers, written with pencil or red pen are *not* accepted.

- Time limit: *90 minutes*

- Turn off your mobile phones!

Result:

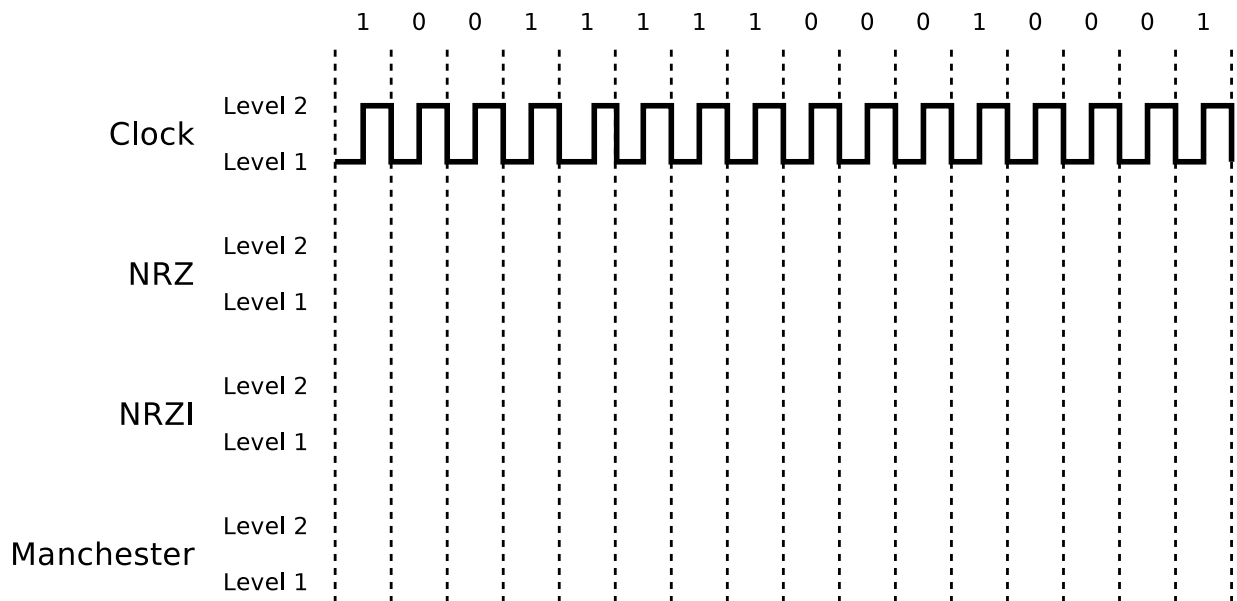| Question:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Σ	Grade
Maximum points:	6	6	4	10	11	7	5	6	5	8	4	7	4	7	90	—
Achieved points:																

Last name: First name: Student number:

Question 1)   Points: . . . .

Maximum points: 6

Give the encoding for the given bit pattern.

Please assume that the initial signal level of NRZI is signal level 1 (low signal).

Question 2)   Points: ....

Maximum points: 0.5+0.5+1+1+1+1+1=6

a) Explain the difference between serial data transmission and parallel data transmission.

b) Computer networks usually implement...

☐ serial data transmission   ☐ parallel data transmission

c) Name an advantage of serial data transmission.

d) Name an advantage of parallel data transmission.

e) Name 2 systems, that operate according to the simplex principle.

f) Name 2 systems, that operate according to the full-duplex principle.

g) Name 2 systems, that operate according to the half-duplex principle.

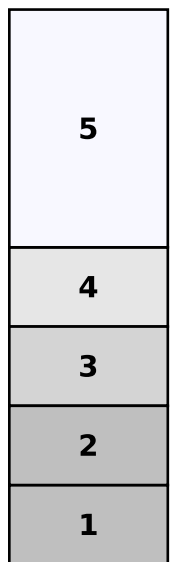# Question 3)   Points: ....
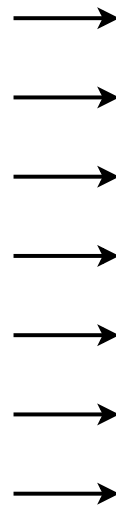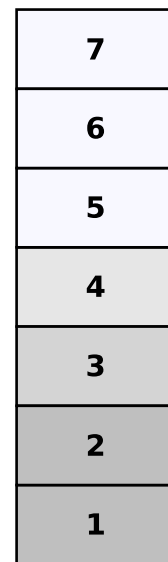
Maximum points: 3.5+0.5=4

a) Write on the dotted lines the names of the layers.
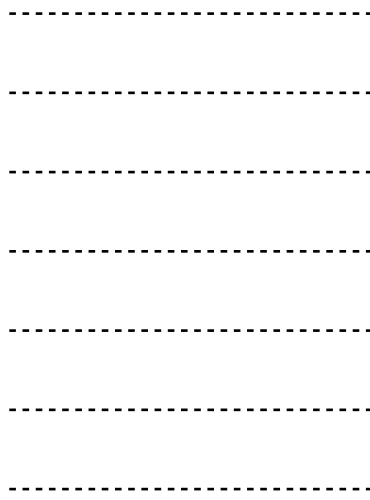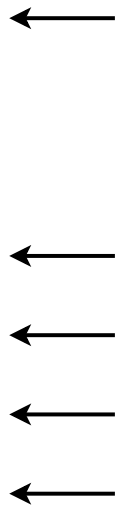
Hybrid Reference Model   **OSI Reference Model**

b) Why are the layers 5 and 6 of the OSI reference model not intensively used in practice?

Question 4)

Points: . . . .

Maximum points: 10

Mark for each row of the table the corresponding layer of the **hybrid reference model**.

1 stands for the bottom layer and 5 for the top layer in the hybrid reference model. If more than just a single layer are a correct answer, it is sufficient to select at least a single correct layer.

	Hybrid reference model layer				
	1	2	3	4	5
4B5B					
Address Resolution Protocol (ARP)					
Alternate Mark Inversion (AMI)					
Autonomous Systems					
Border Gateway Protocol (BGP)					
Bridge					
Congestion control					
CSMA/CA					
CSMA/CD					
Cyclic Redundancy Check (CRC)					
Distance vector routing protocols					
Dynamic Host Configuration Protocol (DHCP)					
Ethernet					
File Transfer Protocol (FTP)					
Flow control					
Gateway					
Hub					
Hypertext Transfer Protocol (HTTP)					
ICMP					
Internet Protocol (IP)					

Question 5)

Points: . . . .

Maximum points: 11

Mark for each row of the table the corresponding layer of the **hybrid reference model**.

1 stands for the bottom layer and 5 for the top layer in the hybrid reference model. If more than just a single layer are a correct answer, it is sufficient to select at least a single correct layer.

	Hybrid reference model layer				
	1	2	3	4	5
Logical addresses					
Link state routing protocols					
Manchester-Code					
Media access control					
Modem					
Multilevel Transmission Encoding - 3 Levels					
Multiport Bridge					
Non-Return to Zero					
Open Shortest Path First (OSPF)					
Physical addresses					
Port numbers					
Reliable end-to-end data connection					
Repeater					
Router					
Routing Information Protocol (RIP)					
Security					
Spanning Tree Protocol (STP)					
Switch					
Telnet					
Transmission Control Protocol (TCP)					
User Datagram Protocol (UDP)					
Wireless LAN					

Question 6)   Points: ....

Maximum points: 1+1+1+1+1+1+1=7

a) What is the major difference between Bridges and Layer-2-Switches?

b) Why do Bridges and Layer-2-Switches not require physical or logical addresses?

c) What is the advantage of learning Bridges in contrast to „dumb" Bridges?

d) What happens, if for a network device no entry exists in the forwarding table of a Bridge?

e) What is a switched network?

f) Name an advantage of a switched network.

g) Why is it impossible to connect different buildings with shielded cables?

Question 7)

Maximum points: 1+1+1+1+1=5

a) What is the task of the Root Bridge?

b) What is the selection criteria for determining, whether a Bridge becomes the Root Bridge?

c) What is a Designated Bridge and what is its task?

d) How many Designated Bridges does a computer network contain?

e) What is the selection criteria for determining, whether a Bridge becomes a Designated Bridge?

Question 8)

Maximum points: 1+1+1+3=6

a) One way to mark the frames' borders is via character count in the frame header. Name a potential issue that can arise from this method.

b) One way to mark the frames' borders is via Byte Stuffing. Name a drawback of this method.

c) Why work up-to-date Data Link Layer protocols, such as Ethernet and WLAN, bit-oriented and not byte-oriented?

d) What information contains an Ethernet frame?

☐ Sender IP address
☐ Sender MAC address
☐ Hostname of the receiver
☐ Information about the Transport Layer protocol used
☐ Preamble to synchronize the receiver
☐ Port number of the receiver
☐ CRC checksum
☐ Information about the Application Layer protocol used
☐ VLAN tag
☐ Receiver MAC address
☐ Receiver IP address
☐ Information about the Network Layer protocol used
☐ Hostname of the sender
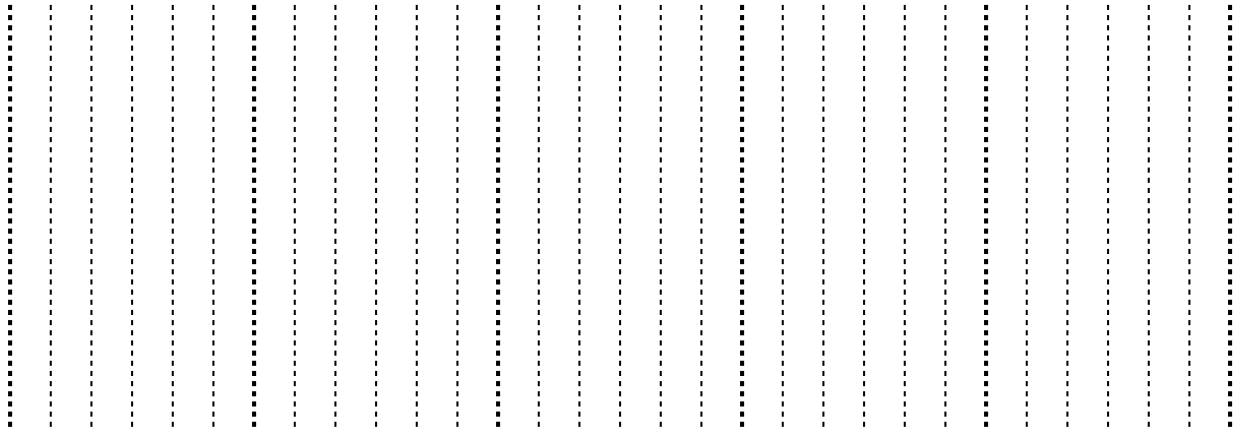☐ Signals, which are transmitted via the transmission medium
☐ Port number of the sender

Question 9)

Maximum points: 5

Encode the bit sequence with 5B6B and NRZ and draw the signal curve.

Bit sequence: `11010 11110 01001 00010 01110`

| 5B	6B neutral	6B positive	6B negative	5B	6B neutral	6B positive	6B negative
00000		001100	110011	10000		000101	111010
00001	101100			10001	100101		
00010		100010	101110	10010		001001	110110
00011	001101			10011	010110		
00100		001010	110101	10100	111000		
00101	010101			10101		011000	100111
00110	001110			10110	011001		
00111	001011			10111		100001	011110
01000	000111			11000	110001		
01001	100011			11001	101010		
01010	100110			11010		010100	101011
01011		000110	111001	11011	110100		
01100		101000	010111	11100	011100		
01101	011010			11101	010011		
01110		100100	011011	11110		010010	101101
01111	101001			11111	110010		

Question 10)

Maximum points: 5.5+1.5+1=8

　　a) Sketch in the diagram of the network topology all collision domains.
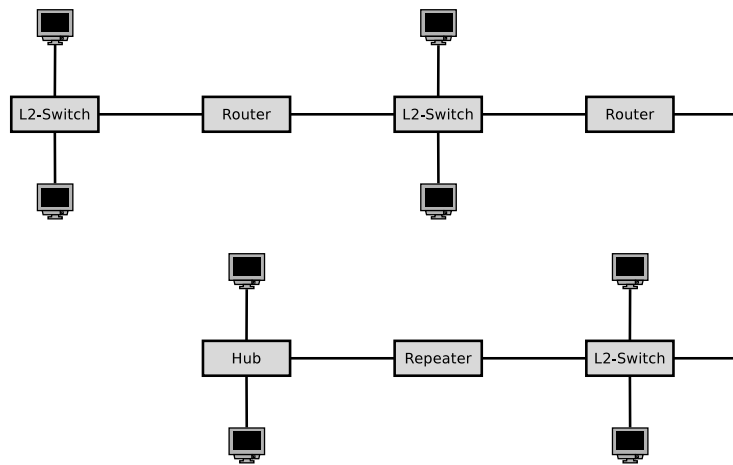
　　b) Sketch in the diagram of the network topology all broadcast domains.
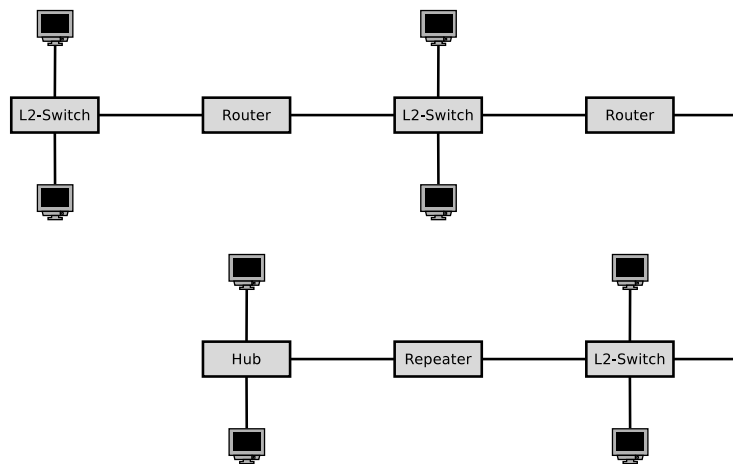
　　c) How many logical subnets are required for this network topology?

Question 11)

Maximum points: 4

Error Detection via CRC: Check, if the received frame was transmitted correctly.

Received frame: 1101001111100   Generator polynomial: 100101

Question 12)

Maximum points: 3+4=7

a) Error Correction via simplified Hamming Distance (Hamming ECC method). Calculate the message, that will be transmitted (payload inclusive parity bits).

Payload: 10011010

b) Error Correction via simplified Hamming Distance (Hamming ECC method). Verify, if the received message was transmitted correctly.

Received message: 0001101100101101

Question 13)

Points: . . . .

Maximum points: 4

Calculate the first and last host addresses, the network address and the broadcast address of the subnet.

```
IP Address:        151.175.31.100    10010111.10101111.00011111.01100100

Subnet mask:       255.255.255.128   11111111.11111111.11111111.10000000

Network address?   ___.___.___.___   _____._____._____._____

First host address? ___.___.___.___  _____._____._____._____

Last host address?  ___.___.___.___  _____._____._____._____

Broadcast address?  ___.___.___.___  _____._____._____._____
```

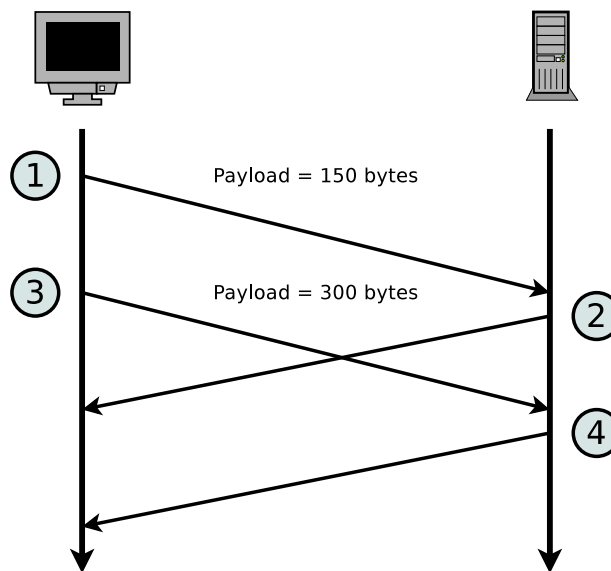| binary representation	decimal representation
10000000	128
11000000	192
11100000	224
11110000	240
11111000	248
11111100	252
11111110	254
11111111	255

Question 14)

Points: ....

Maximum points: 7

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
1	0			150	831	1251
2	1			0		
3	0			300		
4	1			0		