

**LUNDS TEKNISKA HÖGSKOLA**  
**Institutionen för elektro och informationsteknik**  
**Example exam in Data Communication**  
**Time: 5 hours**

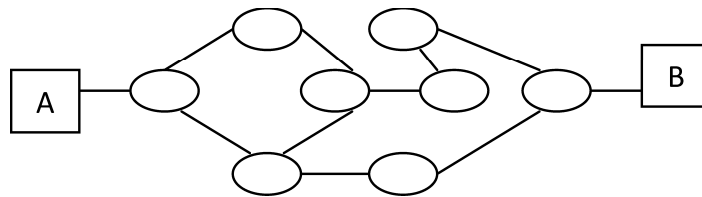
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- **All solutions should be properly written and justified.**
  - **All calculations have to be shown.**
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1. a) Determine whether the following statements are true or false. Each correct answer gives 0.5 points, each wrong answer -0.75 points and unanswered statement 0 points. (The total score of the question cannot be less than zero)
  - i) The bitstuffing technique is used to make the HDLC frames equal to a multiple of 8 bits (byte)
  - ii) CSMA/CD is generally more suitable than Token Ring when the network requests messages to be delivered within time limits.
  - iii) Piggybacked acknowledgement means that the receiver of a packet, in order to minimize the round-trip times in the network, sends an ACK before he actually gets the sent packet.
  - iv) In the Ethernet the access algorithm IEEE 802.3 is used.
  - v) The TCP and IP protocols are found on the same level in the OSI model.
  - vi) If we start with the lowest frequency, the following order is correct; FM radio, visible light, micro waves.
  - vii) A mesh topology for 4 terminals needs 8 communication links.
- b) Determine which ending(s) is the correct for the following statements. Each correct answer gives 0.5 points, each wrong answer -0.75 points and unanswered statement 0 points. (The total score of the question cannot be less than zero)
  - i) "The main advantage of replacing Stop-and-Wait flow control scheme by Sliding Window scheme is that the
    - I) number of errors are reduced on the link
    - II) utilization of a link is increased
    - III) network interfaces of sender and receiver are less loaded.
  - ii) "When router Z (using distance vector algorithm) transmits its distance vector, the vector is received ..."
    - I) only by the directly connected neighbors of Z
    - II) by all the routers in the network, due to flooding procedure
    - III) only by one router with a shortest distance from Z.

- c) To which layers in the OSI model do the following services belong?
    - i) file transfer
    - ii) controlling the dialogue between end system application
    - iii) frame synchronization
    - iv) routing
    - v) frequency modulation
  - d) Explain the following terms
    - i) half duplex
    - ii) peer protocols
    - iii) guided media
- 2.
- a) Describe the set-up procedure for a packet switched network that is based on
    - i) virtual circuit
    - ii) datagram.
  - b) What is the main purpose of *ICMP* packets?
  - c) Could the HDLC protocol be used on a LAN? (Why/Why not?)
  - d) Describe the function of each of the following intermediate systems, **and** explain on which OSI layer they are to be found.
    - i) repeater,
    - ii) router,
    - iii) bridge.
- 3.
- a) Describe the fundamental differences between UDP (User Datagram Protocol) and TCP (Transmission Control Protocol).
  - b) Both transport protocols at OSI level 4 and the datalink protocols at layer 2 do error detection and correction. Why is this mechanism needed on both layers?
  - c) Some protocols use piggybacking, how does his work?
  - d) Explain the following notions; *SAP*, *protocol*, *interface*, *OSI-layer* and *entity*, and discuss if there exist any relations between them and if so which?
  - e) Assume that the primary HDLC station has sent 8 I-frames to a secondary. The primary's N(S) count was five (101 binary) prior to sending the eight frames. If the poll bit is set in the eight frame, what will be the value of N(R) back from the secondary after the last frame?

4. a) Suppose that we want to send the message  $M = ABBA01_{16}$ . Use the generator polynomial  $P = 2B_{16}$  to calculate the CRC.
- b) Use Differential Manchester coding to draw the wave form of the bit pattern 000110011100000.
- c) In the following network which use IP flooding is also used. Describe how flooding works? Node A wants to send a message to node B. Determine the minimum value of TTL for that IP packet to reach the destination.



- d) Find the range of addresses for 17.34.16.0/23.
- e) Explain **all** the steps taken by a host before it can send out an IP packet on the local Ethernet. The destination is known only as *www.lth.se*. All caches are empty. The routing table and the DNS's IP address are known by the source. The source and DNS is on one network and the destination on another network.
5. a) Router A has received the following set of link state advertisement packets.

A	
B	1
E	4
C	4

B	
A	1
C	2
E	2
D	3

C	
A	4
B	2
D	5
E	1

D	
B	3
C	5
E	1
F	2

E	
C	1
A	4
B	2
D	1
F	5

F	
D	2
E	5

- i) Illustrate the network topology.
- ii) Use Dijkstras's algorithm to find the new routing table for router A. Show your steps in a table.
- b) What is the difference between a Link state and a Distance vector routing algorithm?
- c) Which of the algorithms in *b)* could be used for intradomain routing?

6. Use the routing table to answer the following questions.

Network Destination	Netmask	Gateway	Interface	Metric
0.0.0.0	0.0.0.0	130.235.200.1	130.235.201.38	1
127.0.0.0	255.0.0.0	127.0.0.1	127.0.0.1	1
130.235.200.0	255.255.252.0	130.235.201.38	130.235.201.38	1
130.235.201.38	255.255.255.255	127.0.0.1	127.0.0.1	1
130.235.255.255	255.255.255.255	130.235.201.38	130.235.201.38	1
224.0.0.0	240.0.0.0	130.235.201.38	130.235.201.38	1
255.255.255.255	255.255.255.255	130.235.201.38	130.235.201.38	1
Default Gateway: 130.235.200.1				

- a) What is the IP address of the computer the routing table is taken from?
- b) Which class does this IP address belong to?
- c) What is the netmask of this class by default?
- d) What is the netmask of the IP-address according to this routing table?
- e) Determine the net-id and the host-id of the IP address. Motivate for the two cases according to question c) and d).
- f) What is the limited broadcast address?
- g) How many hops away is the default gateway found?