LUNDS TEKNISKA HÖGSKOLA
Institutionen för Telekommunikationsssystem

Final exam in ETS152 Computer Communication
Date: 2006-12-14, 14-19

Instructions: Answer each question in a concise way. **All answers must be well motivated!** Your score on the final exam will be added to your scores on the midterm exams. The total score will give you the following grades: <50: Fail; 50-64: Grade 3; 65-84: Grade 4; >84: Grade 5.

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1. **(10p)**

(a)Give both the analog and digital definitions of bandwidth. (1p)

(b)Describe the three steps in Pulse Code Modulation (PCM). (3p)

(c)Explain how a link layer protocol can separate different packets coming from the physical layer. (2p)

(d)Explain why Go-back-N ARQ is more effective than Stop-and-Wait ARQ. (2p)

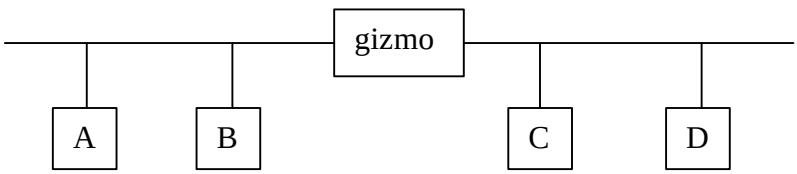
(e)What is distortion and how can it affect the data transfer? (2p)

2. **(10p)**

(a)Describe the medium access method in a standard Ethernet. (3p)

(b)On an Ethernet, a host that detects a collision has to send a jamming signal. The jamming signal is a bit sequence that is 32 bits long. In the network below host A detects a collision. Which other hosts detects the jamming signal that A transmits if the network device (called gizmo) is a

(i) repeater?
(ii)bridge? (3p)



(c)Both IEEE 802.11b and Bluetooth uses spread spectrum techniques. Why? (2p)

(d)Describe the data transfer process in a connection-oriented packet-switched network. (2p)

3. **(10p)**

(a)What does it mean that IP is a best-effort protocol? (2p)

(b)Compare the OSI-model with the TCP/IP-model! (3p)

(c)How is it possible to have several Internet applications running at the same time on a computer without the packets getting mixed up? (2p)

(d)What are the two factors that usually are associated with the network performance? (1p)

(e)Describe how NAT works. (2p)

4. **(10p)**

(a)What is the main objective of a routing protocol? (2p)

(b)Show the basic structure of a router. (2p)

(c)Describe how traceroute works. (3p)

(d)Explain how a digital signature can provide message authentication and integrity. (3p)

5. **(15p)**

Consider the following data sequence of bits: **11101101 01011100**

(a)Write the data sequence in hexadecimal format. (1p)

(b)Assume that the data sequence has been transmitted using QAM. Explain how the two modulation techniques used in QAM works. (2p)

(c)Encode the data sequence using Manchester coding. (2p)

(d)Encode the data sequence using Differential Manchester coding. (3p)

(e) Determine an CRC for the data sequence if the divisor (generator polynomial) is 33_{16}. (4p)

(f) Assume that the data sequence is transmitted in a synchronous TDMA system. The system has a total bit rate of 1 Mbps, with 4 slots per frame, and each slot contains 8 bits. How long time will it take to transmit the data sequence? (3p)

6. **(15p)**

Below are three Ethernet-II frames. The Preamble, Start Delimiter and CRC fields have been removed in the frames below. The frames are shown in hexadecimal format.

(a) In Frame 1, how long is the IP-header? (1p)

(b)Determine the value of the IP checksum field! (2p)

(c)Has the datagram in Frame 1 been received correctly? Include your calculations. (3p)

(d)Which flags have been set in the different IP-headers? (3p)

(e)The IP datagram's payload contains information about a certain protocol, which? (1p)

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Frame 1:
0000: 00 00 0c 07 ac 01 00 00 - 39 51 90 37 08 00 45 00
0010: 05 dc 48 00 20 00 20 01 - 94 67 82 eb 12 7f 82 eb
0020: 80 64 08 00 e3 fb 03 00 - 0c 00 61 62 63 64 65 66
0030: 67 68 69 6a 6b 6c 6d 6e - 6f 70 71 72 73 74 75 76
0040: 77 61 62 63 64 65 66 67 - 68 69 6a 6b 6c 6d 6e 6f
...
...

Frame 2:
0000: 00 00 0c 07 ac 01 00 00 - 39 51 90 37 08 00 45 00
0010: 05 dc 48 00 20 b9 20 01 - 93 ae 82 eb 12 7f 82 eb
0020: 80 64 61 62 63 64 65 66 - 67 68 69 6a 6b 6c 6d 6e
0030: 6f 70 71 72 73 74 75 76 - 77 61 62 63 64 65 66 67
0040: 68 69 6a 6b 6c 6d 6e 6f - 70 71 72 73 74 75 76 77
...
...

Frame 3:
0000: 00 00 0c 07 ac 01 00 00 - 39 51 90 37 08 00 45 00
0010: 04 2c 48 00 01 72 20 01 - b4 a5 82 eb 12 7f 82 eb
0020: 80 64 69 6a 6b 6c 6d 6e - 6f 70 71 72 73 74 75 76
0030: 77 61 62 63 64 65 66 67 - 68 69 6a 6b 6c 6d 6e 6f
0040: 70 71 72 73 74 75 76 77 - 61 62 63 64 65 66 67 68
...
...
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(f)For the IP address 200.34.22.156/17 answer the following questions:

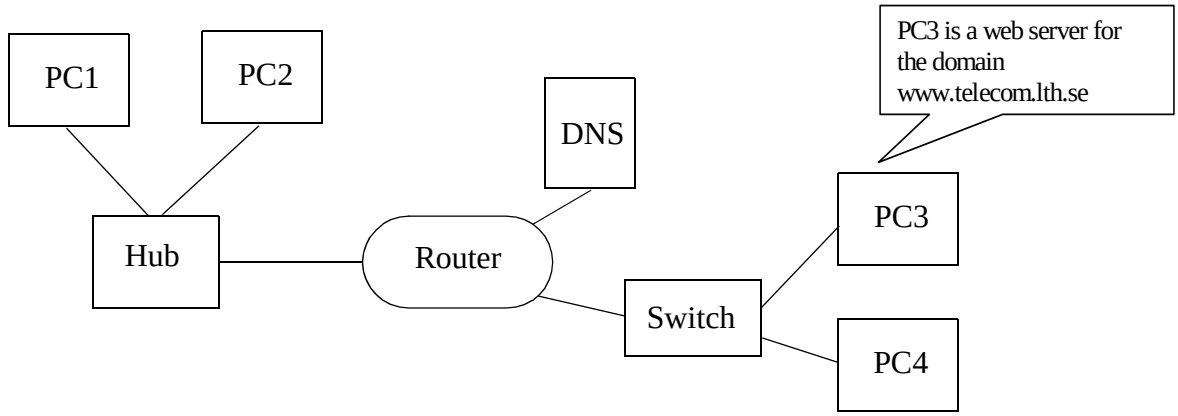
(i)If you ignore /17 for a moment, what would the default mask for the IP address be? (1p)

(ii)Calculate the net-id and host-id for the IP address. (2p)

(iii)Find the maximum number of hosts in the address block. (2p)

7. **(15p)**

Assume the network shown in the figure below.



(a)What are the maximum number of subnets with unique net-ids in the figure, and which computers are in this case belonging to which subnet? (2p)

(b)Assume that PC1 transmits an ICMP message to PC4. Describe how the message will be transferred in the network, and explain the role and action of **all** involved entities. You can assume that PC1 knows all necessary MAC- and IP-addresses. (4p)

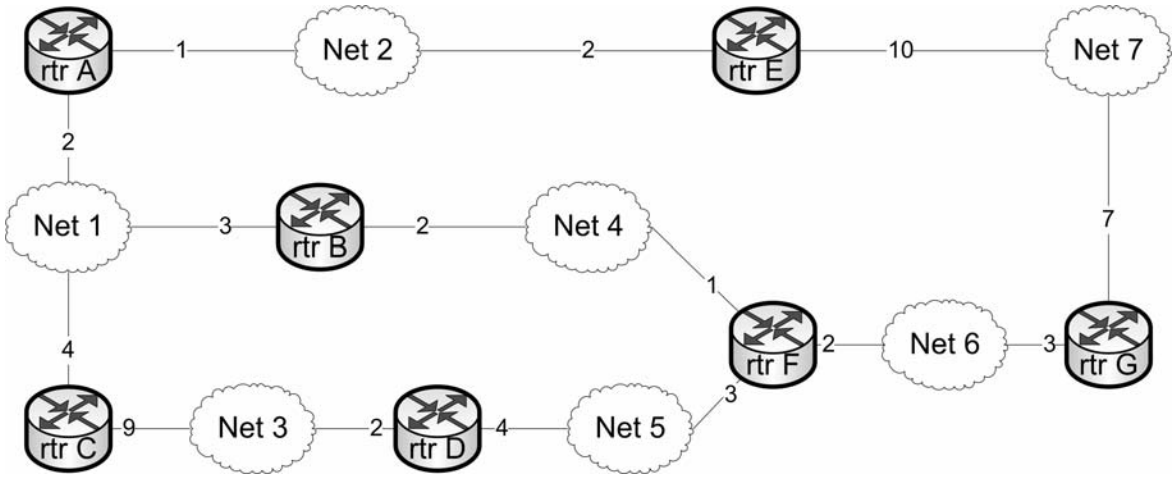
(c)What is the minimum TTL that PC1 should put on a packet in order to be sure that the packet reaches at least all hosts in the shown network? (2p)

(d)Assume that PC2 downloads the webpage www.telecom.lth.se/index.html from PC3. Make a table (as the example below) and use it to describe all communication that occurs in the network during the download. Assume that the network is configured correctly and that all caches/tables are empty when the download starts. (7p)

Type of packet	Source MAC	Source IP	Dest. MAC	Dest. IP	Content
....	.....	.....	...		
http request	PC1	PC1	PC2	PC2	Request for webpage contacts.html

8. **(15p)**

Use the network below when you answer the questions.



(a)Flooding is a very robust forwarding technique. Describe the flooding "algorithm". (2p)

(b)There is a major drawback in flooding that can cause the network to become overloaded. What is this drawback and how it is prevented in IP? (2p)

(c)Assume that the routers in the network run a Distance Vector hop count based protocol.

(i)Show the content of the initial message(s) router F will send. (1p)

(ii)To which router(s) is this message sent? (1p)

(iii)Assume that router F receives router G's initial routing message. Show router F's updated routing table. (1p)

(d)Assume now that we change to a Link State based routing protocol. Link metrics are shown in the figure. Note! Only costs for going from a router to a network are shown. The path cost going from a network to a router is zero and is therefore not shown explicitly in the figure.

(i)Show the content of the initial message(s) router F will send. (1p)

(ii)To which router(s) is the message sent? (1p)

(iii)Show router F's routing table when the network has converged. Show and motivate all calculations. Sort the routing table according to network id. (6p)