Lund University, Dept. of Electrical and Information Technology (EIT)
ETS052 Computer Communication
Final exam: 2012-10-23, 14-19

Instructions: Answer each question in a concise way. You are allowed to use a calculator. **All answers must be well motivated!**

Your score on the final exam will be added to your scores on the midterm exam. The total score will give you the following grades: <50: Fail; 50-70: Grade 3; 71-84: Grade 4; >84: Grade 5.

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1. ***(10p)***

a) Explain the term *framing* in link control protocols. (1p)

b) A modulated signal can be described with the function $f(t) = A \cdot \sin(2\pi ft + \theta)$. Explain the three basic modulation schemes, and how you can encode 1:s and 0:s, by using this function. (3p)

c) Show how the bit sequence 111001001 can be represented with Manchester encoding. (3p)

d) Explain why a telephone call uses 64 kbps. (3p)

2. ***(10p)***

a. In an 802.11 WLAN, medium access control methods with collision detection do not work well. Explain why, and also, explain how the problem can be solved. (3p)

b. The multiple access method in GSM uses time division multiplexing and frequency division multiplexing. In UMTS, code division multiplexing is used. Explain the three multiplexing concepts. (3p)

c. Explain the concept of *collision domain*. (2p)

d. Explain the advantages and disadvantages with the Token passing medium access control method. (2p)

3. ***(10p)***

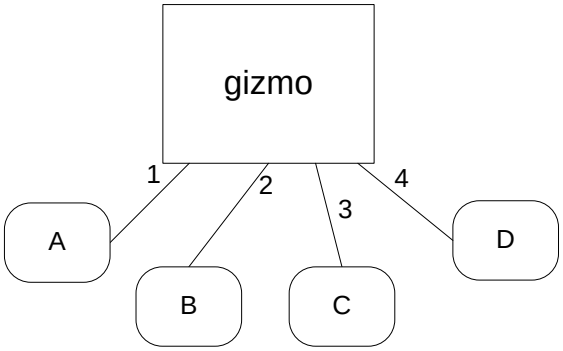
a. Show the complete form of the following 128-bits long IPv6 address: FFDE::B0FF:0:0:FFF0 (2p)

b. Explain where in the OSI model the following protocols belong: HTTP, 802.3, TCP, PPP, IP,UDP, ICMP, ARP. Your answers should be motivated! (4p)

c. Describe shortly the three main parts of WWW. (2p)

d. Explain the concept of *message integrity*. (2p)

4. ***In this exercise, use the illustration of a network device (gizmo) below. The gizmo is assumed to connect four hosts (A, B, C, D). All answers should be well motivated!*** ***(10p)***



a. Assume that host A sends a packet to host B. Then host B sends a packet to A. On which ports will the gizmo forward the packet from B to A if it is a (3p)
   i. Repeater/Hub?
   ii. Switch?
   iii. Router?

b. On which ports will the gizmo forward an ARP request from A if it is a (3p)
   i. Repeater/Hub
   ii. Switch
   iii. Router

c. In which cases above do we need an IP address. (4p)

5. ***(15p)***

a. Given the sequence 1010011010 and the divisor 1011;
   i. Find the CRC (3p)
   ii. Introduce errors in the sequence in such way that the receiver cannot detect them. (3p)

b. Why is it so important for Go-back-N to have a window size less than 2^n where n is the number of bits used for the sequence numbers? (1p)

c. One computer tries to send 5 packets to another computer. Packet number 3 does not arrive correctly (assumed to be lost). How many packets (DATA and ACK) are sent by the two computers assuming that they use
   i. Stop-and-wait ARQ? (2p)
   ii. Go-back-N ARQ with window size 5, where the receiver ACKs each packet? (3p)

d. Consider an 10Base5 Ethernet (10Mbps) with propagation speed of $2*10^8$ m/s, and a cable length of 500 m. Assume that we send frames with a payload of 474 bytes. Calculate the maximum amount of frames that can be travelling on the link. Include the physical layer preamble and SFD in your calculations. (3p)

6. ***(15p)***

a. The following Ethernet frame was sniffed with Wireshark (preamble and SFD already taken out). The frame contains an IP datagram. Motivate your answers!
   i. Which IP version is encapsulated in the Ethernet frame? (2p)
   ii. How long is the IP datagram including the header? (3p)
   iii. Find the destination address of the IP datagram! (3p)
   iv. What is the maximum number of router hops for the datagram? (2p)

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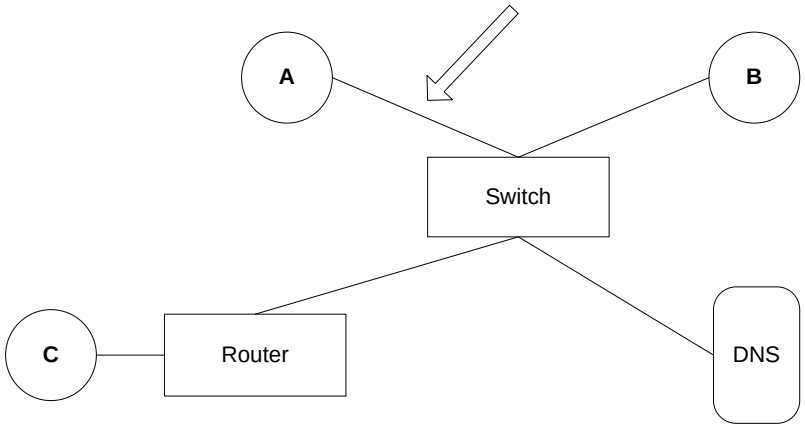
0000: 00 25 22 81 dd 39 ac 81 12 1b 97 55 86 dd 60 00
0010: 00 00 00 28 3a 80 20 01 16 d8 cc 3a 0b f6 d4 91
0020: 66 c2 cf c2 02 71 20 01 09 b0 01 00 00 04 00 00
0030: 00 00 00 00 00 04 80 00 8d a6 00 01 00 07 61 62
0040: 63 64 65 66 67 68 69 6a 6b 6c 6d 6e 6f 70 71 72
0050: 73 74 75 76 77 61 62 63 64 65 66 67 68 69
```

b. Find the net-id and host-id for the following addresses: (2p)
   i. 160.184.66.53/28
   ii. 220.220.220.220/30

c. Find the range of IP addresses for the above address blocks. (3p)

7. Use the figure below when answering the questions: ***(15p)***

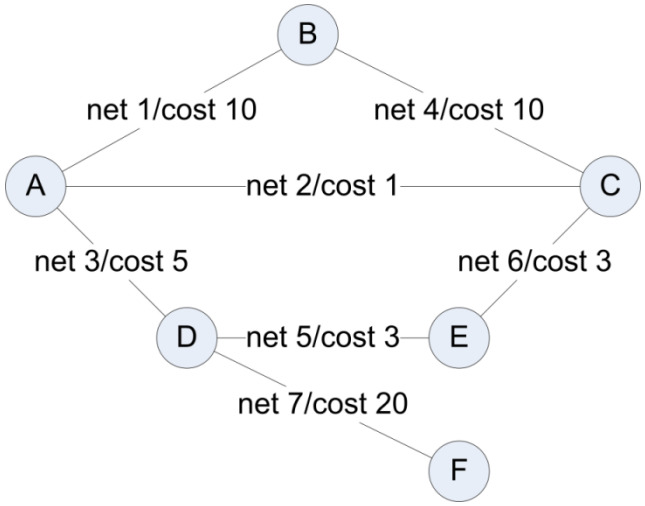


a. How many subnets are there in the figure? Motivate your answer. (2p)

b. Make a table and describe all data packets that are required for host A to send an ICMP echo request to host C. For host A, host C is only known as c.citynetwork.se. Assume that all address caches are empty. The table should clearly show the sender's and receiver's MAC and IP addresses (for example, *MAC(A)* for A's MAC address) and the main content of the data packet. (7p)

c. If host B repeats the same thing afterwards, which data packets will be transmitted on the link marked with the arrow? (6p)

8. Given the network in the figure below. There are 6 routers and 7 networks (shown as links). The metric for each link is found in the figure. ***(15p)***



a. In the first exercise we assume that the routers are using a *distance vector based routing protocol*, but instead of just using hop count this version uses link cost (this is perfectly ok). **Consider the case where network 2 is not yet connected to router A**. The routing tables for router A and C are: (5p)

A's table			C's table		
Net	Cost	Next hop	Net	Cost	Next hop
1	10	n/a	1	20	B
3	5	n/a	2	1	n/a
4	20	B	3	11	E
5	8	D	4	10	n/a
6	11	D	5	6	E
7	25	D	6	3	n/a
			7	26	E

Now network 2 is connected to router A, and thus router A gets an update from router C. Show router A's table after implementing the update from router C. Show the steps router A takes in this process.

b. In the second exercise we instead assume that a link state based routing protocol is used. All links are active as shown in the figure above. Show the steps that router A performs to build a routing table. Describe the process of creating the shortest path tree using Dijkstra's algorithm and the routing table for A. (10p)