

Duration: 1 hour. Answer the quiz and the problems in the same sheet.

Quiz. (4,2 points) All the questions are multi-answer: 0,6 point if correct, 0,3 if there is one error, 0 otherwise.

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19:11:05.330584 IP 147.83.34.125.54277 > 147.83.32.3.53: 27254+ A? www.google.com. (32)
19:11:05.331127 IP 147.83.32.3.53 > 147.83.34.125.54277: 27254 q: A? www.google.com. 7/7/6
www.google.com. CNAME www.l.google.com., www.l.google.com. A 74.125.39.99, www.l.google.com. A
74.125.39.103, www.l.google.com. A 74.125.39.104, www.l.google.com. A 74.125.39.105,
www.l.google.com. A 74.125.39.106, www.l.google.com. A 74.125.39.147 ns: l.google.com. NS
a.l.google.com., l.google.com. NS b.l.google.com., l.google.com. NS c.l.google.com., l.google.com.
NS d.l.google.com., l.google.com. NS e.l.google.com., l.google.com. NS f.l.google.com.,
l.google.com. NS g.l.google.com. ar: a.l.google.com. A 209.85.139.9, b.l.google.com. A 74.125.45.9,
c.l.google.com. A 64.233.161.9, d.l.google.com. A 74.125.77.9, f.l.google.com. A 72.14.235.9,
g.l.google.com. A 74.125.95.9 (356)
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<p>1. In an Ethernet network, say which of the following protocols will use a PDU encapsulated directly inside an Ethernet frame:</p> <p><input checked="" type="checkbox"/> ARP <input type="checkbox"/> ICMP <input checked="" type="checkbox"/> IP <input type="checkbox"/> UDP <input type="checkbox"/> DHCP</p>	<p>2. The dump shown previously have been captured with tcpdump. Say which statements are true:</p> <p><input checked="" type="checkbox"/> The identification of the DNS messages is 27254. <input checked="" type="checkbox"/> The canonical name of www.google.com. is www.l.google.com. <input checked="" type="checkbox"/> 6 IP addresses have been given for the requested name. <input checked="" type="checkbox"/> .a.l.google.com. is the name of an authority of the domain l.google.com. <input checked="" type="checkbox"/> The IP address of 6 name servers have been given for the requested name.</p>
<p>3. Assume an Ethernet network with 10 hosts (PC1...PC10) and all ARP caches empty. In one of the hosts (PC1) is executed a ping broadcast, and all the other hosts answer the ping. Say which statements are true after the ping:</p> <p><input type="checkbox"/> All the ARP tables will have the same number of entries. <input type="checkbox"/> The ARP table of PC1 will have 10 entries. <input checked="" type="checkbox"/> The ARP table of PC2 will have 1 entry. <input type="checkbox"/> All the PCs will send ARP requests. <input type="checkbox"/> There will be no ARP messages.</p>	<p>4. Say which statements are true regarding the routing algorithms:</p> <p><input checked="" type="checkbox"/> For a large network OSPF is more convenient than RIP. <input checked="" type="checkbox"/> For a subnetted network with a variable length mask, RIP version 1 will not work. <input checked="" type="checkbox"/> OSPF use flooding to send the link state advertisements. <input type="checkbox"/> BGP messages are sent using UDP. <input type="checkbox"/> OSPF link state advertisements are sent periodically.</p>
<p>5. Assume that we have contracted the base address 200.0.0.0/24 to our ISP provider. Say what of the following subnets will be possible (the statements give the maximum number of hosts we are willing to connect):</p> <p><input type="checkbox"/> 1 subnet of 130 hosts and 2 subnets of 50 hosts. <input checked="" type="checkbox"/> 1 subnet of 120 hosts, 1 of 60, 1 of 25, 1 of 10 and 1 of 5. <input type="checkbox"/> 5 subnets of 50 hosts. <input checked="" type="checkbox"/> 2 subnets of 50 and 4 subnets of 25 hosts.</p>	<p>6. Say which statements are true regarding the TCP protocol:</p> <p><input checked="" type="checkbox"/> One of the TCP flags is the reset flag. <input checked="" type="checkbox"/> The RTO timer is doubled when a segment is retransmitted. <input type="checkbox"/> A TCP connection is automatically closed after a period of inactivity. <input checked="" type="checkbox"/> The SYN and the FIN segments consume 1 sequence number.</p>

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IP 147.83.34.125.55307 > 91.198.174.2.80: S 878499419:878499419(0) win 5840 <mss 1460,sackOK,timestamp
8758340 0,nop,wscale 6>
...
```

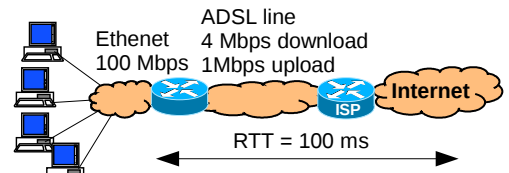
<p>7. Say which of the following segments could have been sent by the server after receiving the segment shown in the previous dump (the timestamp is not shown):</p> <p><input type="checkbox"/> IP 91.198.174.2.80 > 147.83.34.125.55307: S 2489123673:2489123673(0) <input type="checkbox"/> IP 91.198.174.2.80 > 147.83.34.125.55307: . 2489123673:2489123673(0) ack 878499420 win 5840 <input checked="" type="checkbox"/> IP 91.198.174.2.80 > 147.83.34.125.55307: S 2489123673:2489123673(0) ack 878499420 win 5792 <input checked="" type="checkbox"/> IP 91.198.174.2.80 > 147.83.34.125.55307: S 2489123673:2489123673(0) ack 878499420 win 5792 <timestamp 974065942 8758340,nop,nop> <input type="checkbox"/> IP 91.198.174.2.80 > 147.83.34.125.55307: S 2489123673:2489123673(0) win 5792 <mss 1460></p>

Question 1. (0,8 points) The router of the figure is connected to 2 Ethernet networks. Suppose that the router receives an IP datagram of 1500 bytes form N1 with the flag DF=0 which must be sent in an IP-over-IP tunnel in N2. Assume that the router makes the fragmentation before the tunnel encapsulation (thus, the de-fragmentation will be done at the destination). Say what will be the value of the following fields for the 2 fragments that will be generated.



	External header		Internal header	
	Fragment 1	Fragment 2	Fragment 1	Fragment 2
Total length				
Offset				
Flag M				

Question 2. (5 points) In the network of the figure all hosts are using a file sharing peer-to-peer application. In this application all nodes are clients/servers at the same time, and open simultaneous TCP connections to other nodes to download simultaneously different parts of the same file (to speed up the transfer). Assume the following: (i) Each of the 4 hosts is downloading 1 file from the Internet, while other files are uploaded from nodes in the Internet. (ii) In each of the hosts here are 10 TCP connections opened for the file being downloaded, and 4 TCP connections for the files being uploaded. (iii) The RTT for all TCP connections is 100 ms, and the ADSL line is working at its maximum capacity.



- 2.A** Estimate the throughput of 1 TCP connection in each direction.
- 2.B** Estimate the time it will take to one of the hosts to download a file of 1 Gbyte (assume that all the other TCP connections are active during the transfer).
- 2.C** Compute the optimal window of 1 TCP connection in each direction.
- 2.D** Assume that there are no losses and $awnd=64$ kbytes for all the TCP connections (the window scale option is not used). Estimate the minimum RAM memory necessary at the ADSL router. Explain your assumptions.