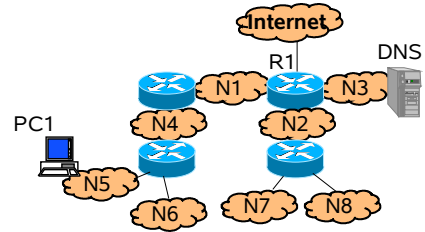


Duration: 1 hour. Answer the quiz and the problems in the same sheet.

net	address	mask	net	address	mask
N1	200.0.0.0	255.255.255.252	N5	200.0.0.40	255.255.255.248
N2	200.0.0.4	255.255.255.252	N6	200.0.0.48	255.255.255.240
N3	200.0.0.16	255.255.255.240	N7	200.0.0.64	255.255.255.224
N4	200.0.0.32	255.255.255.248	N8	200.0.0.96	255.255.255.224



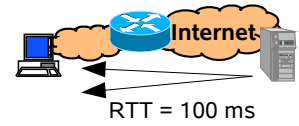
**Quiz. (5 points)** All the questions are multi-answer: 0,5 point if correct, 0,25 if there is one error, 0 otherwise.

<p><b>1.</b> Say which statements are true regarding the IP network of the figure:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> In network N1 there are no IP addresses available to add any host.</li> <li><input type="checkbox"/> In network N5 we can have at most 5 hosts.</li> <li><input type="checkbox"/> All the available IP addresses of network 200.0.0.0/24 have been assigned to the networks N1... N8.</li> <li><input type="checkbox"/> Addresses from networks N1 and N2 can be summarized with the IP address 200.0.0.0/29</li> </ul>	<p><b>2.</b> Assume that all routers in the figure use RIP version 2 with split horizon and advertise all the routes in network 200.0.0.0/24. The default route in R1 is also advertised. There are no additional static routes. Say which statements are true:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> R1 will be sending routing updates with 6 entries to network N2.</li> <li><input type="checkbox"/> When routing tables have converged, all routers will have 9 entries in their routing tables.</li> <li><input type="checkbox"/> Network N6 with metric 3 will be one of the entries of the update messages sent by R1 into network N1.</li> <li><input type="checkbox"/> If the connection to network N3 is lost, R1 will send update messages with network N3, metric 16 to networks N1 and N2.</li> </ul>
<p><b>3.</b> Assume that all ARP caches in the figure are empty, we execute a successful ping 200.0.0.20 at PC1. Say which statements are true after the ping:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> ARP table of PC1 will have 2 entries.</li> <li><input type="checkbox"/> Router R1 will have sent 1 ARP request.</li> <li><input type="checkbox"/> In the ARP table of PC1 there will be the IP address 200.0.0.20.</li> <li><input type="checkbox"/> There will be 4 ARP resolutions.</li> </ul>	<p><b>4.</b> Say which statements are true regarding DNS in the figure:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Each time the DNS server solves a name of foreign domain, it sends a query to a root-server.</li> <li><input type="checkbox"/> All the resource records of the zone files of the DNS server must have IP addresses in the network 200.0.0.0/24.</li> <li><input type="checkbox"/> PC1 can send a recursive query message to the DNS server.</li> <li><input type="checkbox"/> The hosts in the network are likely to be configured with the IP address of the DNS server, possibly obtained by DHCP.</li> </ul>
<p><b>5.</b> Say which statements are true regarding the IP protocol:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Each time an IP datagram crosses a router, the TTL field is decremented.</li> <li><input type="checkbox"/> The checksum is computed using only the IP header fields.</li> <li><input type="checkbox"/> The IP checksum is the 16 bit one's complement of the one's complement sum of all 16 bit words to protect.</li> <li><input type="checkbox"/> One of the IP options is called "Record Route".</li> <li><input type="checkbox"/> The "total length" field of the IP header is a field of 16 bits with the length of the datagram, measured in bytes, including internet header and data.</li> </ul>	<p><b>6.</b> Say which statements are true regarding the TCP protocol:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> One of the TCP flags is the DF flag.</li> <li><input type="checkbox"/> The RTO timer is restarted each time an ack is received.</li> <li><input type="checkbox"/> The client always crosses the SYN_SENT state.</li> <li><input type="checkbox"/> The SYN segments sent by the client always have the ack flag unset.</li> </ul>
<p><b>7.</b> Say which statements are true regarding DHCP:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The clients must know the IP address of the DHCP server.</li> <li><input type="checkbox"/> The clients always sent the DHCPDISCOVER message with the destination address 255.255.255.255.</li> <li><input type="checkbox"/> It can be used to configure the default route.</li> <li><input type="checkbox"/> The clients must know the DHCP port used by the server.</li> </ul>	<p><b>8.</b> Say which statements are true regarding a NAT router:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> May have to change the checksum of the IP datagrams.</li> <li><input type="checkbox"/> May have to change the checksum of the TCP datagrams.</li> <li><input type="checkbox"/> May have to change the port of UDP datagrams.</li> <li><input type="checkbox"/> If PAT is used, it is no possible to have more that <math>2^{16}</math> simultaneous connections.</li> </ul>
<p><b>9.</b> Say which statements are true regarding an IP over IP tunnel:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The source address in the external header is the the IP address of the tunnel entry point.</li> <li><input type="checkbox"/> The addresses in the internal header can be private.</li> <li><input type="checkbox"/> ICMP messages generated inside the tunnel will be sent to the router at the entry point in the tunnel.</li> <li><input type="checkbox"/> RIP messages can be sent inside a tunnel.</li> </ul>	

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...
15:53:13.777675 IP 147.83.34.125.10208 > 130.206.192.15.80: . ack 5793 win 273
...
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- 10.** Say which of the following segments can be sent by the server after receiving the segment shown in the previous dump:
- IP 130.206.192.15.80 > 147.83.34.125.10208: . 5793:7241(1448) ack 578 win 6924
  - IP 130.206.192.15.80 > 147.83.34.125.10208: . 4345:5793(1448) ack 578 win 6924
  - IP 130.206.192.15.80 > 147.83.34.125.10208: P 8689:9479(790) ack 578 win 6924
  - IP 130.206.192.15.80 > 147.83.34.125.10208: . 5773:7221(1448) ack 578 win 6924

**Question 1.** (5 points) One host downloads a large file from the Internet. Once the connection has reached the steady state, we observe at the server side that the slow start threshold (ssth) is constant and equal to 2593 bytes, and the transmission window follows a periodic sawtooth shape. We know that the MSS is 1460 bytes,  $RTT = 100$  ms and the  $RTO \approx RTT$ .



**1.A** Draw a possible evolution of one period of the transmission window. Indicate in the graph: (i) the values that transmission window will take, in bytes, (ii) the time in RTT, (iii) the intervals when TCP is in slow start / congestion avoidance. Explain your assumptions and the events that justify your graph.

**1.B** Compute the throughput.