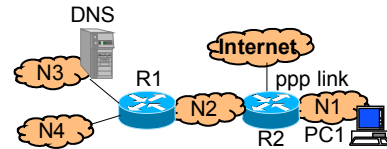


Duration: 1 hour. Answer the quiz and the problems in the same sheet.

net	address	mask	net	address	mask
N1	200.0.0.0	255.255.255.128	N3	200.0.0.192	255.255.255.224
N2	200.0.0.128	255.255.255.192	N4	200.0.0.224	255.255.255.240



Quiz. (4,5 points) All the questions are multi-answer: 0,5 point if correct, 0,25 if there is one error, 0 otherwise.

<p>1. Say which statements are true regarding the IP network of the figure:</p> <p><input checked="" type="checkbox"/> Network N1 is the one that can have the maximum number of hosts.</p> <p><input checked="" type="checkbox"/> In network N2 we can have at most 60 hosts.</p> <p><input type="checkbox"/> All the available IP addresses of network 200.0.0.0/24 have been assigned to the networks N1... N4.</p> <p><input type="checkbox"/> The broadcast address of network N4 is 200.0.0.255.</p>	<p>2. Assume that all routers in the figure use RIP version 2 with split horizon and trigger updates and advertise all the routes in network 200.0.0.0/24. The default route in R2 is also advertised. There are no additional static routes. Updates are sent in all the networks N1...N4. Say which statements are true:</p> <p><input checked="" type="checkbox"/> R1 will be sending routing updates with 2 entries to network N2.</p> <p><input checked="" type="checkbox"/> When routing tables have converged, all routers will have 5 entries in their routing tables.</p> <p><input type="checkbox"/> Network N3 with metric 3 will be one of the entries of the update messages sent by R2 into network N1.</p> <p><input checked="" type="checkbox"/> If the connection to network N3 is lost, R1 will send a trigger update message with network N3, metric 16 to networks N2 and N4.</p>
<p>3. Assume that all ARP caches in the figure are empty, we execute a successful ping www.cisco.com at PC1. Say which statements are true after the ping:</p> <p><input type="checkbox"/> ARP table of PC1 will have 2 entries.</p> <p><input checked="" type="checkbox"/> Router R1 will have sent 1 ARP request.</p> <p><input type="checkbox"/> In the ARP table of PC1 there will be the IP address of the name www.cisco.com.</p> <p><input checked="" type="checkbox"/> There will be 3 ARP resolutions.</p>	<p>4. Say which statements are true regarding DNS in the figure:</p> <p><input type="checkbox"/> Each time the DNS server solves a name of foreign domain, it sends a query to a root-server.</p> <p><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.</p> <p><input checked="" type="checkbox"/> PC1 can send a recursive query message to the DNS server.</p> <p><input checked="" type="checkbox"/> The hosts in the network are likely to be configured with the IP address of the DNS server, possibly obtained by DHCP.</p>
<p>5. Say which statements are true regarding the IP protocol:</p> <p><input checked="" type="checkbox"/> Each time an IP datagram crosses a router, the TTL field is decremented.</p> <p><input checked="" type="checkbox"/> The checksum is computed using only the IP header fields.</p> <p><input type="checkbox"/> Each time a router discards an IP datagram generates an ICMP message.</p> <p><input checked="" type="checkbox"/> The IP header length counts the number of 32 bits words of the header.</p> <p><input checked="" 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.</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.</p> <p><input checked="" type="checkbox"/> The value of the RTO timer is duplicated each time a segment is retransmitted.</p> <p><input type="checkbox"/> The client always crosses the LAST_ACK state.</p> <p><input checked="" type="checkbox"/> The payload of the three way handshaking segments is always 0 bytes.</p>
<p>7. Say which statements are true regarding DHCP:</p> <p><input type="checkbox"/> The clients must know the IP address of the DHCP server.</p> <p><input type="checkbox"/> The clients always sent the DHCPDISCOVER message.</p> <p><input checked="" type="checkbox"/> It can be used to configure the default route.</p> <p><input checked="" type="checkbox"/> A DHCP client may send DHCPREQUEST messages periodically to refresh an IP address.</p>	<p>8. Say which statements are true regarding a NAT router:</p> <p><input checked="" type="checkbox"/> May have to change the checksum of the IP datagrams.</p> <p><input checked="" type="checkbox"/> May have to change the checksum of the TCP datagrams.</p> <p><input checked="" type="checkbox"/> May have to change the port of UDP datagrams.</p> <p><input type="checkbox"/> NAT is necessary if we build a VPN (Virtual Private Network).</p>

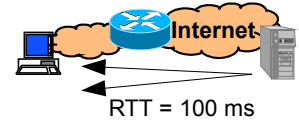
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15:53:13.777675 IP 147.83.34.125.10208 > 130.206.192.15.80: . ack 5793 win 273
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...

<p>9. Say which of the following segments could have been sent by the server upon receiving the segment shown in the previous dump:</p> <p><input checked="" type="checkbox"/> IP 130.206.192.15.80 > 147.83.34.125.10208: . 5793:7241(1448) ack 578 win 6924</p> <p><input type="checkbox"/> IP 130.206.192.15.80 > 147.83.34.125.10208: . 4345:5793(1448) ack 578 win 6924</p> <p><input checked="" type="checkbox"/> IP 130.206.192.15.80 > 147.83.34.125.10208: P 8689:9479(790) ack 578 win 6924</p> <p><input checked="" type="checkbox"/> IP 130.206.192.15.80 > 147.83.34.125.10208: F 8689:10137(1448) ack 578 win 6924</p>

Question 1. (5,5 points) One host downloads a file of 1 Gbyte 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 slightly larger than 4 MSS bytes, and the transmission window follows a periodic behavior. We know that the MSS is 1460 bytes, $RTT = 100$ ms and the $RTO \approx RTT$. We observe that the losses occurs approximately every 700 ms. Assume that TCP follows only slow start (SS) and congestion avoidance (CA) phases. Approximate the increase of the cwnd in CA with a linear increase.



- 1.A** How many segments will the cwnd be approximately increased every RTT during the CA phase? (justify your answer).
- 1.B** Using the previous result, guess and draw a possible evolution of one period of the cwnd. Indicate in the graph: (i) the values that transmission window will take (in segments), (ii) the time in RTT, (iii) the intervals when TCP is in SS / CA. Explain your assumptions and the events that justify your graph.
- 1.C** Compute approximately the throughput and time to download the file.