First control de Xarxes de Computadors (XC), Grado en Ingeniería Informática		7/11/2019	Autumn 2019
NAME:	**SUNAME:**	**GROUP:**	**ID:**

Duration: 1h30m. The test will be collected in 25 minutes. Answer the problems in this page.

Test. (3 points) Each question counts 0.5 points if no error, 0.25 if an error, 0 if more than one error.

1. Tick the correct statements about IP protocol address ranges:
- ☐ The network 147.83.0.0/16 is class B.
- ☐ The network 147.0.0.0/8 is class A.
- ☐ The network 192.168.1.0/24 is private.
- ☐ The network 10.10.10.10/30 is valid.

2. Summarization to the class of the IP addresses:
- ☐ 10.0.0.0/24 and 10.0.1.0/24 is 10.0.0.0/23.
- ☐ 10.0.0.0/24 and 10.0.1.0/24 is 10.0.0.0/16.
- ☐ 10.0.0.0/24 and 10.0.1.0/24 is 10.0.0.0/8.
- ☐ 10.0.0.0/24 and 10.0.1.0/24 is 10.0.0.0/7.

3. Along the path from source to destination, in the header of an IPv4 packet, it is always maintained:
- ☐ The checksum.
- ☐ The source address.
- ☐ The TTL.
- ☐ The protocol of the payload.

4. Tick the correct statements about the DHCP protocol:
- ☐ The client sends messages to the IP address 255.255.255.255.255.
- ☐ It only configures the IP address.
- ☐ To maintain an IP allocation, the IP allocation must be renewed after expiration.
- ☐ To maintain an IP allocation, the IP assignment must be renewed before expiration.

5. The traceroute command receives response messages:
- ☐ ICMP destination unreachable: fragmentation required.
- ☐ ARP reply.
- ☐ ICMP error: time exceeded.
- ☐ ICMP echo reply.

6. Tick the correct statements about Internet routing with autonomous systems (AS):
- ☐ BGP is the routing protocol between AS.
- ☐ OSPF is the routing protocol between AS.
- ☐ An AS is identified by its IP address prefix.
- ☐ An AS is identified by its number.

7. Tick the correct statements about the RIP version 2 protocol:
- ☐ Route updates are sent to all networks.
- ☐ It uses a multicast IP address to distribute updates (update messages).
- ☐ The split horizon method serves to reduce the count to infinity effect.
- ☐ Link state announcements indicate changes in a network.

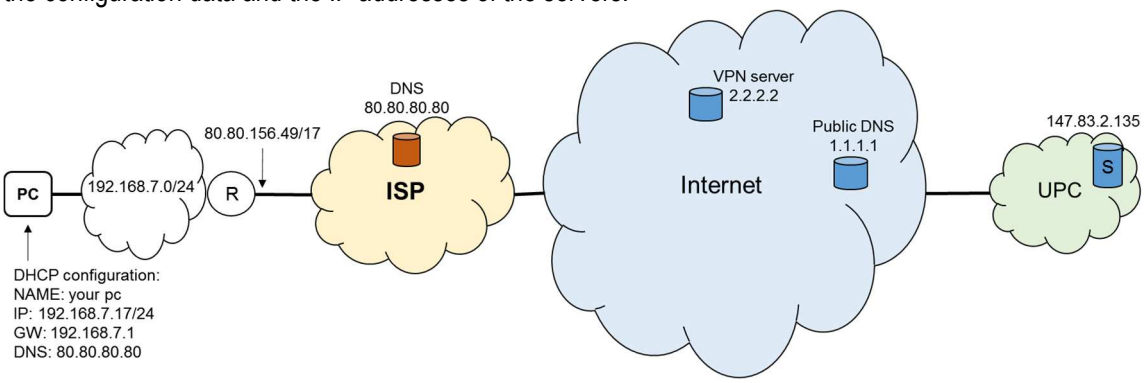
8. Tick the correct statements about the ARP protocol:
- ☐ Gratuitous ARP is used to detect duplicate IPs.
- ☐ Gratuitous ARP is used to detect duplicate MACs.
- ☐ An ARP request is sent by broadcast.
- ☐ An ARP response is sent by broadcast.

First Midterm. Xarxes de Computadors (XC). Grau en Enginyeria Informàtica		7/11/2019	Fall 2019
NAME (in UPPERCASE LETTERS):	FAMILY NAME (in UPPERCASE LETTERS):	GROUP:	DNI/NIE:

Duration: 1h 30 minutes. The quiz will be collected in 25 minutes.

Problem 1 (4.5 points)

The figure shows a home network, the Internet Service Provider (ISP) network, some public servers in the Internet and UPC's network. The home network uses private addressing (192.168.7.0/24). The home router (R) does PNAT (PAT) and it is the DHCP server that configures the devices at home. The figure includes the configuration data and the IP addresses of the servers.



When the PC is connected the rest of the network devices and servers are running since long ago. That is, PC receives its configuration via DHCP and its ARP and DNS tables are empty.

a) (0.5 points) Deduce which network R belongs to: network address, broadcast address and the number of IP addresses available.

b) (0.5 points) deduce the public network where the DNS server in the ISP's network may be attached to (network address and broadcast address). Can it be the same network where R is attached to?

c) (0.5 points) If the addressing space for the l'ISP is 80.80.0.0/13, how many /17 networks can be?

From the PC the command "*ping s.upc.edu*" is issued. The result gives the IP address 147.83.2.135 and an RTT of about 80ms.

d) (0.5 points) Which Ethernet frames will be transmitted and received through the PC network interface until the first response of the ping command is received? Show the contents of each Ethernet frame. Use lowercase letter for the Ethernet (MAC) address of each interface.

Source MAC (Ethernet) address	**Destination MAC (Ethernet) address**	**Ethernet Frame Payload (Protocol and contents of the message)**

e) (0.5 points) Complete the PNAT (PAT) table of router R once the execution of the ping command has finished. The port number for the DNS server is 53.

Private IP@	Private port#	Protocol	Public IP@	Public port#	Destination IP@	Destination port#
PC	P1					

f) (0.5 points) From the PC the command "*traceroute s.upc.edu*" is issued. Which router addresses will be shown (consider the available information only)?

The same if the *traceroute* command is executed from s.upc.edu ("traceroute PC")?

On one day, just after booting the PC the command *"ping s.upc.edu"* gives an error message saying that it cannot resolve the name. The user has a look at the configuration and sends the command "*ping 80.80.80.80*" and it does not respond. It seems that the ISP's DNS server is not working. Then the user modifies manually the configuration of the PC with the IP address of a public DNS server (1.1.1.1). Then the *"ping s.upc.edu"* works again and the RTT is about 80ms.

g) (0.5 points) Why the RTT (*Round Trip Time*) is approximately the same if we used a different DSN server?

After a while the connection does not work; ping does not work, traceroute neither, but "ping 1.1.1.1" works. It seems now that there is serious problem in the network. As a "ping 2.2.2.2" (A VPN server) works the user decides to establish a tunnel between the PC and the VPN server in order to reach server S at UPC.

h) (0.5 points) Complete the table with information carried by the datagrams going through the IPS's network.

Source IP@	Destination IP@	Protocol	Payload (Data)

i) (0.5 points) If the IP datagram carries 1200 byte of data the length of the datagram is 1224 bytes (20 bytes of the IP header plus 1200 bytes of data).
If the MTU of the VPN server is 512 bytes, will fragmentation take place? If so, where is it performed? How many fragments per datagram will be generated? What is their length?

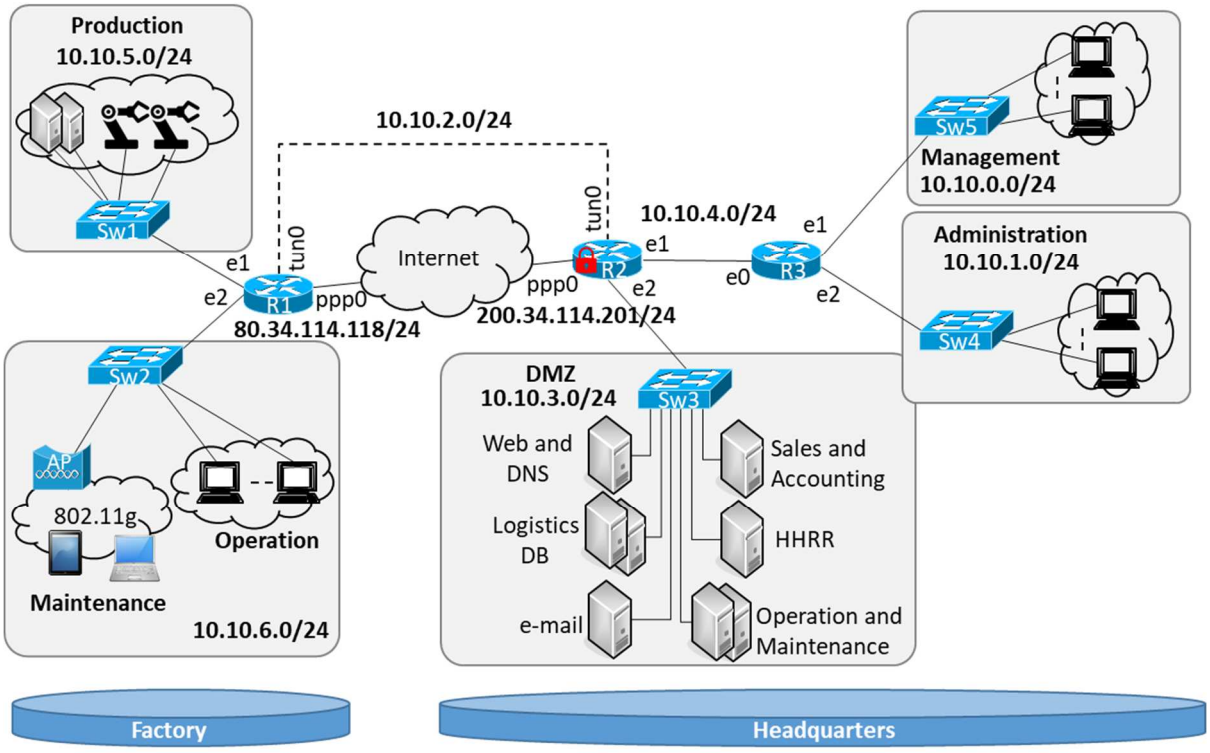
First exam of Computer Networks (XC), Degree in Informatics Engineering		07/11/2019	Fall 2019
NAME:	SURNAME:	GRUP	ID

Duration: 2h. Please answer the questions in the tables.

Problem 2 (2.5 points)

The figure represents the network topology of a company, which includes two locations, the Factory and the Headquarters, geographically separated. Three routers (R1..R3) are used to create the internal network that is configured as 5 sub-networks (*Production* and *Operation and Maintenance* in the Factory and *Management*, *Administration*, and the *DMZ* in the Headquarters) to facilitate its management. Routers R1 and R2 are used to connect the locations between them by an IPinIP tunnel through the Internet.

The company has been assigned two public @IPs: 80.34.114.118/24 for R1 and 200.34.114.201/24 for R2, being the @IPs of the gateways 80.34.114.7 for R1_ISP and 200.34.114.9 for R2_ISP. The internal IP addressing has been planned based on the private @IP block 10.10.0.0/16 and interfaces of the routers are assigned from .1 upwards.



The network is configured so as router R2 in the Headquarters to be the only entrance/leaving point for the Internet traffic. R2 implements PAT and DNAT for the internal network, as well as Firewall functionalities to enforce the security. The networks in the Factory are connected to the Internet through R2 only (via the tunnel)

Answer the following questions.

A. (0.75 points) Complete the routing table of router R1 in the Factory. Use the tighter possible mask to ensure that only the strictly required datagrams get routed through the entries that you added.

Note: although the routing table is represented not ordered, it will be explored after being ordered by the length of the mask.

Prefix/Mask	Gateway	Interface
80.34.114.7/32	0.0.0.0	ppp0
10.10.5.0/24	0.0.0.0	e1
10.10.6.0/24	0.0.0.0	e2
10.10.2.0/24	0.0.0.0	tun0

B. (1.25 points) Specify the ACL rules to be configured when they are applied to the datagrams arriving at router R2 to allow that:

a. any computer in the Management, and the Operation and Maintenance networks to access *well-known* services using TCP/UDP on the Internet
b. the Web (port 80) and DNS (port 53) services to be accessible from any host on the Internet.

Recall that R2 implements NAT.

Interface (input)	Protocol	Destination @IP/mask	Destination Port	Source @IP/mask	Source Port	Action (accept/deny)
ppp0	IPinIP	200.34.114.201/32	-	80.34.114.118/32	-	accept

C. (0.5 points) To test the connectivity between the two locations, an operator executes the *ping* command from the console of router R3 to the interface R1.e1. Write the @IPs and the value in the *protocol* field in the headers of the IP datagrams seen after they leave the R2.ppp0 interface.

Outer IP Header			Inner IP Header		
Source address	Destination address	Protocol	Source address	Destination address	Protocol