

First exam of Computer Networks (XC), Degree in Informatics Engineering		4/4/2019	Spring 2019
NAME:	SURNAME:	GROUP	DNI/ID

Duration: 1h30m. The test will be collected in 20 minutes. Please answer the questions in the same paper.

Quiz. (4 points) Each question counts half if 1 error, 0 if more.

1. Tick the correct statements about the IP protocol.

☐ 224.0.0.9 is a class D address (multicast).
☐ 127.0.10.1 is a loopback address on a host (Interprocess communication, without leaving to the network)
☐ With a 30-bit network mask, in a network with a router only 1 address remains for a host or router.
☐ The IP broadcast address on network 10.0.0.252/30 is 10.0.0.255.

2. Tick which of the following subnets are valid on network 1.2.3.0/24.

☐ One subnet with 100 hosts and another with 120 hosts.
☐ Two subnets with 64 hosts and one with 120 hosts.
☐ One subnet with 100 hosts and another with 128 hosts.
☐ Two subnets with 125 hosts.

3. In IPv4 packets.

☐ The header has at least 20 bytes.
☐ The header has a checksum that allows to detect errors in the whole packet.
☐ The header has a checksum that allows to detect errors only in the header.
☐ Larger MTU packets have to be fragmented in origin so that they can reach the destination.

4. Tick the correct DHCP protocol statements.

☐ The client has to send several multicast IP messages.
☐ The dialog uses IP broadcast messages.
☐ There must be at least one DHCP server on the network.
☐ The IP allocation can have a temporary validity to be renewed.

5. Regarding the ARP protocol:

☐ ARP looks for the IP address corresponding to a physical address (MAC).
☐ ARP uses the broadcast MAC address.
☐ ARP uses the broadcast IP address.
☐ The ARP response is unicast.

6. Tick the correct statements about the different forms of NAT.

☐ DNAT requires prior configuration (mapping) to assign connections to private servers from clients on public networks.
☐ PAT requires prior configuration (mapping) to assign connections to public servers from clients in private networks.
☐ PAT maintains the value of the source port on an outgoing connection.
☐ PAT is used when a machine on a private network is to be accessible from outside.

7. Tick the correct statements about the OSPF protocol.

☐ It is a "link state" protocol.
☐ It is a "distance vector" protocol (like RIP).
☐ It uses the "split horizon" protocol to avoid convergence problems.
☐ The metric usually reflects the capacity of each link and not just the number of hops.

8. Tick the correct statements about IP tunnels.

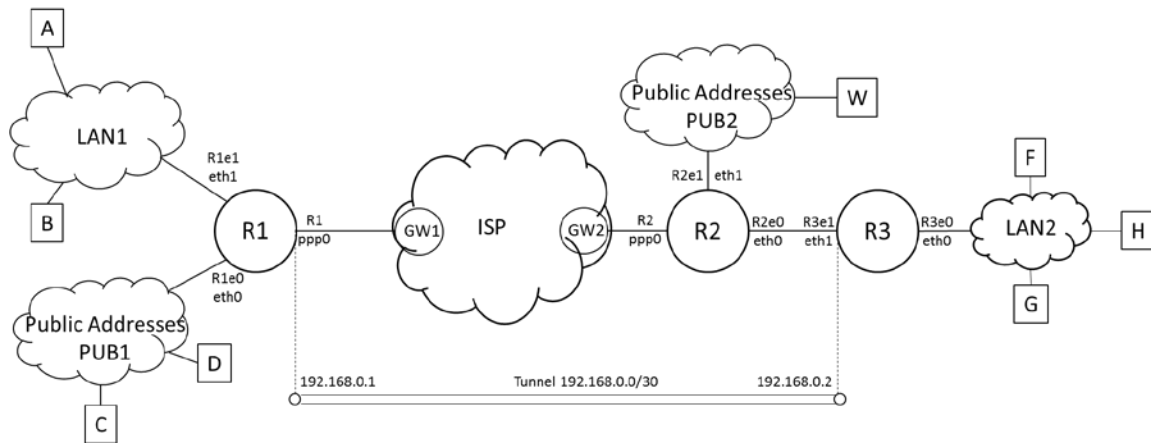
☐ A tunnel has the same MTU as the underlying network.
☐ The TTL of an IP packet passing through an IP tunnel between 2 routers will be reduced 2 hops when passing through the tunnel.
☐ The interfaces of a tunnel are physical interfaces.
☐ The interfaces of a tunnel are logical interfaces.

First Midterm Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		4/4/2019	Spring 2019
NAME (UPPERCASE LETTERS):	FAMILY NAME (UPPERCASE LETTERS):	GROUP:	DNI/NIE:

Duration: 1h 30 min. The quiz will be collected after 20 minutes. Answer in the same exam sheet.

Problem 1 (4 points)

The figure shows the network installed in a company and its connection to the Internet. Each router interface is labelled with its IP address and interface. Hosts and servers are identified by a letter. The notation used is the following: uppercase letter for the IP address and lowercase letter for the MAC address. Server D is the local DNS server of the company; its IP address is D and its MAC (Ethernet) address is d.



The internal network, formed by LAN1 and LAN2, uses private addresses. So, hosts A, B, F, G and H have private addresses. Traffic between LAN1 and LAN2 is routed through the tunnel. The firewall is located in R1 and all traffic to and from LAN2, including the traffic LAN2 exchanges with the Internet, must go through R1. The range of public IP addresses assigned to the company is 100.100.112.0/20.

a) (0.25 points) What is the broadcast address of the public address range? How many host can allocate?

b) (0.25 points) Network PUB1 has a /24 mask and the rest of the public address space is allocated to network PUB2. Assign the corresponding network/mask to both public subnetworks and the IP address for R1e0 and R2e1 interfaces.

c) (0.5 points) The private address space used is 172.16.0.0/16 and it is distributed between LAN1 and LAN2. Allocate all the address space and assign the addresses for both networks and the addresses for R1e1 and R3e0 interfaces and identify the corresponding broadcast addresses.

d) (0.25 points) Identify the placement of the required DHCP servers and which networks they configure.

e) (0.25 points) Which interfaces should be configured with NAT (*Port and Address Translation*)?

f) (0.5 points) Complete the routing table for R1 and R2 using the notation of the figure for the IP addresses. Take into account the tunnel.

Router R1			Router2		
network/mask	Gateway	Interface	network/mask	Gateway	Interface
LAN1		eth1	PUB2		eth1

g) (0.5 points) Initially all ARP tables are empty, except the ones for the *ppp* interfaces at R1 and R2. When the command "*ping B*" is issued from host A the resulting contents of the ARP tables is:

A contains B (IP address) associated with b (MAC address), and B contains A, a.

Complete the contents of the following ARP tables if after "*ping B*" host A executes the command "*ping www.trademark.org*". This web server corresponds to server W in the figure.

Interface A		Interface R1e1		Interface R1e0		Interface R2e0		Interface R2e1	
B	b								

h) (0.25 points) In the previous situation, which are the IP addresses of the datagram that reaches W?

Source IP address:

Destination IP address:

i) (0.25 points) Host A executes the command "*traceroute H*". Suppose it uses an ICMP message (ping).

Complete the sequence of IP addresses that *traceroute* will show.

j) (0.25 points) In the previous case, fill the IP addresses of the datagram crossing the link R2-R3.

Source IP	Destination IP	Source IP	Destination IP	Contents

k) (0.25 points) If the link R2-R3 uses private addresses, answer the previous question.

Source IP	Destination IP	Source IP	Destination IP	Contents

l) (0.25 points) All interfaces are configured with an MTU of 1500 bytes. Will fragmentation take place in any situation?

m) (0.25 points) Assume now that the MTU of the interfaces of the link between R2 and R3 is 760 bytes. Which of the following communications will require fragmentation, and, if so, how many fragments per datagram will be required?

From A to D:

From C to W:

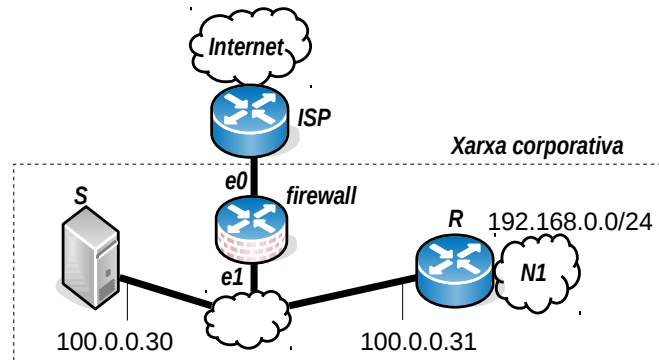
From C to F:

From W to G:

From H to W:

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Problem 2

In the corporate network of the figure in S there is a web (port 80) and name server (port 53). The network has 2 routers: R and the firewall. R is a NAT-PAT (port and address translation) router with an SNAT configuration (allows hosts in N1 to access the Internet). Write the firewall settings to achieve the following conditions:

1. The web server in S is accessible from the Internet
2. The name server in S is accessible from the Internet
3. The server S responds to the pings from the Internet
4. Hosts in N1 can access without restrictions to the Internet

To the extent possible, any other traffic is not allowed.

1. (1.5 punts) Fill in the table below to get the above conditions. Consider the following:

- The name of each rule in the first column of the table must allow the condition with the same number in the previous list
- The interface can be *e0* or *e1* of the figure
- The address can be *in* (enter firewall) or *out* (firewall out)
- Protocol refers to the protocol field of the IP header
- In any cell use *any* to mean any value
- If a cell is not applicable in some rule, put NA
- In the port you can use the operators =, <, >
- All interfaces that have some rule have the implicit final rule *discard everything*
- If you need any information or you do any assumption, justify it below the table

Rule	Interface	Direction	Protocol	IP src/mask	Port src	IP dst/mask	Port dst	Action
1								permit
2								permit
3								permit
4								permit

Justify, if necessary, your assumptions:

2. (0.5 punts) Suppose that there is a web server in N1. Would it be accessible from the Internet with the NAT configuration in R and your configuration of the firewall? If it is not, what should be done in order to access this server from the Internet? Justify your answer.