First Midterm. Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		02/11/2017	Fall 2017
NAME (in CAPITAL LETTERS):	**FAMILY NAME (in CAPITAL LETTERS):**	**GROUP:**	**DNI/NIE:**

Time: 1hour and 30 minutes. The quiz will be collected in 25 minutes.

Test (3 points).

Multiple choice questions (any number of correct answers). Half value if there is one error and 0 if there are more.

1. About the IP protocol
- ☐ Any device with two or more interfaces may perform as a router if "IP forwarding" is activated.
- ☐ The header of an IP datagram contains a filed for error checking.
- ☐ The IP protocol provides a service known as "best effort".
- ☐ IP protocol allow to transport IP datagrams between two user's devices ("host") but some packets may get lost.

2. About the IP protocol
- ☐ IPv4 addresses have 32 bits and the first 18 bits identify the network.
- ☐ At each router, the IP header is modified to include the IP address of the next router.
- ☐ IP packets follow the same path to reach the destination always.
- ☐ The fragmentation of a datagram may be avoided using the 'DO NOT FRAGMENT' flag of the IP header.

3. About the ARP protocol
- ☐ In an Ethernet network, an ARP-Request is sent if the IP address of the next device is not found in the ARP table.
- ☐ Allows to find out the physical layer address of the remote destination device.
- ☐ Allows the detection of supplicate IP addresses in the same network.
- ☐ It is based on a server which resolves the associations between the IP address and the corresponding physical address (MAC address).

4. Which of the following blocks include the address 171.15.66.234?
- ☐ 128.0.0.0 /1
- ☐ 128.0.0.0 /2
- ☐ 171.15.0.0 /18
- ☐ 171.15.66.234 /32

5. Which of the following addresses may be a subnetwork address?
- ☐ 71.184.81.0 /24
- ☐ 71.184.81.0 /20
- ☐ 71.184.81.32 /26
- ☐ 71.184.81.64 /26

6. Check all the correct sentences
- ☐ When a router loses a datagram, it sends an ICMP control message to the destination of the lost datagram
- ☐ When a router finds the TTL field of an IP header equal to 0, it discards the datagram
- ☐ When a datagram is fragmented the new fragment cannot be fragmented again.
- ☐ All fragments of the original datagram can be recognized because all of them have the same identifier.

7. About NAT and PAT
- ☐ The dynamic PAT mechanism may allocate different IP public addresses to different hosts of the private network.
- ☐ All router implementing PAT use a protocol to identify the associations "Private Address – Public Address".
- ☐ PAT cannot be applied recursively. It only works once and a datagram cannot go through several PAT.
- ☐ Two private networks may be connected across the Internet using PAT or an IP tunnel but not with both mechanisms at the same time.

8. About the DHCP server
- ☐ The server must always be located on the router of the network.
- ☐ The DHCP server can provide the IP address of the DNS domain server
- ☐ The only way to get an IP address for a host is by using the DHCP protocol.
- ☐ If special mechanisms are not used, the DHCP server must be in the same subnet as the clients.

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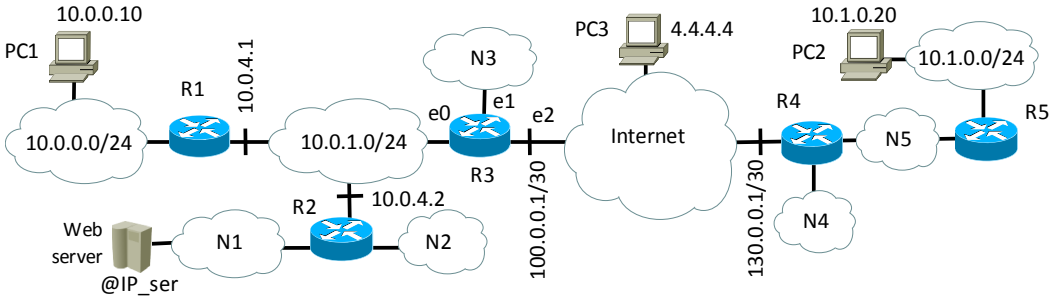
First name:	Last name:

Problem 1 (5 points)

The network in the figure consists of 2 parts: the headquarter and a branch office. A VPN using a tunnel is configured between R3 and R4 with interfaces called tun0 and @IP address 192.168.0.1/30 and 192.168.0.2/30, respectively. For the connectivity of the private hosts to the Internet, R3 uses dynamic NAT with the range 100.0.0.5-100.0.0.25.



Determine

a) (1.75 points) A valid addressing for the networks N1-N5 using the range 160.0.0.128/25 and knowing the following requirements: N1: 10 hosts, N2: 5 hosts, N3: 20 hosts, N4: 10 hosts, N5: 20 hosts

Calculus

Final solution

Network	Bits in hostID	Network address / Mask	Broadcast address

b) (0.5 points) If there is a valid addressing when networks N1 and N2 are merged in a single network N with a number of hosts equal to the sum of the hosts of both networks. If there is, determine such an addressing.

c) (1.25 points) RIPv2 (without summarization) is active in the entire system. Determine the content of the routing table of the router R3. Note that in the column Acq (acquisition), C stands for direct connect, S for static and R for RIP.

Adq	Destination	Mask	Gateway	Interface	Metric

d) (1 point) Router R3 has to be configured as firewall. In particular, one single ACL has to be created in such a way that:

i. Clients of the Internet can only access to the web server (port TCP 80) connected to network N1 (assume its @IP is IP_ser)
ii. Host of the private network 10.0.0.0/8 can access to all well-known TCP services located in the Internet

Determine to which interface this ACL has to be applied and in which direction (ingress or egress) with respect to the router R3 and complete the following table with the ACL

INTERFACE: DIRECTION:

Permit/deny	Protocol	Source		Destination		State
		@IP/Mask	port	@IP/Mask	port	

e) (0.5 points) The source and destination @IP of the datagrams that enter and exit from the router R3 in the following 2 cases:

i. PC1 sends a ping to PC2

ii. PC1 sends a ping to PC3

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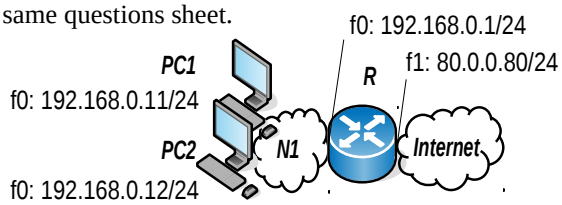
Duration: 1h30m. The quiz will be collected in 25 minutes. Answer in the same questions sheet.

Problem 2 (2 points)

In the network of the figure in PC1 is executed ping -c 1 192.168.0.255, which sends a single echo request message. All ARP tables are empty and all network devices (PCs and the router) respond to the ping. Answer the following questions. If necessary, comment on the assumptions you make and invent the data you need.



2.1 (1 point) Fill in the table with the details of the messages that will be sent. In the "message type" column put the relevant information of the message. Put a hyphen «-» in the boxes that do not apply. Use only the rows you need. Notation: put pc1 to refer to the MAC address of the f0 interface of PC1, and PC1 to refer to the IP address of the f0 interface of PC1, analogously for PC2 and the router R; ff for the broadcast MAC address.

Ethernet header		IP header		
Source	Destination	Source	Destination	Message type

2.2 (1 punt) Fill in the content that the ARP tables of the devices will have when the previous messages have been sent (and no other messages have been sent). Use the same notation as before for MAC addresses and IP addresses.

PC1 ARP table		PC2 ARP table		R ARP table	
MAC	IP	MAC	IP	MAC	IP