Examen final de Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		22/1/2018	Tardor 2017
Name:	**Surname:**	**Group**	**DNI**

Duration: 2h45m. The quiz will be collected in 30 minutes. Answer in the same questions sheet.

Quiz. (2.5 points) All questions are multiple choice: Count as half if there is one error, 0 if more.

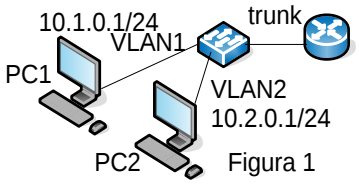


Figura 1

1. Say what statements are true about an IP network:
- ☐ The size of an IP datagram can be larger than 1500 bytes
- ☐ The only protocols that an IP datagram can transport are UDP and TCP
- ☐ IP is a connection-oriented protocol
- ☐ The maximum mask that can be used for a subnetwork is 30 bits

2. An IP router:
- ☐ Decreases the TTL of the IP header of the datagrams it routes
- ☐ The routing table may have the networks 10.1.1.0/16 and 10.1.0.0/24
- ☐ If in the routing table there is 1.0.0.0/8 and 0.0.0.0/0, a datagram with destination 1.1.1.1 will be routerd by 1.0.0.0/8
- ☐ If in the routing table there is 10.0.0.0/24, a datagram with destination 10.0.0.255 will not be forwarded

3. The DHCP protocol:
- ☐ It uses the UDP protocol
- ☐ The server can communicate to the client the IP address of the DNS server
- ☐ The server uses the source IP address 0.0.0.0 when sending a DHCPOFFER message
- ☐ DHCPREQUEST and DHCPACK messages might be enough to configure the client

4. In Figure 1 PC1 ping 10.2.0.1, the ARP and MAC tables are empty. When PC1 receives the answer we can state:
- ☐ Some UDP messages has been sent
- ☐ In the ARP table of PC1 there will be the IP address 10.2.0.1
- ☐ In the ARP table of the router there will be the IP addresses of the 2 PCs
- ☐ Some ICMP message has been sent

5. In Figure 1 PC1 ping 10.2.0.1, the ARP and MAC tables are empty. When PC1 receives the answer we can state:
- ☐ In the MAC table of the switch there will be only 1 Ethernet address
- ☐ In the MAC table of the switch there will be 2 different Ethernet addresses
- ☐ In the MAC table of the switch there will be 3 different Ethernet addresses
- ☐ In the MAC table of the switch there will be 4 different Ethernet addresses

6. In Figure 1 PC1 ping at 10.1.0.255. IP is configured to respond to broadcasts. Tell which devices we can state that will respond:
- ☐ The switch
- ☐ PC1
- ☐ PC2
- ☐ The router

7. Say which of the segments below it is possible that hostB will send after receiving the segment that appears in the following dump:

```
...
IP hostA.28029 > hostB.19: . ack 61267 win 6300
```

- ☐ `IP hostB.19 > hostA.28029: . 61267:61267(1448) ack 1 win 6300`
- ☐ `IP hostB.19 > hostA.28029: . 59179:60627(1448) ack 1 win 6300`
- ☐ `IP hostB.19 > hostA.28029: . 61267:62715(1448) ack 1 win 6300`
- ☐ `IP hostB.19 > hostA.28029: . 60627:61267(1448) ack 1 win 6300`

8. Say what statements are true about an IP tunnel over IP:
- ☐ The source address of the external heading is the IP address of the tunnel entry point
- ☐ The addresses of the internal header may be private
- ☐ The ICMP error messages generated within the tunnel will be sent to the tunnel's entry router
- ☐ RIP messages can be sent inside the tunnel

9. When a host accesses an Internet web server through an HTTP proxy:
- ☐ If NAT is not used, the host must have a public IP address
- ☐ If NAT is not used, the proxy must have a public IP address
- ☐ It is a transparent mechanism. That is, the host can not know that he accesses the Internet through the proxy
- ☐ The proxy can act as a shared cache for all browsers that use it

10. Say which statements are true about the email application:
- ☐ With MIME it is possible to send an email with HTML format
- ☐ When the recipient receives the mail he will see the address that has been placed in the RCPT TO command
- ☐ The message might be transported from the client to the recipient mailbox with only one SMTP session
- ☐ MIME must be used to send text with accented characters that are correctly displayed

Final Exam. Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		22/01/2018	Fall 2017
GIVEN NAME (in CAPITAL LETTERS):	FAMILY NAME (in CAPITAL LETTERS):	GROUP:	DNI/NIE:

Time: 1 hour and 45 minutes. The quiz will be collected in 30 minutes.

Problem 1 (2.5 points)

We have the range of IP addresses: 147.83.0.0/16.

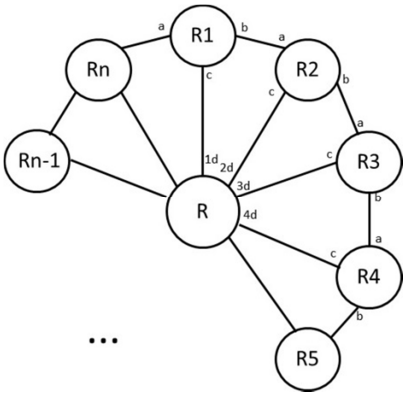
a) (0.25 points) The network manager decides to make subnetworks of /22 blocks that are assigned to the different units and departments.

How many /22 subnets are there?

How many hosts (user devices) can support each subnet?

b) (0.5 points) Within subnetwork 147.83.0.0/22 the block 147.83.1.0/25 is reserved for the public servers (DMZ). Distribute the /22 block using the minimum number of subnetworks (make the subnetworks as large as you can) considering the block that is already allocated for the DMZ.

c) (0.5 points) Previously in question a) we have defined N /22 subnetworks. These subnetworks are connected to the principal router R as shown in the figure. Each router Rn connects subnetwork Xn. We use RIPv2. Complete the routing table for router R3. Start with the routes with the lowest metric and fill the available space in the table. For the router interfaces, use the notation shown in the figure. Do not consider the networks of the links between the routers.



Destination	Gateway interface	Metric

Subnetwork X1 is 147.83.0.0/22 and contains the DMZ (147.83.1.0/25) which hosts the public servers: NS (port 53), SMTP (port 25), WWW (port 80), W1 (port 80), W2 (port 80), and W3 (port 80).

d) (0.5 points) In subnetwork X2 a PC makes a DNS request. Consider that the ARP and DNS tables of the PC are empty. Complete the sequence of frames and packets that go through the internal interface of R2. Use capital letters for the IP address and small letters for the Ethernet (MAC) addresses; for instance PC (for the IP address) and pc (for the MAC address).

Ethernet		ARP		IP				
src	dst	Q/R	message	src	dst	src port	dst port	protocol

e) (0.25 points) At the entry of the external interface of router R (that connects with the ISP) a firewall is configured to protect the network.

src IP	src port	dst IP	dst port	Protocol	Action
ANY	>1024	NS /32	53	UDP/TCP	ACCEPT
NS /32	53	ANY	>1024	UDP/TCP	ACCEPT
NS /32	>1024	ANY	53	UDP/TCP	ACCEPT
ANY	53	NS /32	>1024	UDP/TCP	ACCEPT
ANY	>1024	SMTP /32	25	TCP	ACCEPT
SMTP /32	25	ANY	>1024	TCP	ACCEPT
SMTP /32	>1024	ANY	25	TCP	ACCEPT
ANY	25	SMTP /32	>1024	TCP	ACCEPT

What is the purpose of the rules in the table above?

f) (0.5 points) Complete the filtering rules, placed after the ones shown before, so that the rest of subnetworks (part of X1, X2, X3 …Xn) allow TCP clients only (that is, from the Internet the connection to internal servers is not allowed), and that the rest of the servers in the DMZ may be accessible by external clients. Use the minimum number of entries.

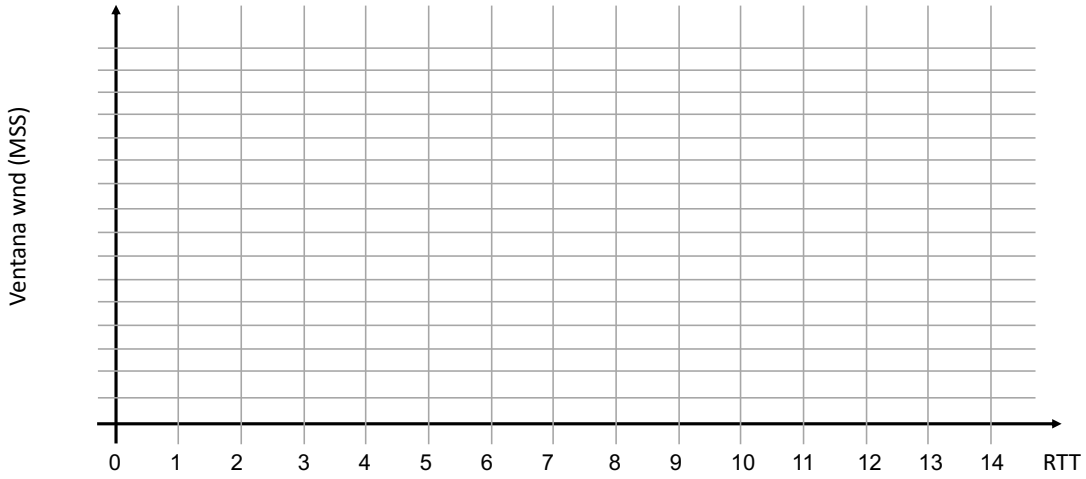
src IP	src port	dst IP	dst port	Protocol	Action

Computer Networks	Q1: 22-01-2018
Name:	Surname:

Problem 2 (2 points).
A host PC1 is connecting to a server SERV to download a file of 20Mbytes. Once the connection is established, the two points agree to use an MSS of 500 bytes. The reception buffers have a capacity of 12000 bytes for PC1 and 10000 bytes for SERV. Assume the RTT constant and equal to 50 ms. Suppose the applications read and write at infinite speed. Determine:

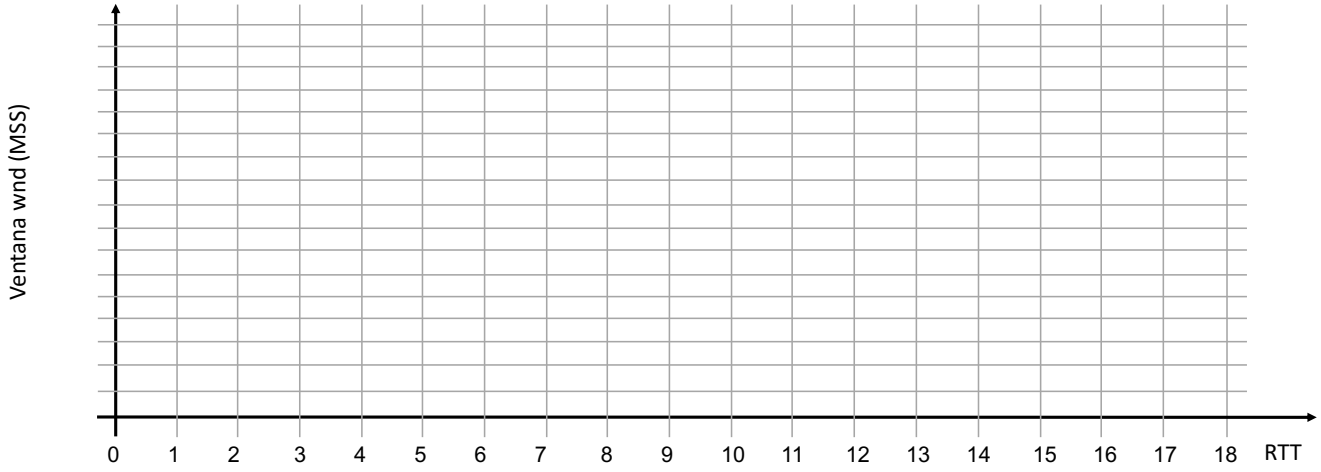
a) (0,5) Assuming there are no losses, complete the following figure from time 0 to 300 ms, clearing indicating the values of the advertised windos awnd, the congestion window cwnd and the transmission window wnd. **Add the appropriate values to the vertical axis.**

Advertised window awnd = _____



b) (0,5) Determine the effective transmission bitrate achieved by the Client and the time needed to download the file.

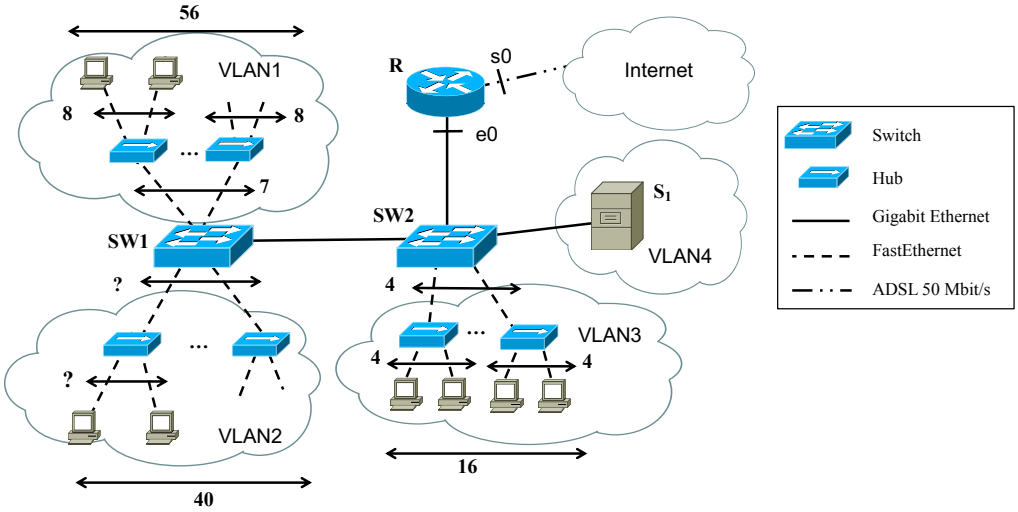
c) (0,5) Assume now that, once the Client reaches this transmission window wnd at time 300 ms, there is a packet loss and this happens everytime wnd reaches this value. Assume the RTO is always 100 ms. Complete the following figure from the first packet loss (time 0 in the figure) until 18 RTT. Clearly show in the figure the Slow-Start and Congestion-Avoidance phases, the value of the threshold ssthresh, and the wnd, awnd and cwnd. **Add the appropriate values to the vertical axix**.



d) (0,5) Determine the effective bitrate achieved by the Client for the case c) and the time needed to download the file.

Problem 3 (1 point).
Four VLANs have been configured in the network of the figure:

- VLAN1 with 56 hosts organized in groups of 8 hosts per hub and 7 hubs
- VLAN2 with 40 hosts
- VLAN3 with 16 hosts organized in groups of 4 hosts per hub and 4 hubs
- VLAN4 with the server S1



Determine:

a) (0,25) Find the number of hubs and the number of hosts per hub for VLAN2. These values need to be determined considering that when the VLAN2 hosts transmit to the server S1, this server has to receive at its maximum capacity without having a bottleneck from Sw1 to S1.

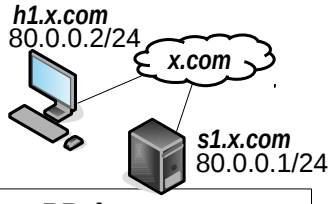
b) (0,5) With the VLAN2 found in a), determine the average transmission bitrate achieved by hosts of VLAN1, VLAN2 and VLAN3 when they all transmit to server S1. Justify the answer and indicate the location of the bottleneck and which mechanism controls it.

c) (0,25 With the VLAN2 found in a), determine the average transmission bitrate achieved by hosts of VLAN1, VLAN2 and VLAN3 when they all transmit to Internet. Justify the answer and indicate the location of the bottleneck and which mechanism controls it.

Examen final de Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		22/1/2018	Tardor 2017
Name:	**Surname:**	**Group**	**DNI**

Duration: 2h45m. The quiz will be collected in 30 minutes. Answer in the same questions sheet.

Problem 4 (0.75 points) We want to configure the name server of the x.com domain in the network of the figure. In the server s1 there are the name server, web server and incoming mail server with names ns, www and mail, respectively. Fill in the following table the resource records (RR) that will have to be configured in the nameserver to be able to solve h1, s1, ns, www, mail and for the users of the domain to receive mail through the incoming mail server. Each row is a RR. We want to use the minimum number of RRs in the table.



Name	RR type	RR data

Problem 5 (0.75 points) The user a@x.com sends a message to b@x.com with subject "reply" and content "OK" with the image "logo.gif". Use the following table to indicate the message header and body (without the SMTP commands). Each box is a line of the message. Put simply "logo.gif" in the line where there is the image. Use only the rows you need.

Problem 6 (0.5 punts) A client has downloaded the web page index.html from a web server and has saved it in the cache. One of the lines of the HTTP header has been "Date: Thu, 25 May 2017 22:19:15 GMT". A few days later the client returns to download the same page. Use the following table to indicate the HTTP message that the client will send if the web page is downloaded only in case it has changed. Each row is a line of the message. Use only the rows you need. If you do not remember some of the HTTP header fields, you can guess the name and and explain it in the space left below.
