Segon Control de Xarxes de Computadors (XC), Grau en Enginyeria Informàtica		18/5/2017	Spring 2017
Name:	**Surname:**	**Group**	**DNI**

Duration: 1h30m. The quiz will be collected in 20 minutes. Answer in the same questions sheet.

Quiz. (3.5 points) Mark the correct answers. All questions are multiple choice: Count as half if there is one error, 0 if more.

1. In a window protocol:
☐ If the transmission window is 1, it behaves like Stop-and-Wait.
☐ Increasing the size of the window beyond the optimal window does not improve efficiency.
☐ The throughput always increases as the window increases.
☐ A retransmission timer (RTO) is always required.

2. Regarding UDP and TCP headers
☐ Both have a field with the source port and the destination port.
☐ Both are the same size.
☐ Both have a checksum field.
☐ Both have a field for the sequence number.

3. Regarding TCP
☐ The retransmission timer, RTO, is updated from the calculation of the round trip time RTT.
☐ There are some options that are only used during connection establishment (three-way-handshake).
☐ The slow start threshold can not be less than 2 segments (2 MSS bytes).
☐ It is possible to send an advertized window equal to 0 bytes.

4. If we know that cwnd=500 bytes and MSS=100 bytes, say which of the following sequences would be possible for the congestion window (cwnd) if 4 acks arrive confirming new data:
☐ 500, 500, 500, 500
☐ 600, 700, 800, 900
☐ 600, 700, 100, 100
☐ 600, 700, 800, 812

5. In an Ethernet switch where 2 VLANs and a trunk are configured:
☐ It is possible that a frame arriving through the trunk is forwarded to ports of both VLANs.
☐ It is possible that a frame arriving through the trunk is forwarded to more than one port.
☐ It is possible that a frame arriving on one VLAN is forwarded to the port of a different VLAN.
☐ It is possible that a frame arriving through the trunk is forwarded by to all ports of the same VLAN.

6. Regarding Ethernet:
☐ In a switch there can be full duplex and half duplex ports simultaneously.
☐ In a hub there can be full duplex and half duplex ports simultaneously.
☐ Ethernet frames have one field with the destination address and another with the source address.
☐ The MAC table of a switch is built automatically from the destination address ot the Ethernet frames.

7. Regarding CSMA/CD:
☐ In CSMA/CD acks are sent to know if there has been a collision.
☐ In CSMA/CD the station that first detects the collision is always the one that retransmits the frame first.
☐ CSMA/CD is not used in a full duplex link.
☐ In CSMA/CD a random number generator is used to decide, when a collision occur, how long to wait before attempting to retransmit.

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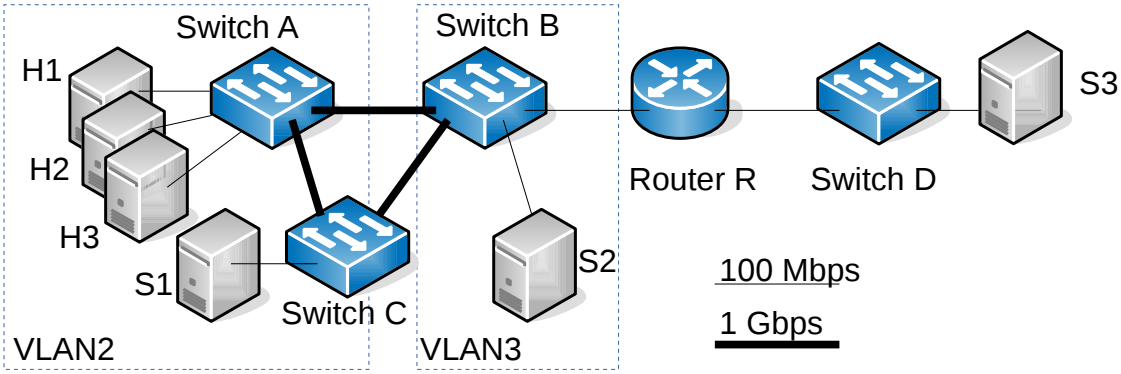
Problem 1 (3 points)
An organization has the local network of the figure. The PCs (labeled H and S) and the router are connected with Fast Ethernet. Switches A, B, C are interconnected at 1 Gbit Ethernet in trunk mode.



1) (0,75) List the devices that would respond to a ping sent to the broadcast network address (suppose is enabled in all devices) sent from:

S1:

S2:

S3:

2) (0,75) List the network devices (routers and switches) that would traverse the Ethernet frames that carry an IP datagram sent from:

H1 to S3:

H1 to S2:

3) (0,75) If all PCs (H*) send data with TCP at the maximum rate and in a sustained manner to server S2, calculate the maximum transfer rate in each PC. Indicate which mechanism acts and why: a) TCP congestion control, b) Switch B flow control, or c) only the speed limitation of the S2 connection.

H1-3:

4) (0,75) What effect does have the three links that connect the switches A, B and C and what mechanism acts when one fails?

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EXERCISE 2 (3.5 points)

The next 29 following lines show part of a TCP-segments interchange between a Client machine (named C) and a Server one (named S). Lines 7 and 23 hide many other lines. Suppose that the RTT is 100 ms.

The columns represent: **1)** Interchange's line number, **2)** IP address and port of the sending machine, **3)** IP address and port of the receiving machine, **4)** Active flags (S, P, F), **5)** *(if there are data)* Sequence number **:** Sequence number of the next segment **(**segment data size**), 6)** ACK number, **7)** Advertised-window size.

```
1)        2)                  3)      4)        5)              6)          7)
    ..........................................................
1.  10.1.0.3.1059 > 10.2.0.1.80: .                       ack 1      win 23168
2.  10.1.0.3.1059 > 10.2.0.1.80: P 1:93(92)             ack 1      win 23168
3.  10.2.0.1.80 > 10.1.0.3.1059: P 1:213(212)           ack 93     win 32120
4.  10.1.0.3.1059 > 10.2.0.1.80: .                      ack 213    win 23168
5.  10.2.0.1.80 > 10.1.0.3.1059: . 213:1661(1448)       ack 93     win 32120
6.  10.1.0.3.1059 > 10.2.0.1.80: .                      ack 1661   win 23168
7.  ..........................................................
8.  10.1.0.3.1059 > 10.2.0.1.80: .                      ack 26277  win 23168
9.  10.2.0.1.80 > 10.1.0.3.1059: . 26277:27725(1448)    ack 93     win 32120
10. 10.2.0.1.80 > 10.1.0.3.1059: . 27725:29173(1448)    ack 93     win 32120
11. 10.2.0.1.80 > 10.1.0.3.1059: . 30621:32069(1448)    ack 93     win 32120
12. 10.2.0.1.80 > 10.1.0.3.1059: . 32069:33517(1448)    ack 93     win 32120
13. 10.1.0.3.1059 > 10.2.0.1.80: .                      ack 29173  win 23168
14. 10.2.0.1.80 > 10.1.0.3.1059: . 33517:34965(1448)    ack 93     win 32120
15. 10.2.0.1.80 > 10.1.0.3.1059: . 34965:36413(1448)    ack 93     win 32120
16. 10.2.0.1.80 > 10.1.0.3.1059: . 36413:37861(1448)    ack 93     win 32120
17. 10.1.0.3.1059 > 10.2.0.1.80: .                      ack 29173  win 23168
18. 10.1.0.3.1059 > 10.2.0.1.80: .                      ack 29173  win 23168
19. 10.1.0.3.1059 > 10.2.0.1.80: .                      ack 29173  win 23168
20. 10.2.0.1.80 > 10.1.0.3.1059: . 29173:30621(1448)    ack 93     win 32120
21. 10.1.0.3.1059 > 10.2.0.1.80: .                      ack 37861  win 23168
22. 10.2.0.1.80 > 10.1.0.3.1059: . 37861:39309(1448)    ack 93     win 32120
23. ..........................................................
24. 10.2.0.1.80 > 10.1.0.3.1059:FP 499773:500213(440)   ack 93     win 32120
25. 10.1.0.3.1059 > 10.2.0.1.80: .                      ack 493981 win 23168
26. 10.2.0.1.80 > 10.1.0.3.1059: . 493981:495429(1448)ack 93     win 32120
27. 10.1.0.3.1059 > 10.2.0.1.80: .                      ack 500214 win 23168
28. 10.1.0.3.1059 > 10.2.0.1.80: F 93:93(0)             ack 500214 win 23168
29. 10.2.0.1.80 > 10.1.0.3.1059: .                      ack 94     win 32120
```

REPLY **REASONABLY**, AND IN THE SPACE PROVIDED, THE FOLLOWING QUESTIONS:

1.A (0.5 points) If there were no losses, what segments had been sent before the capture was started? (Use the same format given).

1.B (0.5 points) Which segment is lost between lines 8 and 22? In which side has the capture been taken?

1.C (0.4 points) On what line, between 8 and 22, can we ensure that the transmission window is 1 MSS?

1.D (0.3 punts) What is the value, in MSS, of the advertised window (`awnd`)?

1.E (0.4 points) Assume that line 23 breaks down into multiple lines and that there are no errors. How many segments (of MSS octets) are sent?

For all other questions, suppose that the first of the lines in which the 23 is decomposed is:

```
23. 10.1.0.3.1059 > 10.2.0.1.80: .                    ack 39309  win 23168
```

Assume also that this ACK causes the congestion window (`cwnd`) to become 2 MSS. Also, assume that the threshold is greater than the advertised window (`awnd < ssthres`).

1.F (0.6 points) When (in RTTs from line 23) does the transmission window match the advertised window?

1.G (0.5 points) How many RTTs will it take to arrive to the original line 24?

1.H (0,3 points) What has been the effective speed in this sequence (the multiple lines of the original line 23)?