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

Quiz. (3 points) All the questions are multi-answer: count half if an error, 0 if more.
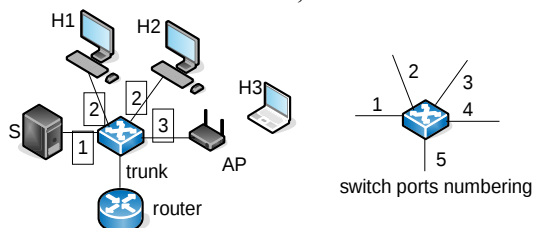
In the network of the figure all ports of the switch are full duplex and 100 Mbps, the Wi-Fi connection between H3 and the AP is 20 Mbps and the framed numbers indicate the VLAN configured in each port.

1. The MAC table of the switch is empty and H1 pings to S. How many entries will there be in the MAC table of the switch when H1 receives the response from the ping? (there is only the traffic generated by the ping)
   - ☐ 1
   - ☐ 2
   - ☐ 3
   - ☐ 4
   - ☐ 5
   - ☐ can not be known

2. All stations (H1, H2, H3) send at full speed to S. Mark the ports of the switch where the flow control will be active (it will send pause frames):
   - ☐ none
   - ☐ port 1
   - ☐ port 2
   - ☐ port 4
   - ☐ port 5
   - ☐ in the wifi interface of the AP

3. Assume that H1, H2 and H3 connect to the chargen server of S. What will be the throughput of each station?
   - ☐ 100/3 Mbps in all stations
   - ☐ In H1 and H2 50 Mbps, and in H3 20 Mbps
   - ☐ In H1 and H2 40 Mbps, and in H3 20 Mbps
   - ☐ In H1 and H2 100 Mbps, and in H3 20 Mbps

4. Suppose that H1, H2 and H3 connect to the chargen server of S. The advertised window (awnd) is the same in all connections. Approximately, the RTT that will see TCP:
   - ☐ Will be the same in H1, H2 and H3
   - ☐ Will be the same in H1 and H2
   - ☐ in H3 will be double than in H1
   - ☐ in H1 will be double than in H3

```
16:04:12.949020 10.1.9.47.57278 > 10.1.24.40.5001: [S], seq 2881316612, win 29200, length 0
16:04:12.949135 10.1.24.40.5001 > 10.1.9.47.57278: [S.], seq 2744514961, ack 2881316613, win 27360,
length 0
16:04:12.958957 10.1.9.47.57278 > 10.1.24.40.5001: [.], ack 1, win 229, length 0
...
16:04:14.014615 10.1.24.40.5001 > 10.1.9.47.57278: [F.], seq 1, ack 520000, win 5259, length 0
16:04:14.023507 10.1.9.47.57278 > 10.1.24.40.5001: [.], ack 2, win 229, length 0
```

5. Suppose now that the previous dump has been captured in H1 (it does not correspond to the chargen server of the previous sections, and it does not show the TCP options). Say what statements are true
   - ☐ The IP address of H1 is 10.1.24.40
   - ☐ The IP address of the client is 10.1.24.40
   - ☐ In total the 10.1.9.47 has sent 0 bytes of data
   - ☐ The throughput has been approximately 488 kbps
   - ☐ The RTT is approximately 9ms

6. Say what statements are true of TCP and UDP
   - ☐ The UDP header is fixed and variable in TCP
   - ☐ The UDP and TCP headers have a checksum field
   - ☐ The UDP and TCP headers have a field with the source port and destination port
   - ☐ The UDP and TCP headers have a field with the sequence number

7. The UDP and TCP headers have a field with the sequence number
   - ☐ The congestion window (cwnd) only increases when new data is confirmed
   - ☐ When the RTO jumps, a segment is always retransmitted
   - ☐ The slow start threshold threshold may be 0
   - ☐ When the RTO jumps, the congestion window is equal to 1 segment

8. Say what statements are true
   - ☐ In full-duplex mode Ethernet does not use CSMA / CD
   - ☐ In CSMA/CD the stations wait for a random time if they find the media to be busy
   - ☐ Wi-Fi can not be in full-duplex mode
   - ☐ A network that has only switches and Wi-Fi access points (with a single VLAN) forms a single broadcast domain

Duration 1h30m. The quiz will be collected in 20m. Please provide answers in this document.

Problem 1 (3.5 points).
In this network C1 downloads from S1, and C2
downloads from S2 system updates > 4 GB.
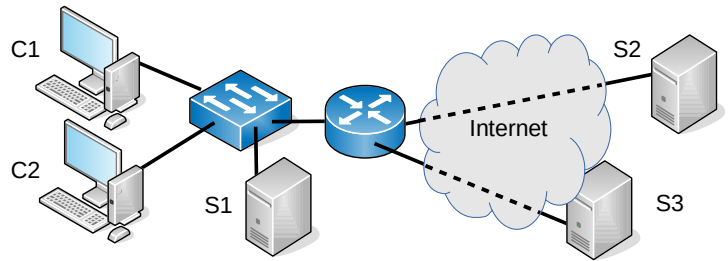We assume a non-congested Internet.
All connections are 1 Gb/s full-duplex.
TCP MSS = 1 Kbyte.
Latency (RTT): C-S1 1ms, C-S2 50ms, C-S3 20ms.
The router queues have 0 size: if there are more than one packet to send only one is saved.
We use decimal units 1 Gbps = 1000 Mbps, 1 kB = 1000 bytes.

a) Determine the optimal reception window for C1 downloading from S1 and C2 downloading from S2:

C1: Vopt =
C2: Vopt =

b) Determine the effective reception speed of C1, C2 if the advertised window for both is 50000 bytes:

C1: Vef =
C2: Vef =

c) Now window scaling 7 ($x2^7$) is active for C1 and C2, indicate how the effective speeds change:

C1: Vef =
C2: Vef =

d) Describe the effect that the C1-S1 download may have on the C2-S2 download.

Now C1 and C2, in addition to downloading from S1 and S2 respectively with the previous window scaling, also download an UDP video stream from S3 that is being sent at 10 Mbps.
e) Indicate the effect that these downloads will have on the TCP transfer with C1 and C2 on both sides of the router and what is the role of the switch?

C1:

C2:

f) With all the above, in what state will be the TCP connections from C1 and C2 towards the end of the connection? (SS/CA and reason)

C1-S1:

C2-S2:

g) Indicate the values of ssthres for each TCP connection towards the end of it:

C1:

C2:

Second exam of Computer Networks (XC), Degree in Informatics Engineering	16/5/2019	Spring 2019
NAME: SURNAME:	GRUP	ID

Duration: 1h30m. The test will be collected in 25 minutes. Please answer the questions in the table.

Problem 2 (3.5 points)

The figure represents the network topology of a company. The network is connected to the Internet through a router (R) that connects two different LANs: (1) public and private servers, and (2) the rest of the company, including the factory, the workers and the management. The efficiency of the switches (Sw) and the bridge (Br) is 100%, that of the hubs (H) is 80% and that of the access-point (AP) is 66.7% (two thirds); the technology of the network interfaces is shown in the figure (consider the double link between the server in the factory and Sw3 as just one with the aggregated speed).

Several VLANs are created to partition the physical infrastructure and separate network traffic; VLANs configuration is shown in the figure.
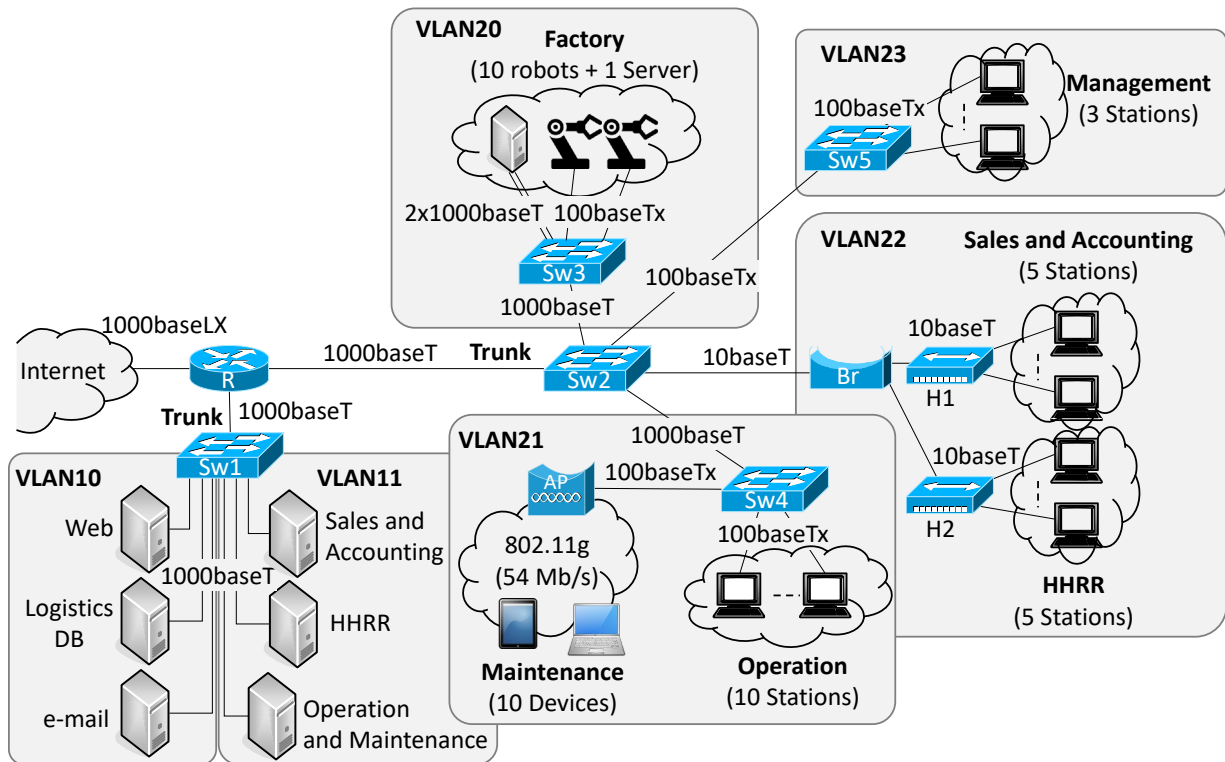
In the factory (VLAN20), let us assume that the robots run an industrial application that uses UDP. Robots are always active and have data ready to transmit to the factory server. For the rest of the stations and mobile devices, let us assume that they run two types of applications, both based on TCP: the first one to download data from the servers and the second one to upload data to the servers, being in both cases negligible the amount data in the opposite direction. Periodically, workers load and download data to/from the servers, while the management connects from time to time. Thus, we can assume that at any time there is a set of stations/devices that are active and have data ready to upload/download to/from the server they are connected to, whereas those not active do not transmit.

Answer the following questions in the next table for the scenarios that are given: (*i*) the bottlenecks that would be created, (*ii*) which would be the mechanism(s) that would regulate the effective speed of the stations/devices, (*iii*) the effective speed that active stations/devices would achieve.

A) (0.5 points) All the HHRR, Sales and Accounting workers in VLAN22 upload data at the same time to the corresponding servers in VLAN11.

B) (0.5 points) All the HHRR, Sales and Accounting workers in VLAN22 download data at the same time from the corresponding servers in VLAN11.

C) (1 point) All Maintenance and Operation workers in VLAN21 upload data at the same time to their server in VLAN11.

D) (1 point) Operation workers in VLAN21 download data from the server in the factory while the management in VLAN23 are downloading the last sales report from the server in VLAN11.

Q	Bottleneck	Flow Control Mechanism(s)	Effective speed per station/device (Mb/s)			
			VLAN22	VLAN21 - Operation	VLAN21 - Maintenance	VLAN23
A)				-	-	-
B)				-	-	-
C)			-			-
D)			-		-	

E) (0.5 points: correct entry: +0.05; empty/incomplete/incorrect entry: -0.05) After the previous activity, which are the contents of the MAC table in Sw2? Answer in the following table, where the *Y/N* field specifies whether every entry would be in the MAC table; as for the *output port* field, specify it by using the name of the connected network device, e.g., *Sw3* for the interface that connects Sw2 to the factory.

MAC addresses learned in Sw2	Y/N	Output Port
VLAN11 - Sales & Account Server		
VLAN11 - HHRR Server		
VLAN11 - Operation and Maintenance Server		
VLAN20 - Factory Server		
VLAN20 - Robots		
VLAN21 - Maintenance		
VLAN21 - Operation		
VLAN22 - Sales & Accounting		
VLAN22 - HHRR		
VLAN23 - Management		