

This test has 17 questions for a total of 35 points. Every three wrong test answers 1 point will be subtracted. Only one option is correct. Calculators are not allowed.

Apellidos: _____ **SOLUCIÓN** _____ Nombre: _____ Grupo: _____

1. (1p) The transport layer is responsible for the communication ...
 - ☐ a) host to host
 - ☐ b) node to node
 - ☐ c) transport to transport
 - ☒ d) process to process
2. (1p) Which of the following functions is not a responsibility of the error control?
 - ☐ a) Detect and discard corrupted packets
 - ☒ b) Control the size of the sliding window in order to avoid packets loses
 - ☐ c) Buffer out-of-order packets
 - ☐ d) Resend lost packets
3. (1p) Which of the following functions is common to both TCP and UDP?
 - ☐ a) Sliding window
 - ☐ b) Error recovery
 - ☒ c) Port multiplexing
 - ☐ d) Routing
4. (1p) If 5 bits are used for the sequence number, which is the maximum size of the transmission and reception windows for ARQ stop-and-wait protocol?
 - ☐ a) Tx window = 5, Rx window = 1
 - ☐ b) Tx window = 31, Rx window = 1
 - ☒ c) Tx window = 1, Rx window = 1
 - ☐ d) Tx window = 16, Rx window = 16
5. (1p) TCP is a ... protocol
 - ☐ a) non-reliable
 - ☐ b) best-effort delivery
 - ☐ c) reliable
 - ☐ d) none of the above
6. (1p) ... control regulates the amount of data a source can send before receiving an acknowledgment from the destination
 - ☐ a) error
 - ☒ b) flow
 - ☐ c) congestion
 - ☐ d) none of the above
7. (1p) Which of the following assertions about IP is false?
 - ☒ a) There's no mechanism defined to transmit errors, such us "host not found"
 - ☐ b) Session establishment is not requested for sending datagrams
 - ☐ c) It's a network layer protocol
 - ☐ d) The maximum size of the datagram is 65535 bytes

8. (1p) The IPv4 header size ...
- ☒ a) is 20 to 60 bytes long
 - ☐ b) is always 20 bytes long
 - ☐ c) is always 60 bytes long
 - ☐ d) depends on the MTU
9. (1p) An IPv4 datagram is divided into three smaller fragments. Which if the following assertions is true?
- ☐ a) The "no fragmentation" bit is set to 1 in all 3 fragments
 - ☒ b) The last fragment has always an "offset" different to 0, and the "more fragments" bit set to 0
 - ☐ c) The "identification" field is consecutive for all three fragments
 - ☐ d) The "offset" field is the same for all three fragments
10. (1p) Which is the broadcast IP address for a network /16?
- ☐ a) 0.0.0.0
 - ☐ b) 255.255.255.255
 - ☐ c) FF:FF:FF:FF:FF:FF
 - ☒ d) It is different for each concrete network
11. (1p) When a router forwards a packet it's because ...
- ☐ a) no default gateway has been defined
 - ☐ b) the IP source address has not been specified
 - ☐ c) the destination network is not included in the routing table
 - ☒ d) the destination address is not local to the router
12. (1p) Let's suppose that you have run traceroute and got the route to www.google.com. Which is the source IP of the packets received? Which upper layer protocol they use? (Note.- Only the packets directly generated by traceroute are taken into account)
- ☐ a) The source IP is the one from www.google.com; ICMP protocol
 - ☒ b) The source IP is the corresponding to each router in the path; ICMP protocol
 - ☐ c) The source IP is the one from your host; ARP protocol
 - ☐ d) The source IP is the one from your host; ICMP protocol
13. (1p) Which of the following assertions is false about the encapsulation of an ARP request over an Ethernet frame?
- ☒ a) In the request message frame, the origin MAC is filled with 00...00
 - ☐ b) In the request message frame, the destination MAC is filled with FF...FF
 - ☐ c) In the reply message frame, the destination MAC is the one from the node that generated the ARP request
 - ☐ d) In the reply message frame, the source MAC is the one the node that generated the ARP request was looking for
14. (1p) How does a bridge with a learning algorithm work when a new frame arrives?
- ☐ a) It remembers and records in its internal table the source host. If the destination is known it is forwarded. Otherwise the frame is discarded.
 - ☒ b) It remembers and records in its internal table the source host. If the destination is known it is forwarded. Otherwise it floods all its output ports
 - ☐ c) It remembers and records in its internal table the source host. If the destination is known it is forwarded. Otherwise it is returned to the source host
 - ☐ d) All previous assertions are false

15. (1p) Can a connection at the link layer be established between hosts belonging to different local networks?

- ☒ a) No, never
☐ b) No, unless their MAC addresses are found through the ARP protocol
☐ c) Yes, always
☐ d) Yes, but only when the source and destination IPs are already known

16. (10p) We want to install 3 subnetworks in a high school. One with 8 seats for teachers, another one with 10 seats for staff, and finally one with 12 seats for students. The global net address to hire for providing the services has the following address: 104.12.97.0. Questions:

(a) Size of the mask for each one of the three subnetworks:

Knowing that the maximum number of valid hosts is $2^{32-n} - 2$, if $2^{32-n} - 2 > 12$, the least integer number in $32-n$ that matches is $32-n=4$. Mask /28 ☐

(b) Network address, valid IPs range, and broadcast address for each of the three subnetworks

- Network | Network address | Valid IPs | Broadcast address
- Teachers: 104.12.97.0 / 28 104.12.97.0 104.12.97.1 – 104.12.97.14 104.12.97.15
- Staff: 104.12.97.16 / 28 104.12.97.16 104.12.97.17 – 104.12.97.30 104.12.97.31
- Students: 104.12.97.32 / 26 104.12.97.32 104.12.97.33 – 104.12.97.46 104.12.97.47

☐

(c) Which will be the minimum size of the global network to hire, and the resulting IPs range (including both the network and broadcast address) before its subdivision?

Since the 3 subnets have mask /28 we should at least hire one /26, so all three are included: 104.12.97.0/ 26. Prior to the division the IP ranges would be from 104.12.97.0 to 104.12.97.63.

Remaining (if weh consider that the router needs one valid address in each subnet).

Students: $62-50-1 = 11$ Teachers: $30-18-1 = 11$ Staff: $14-10-1 = 3$ ☐

(d) Is there any remaining subnetwork? In that case, which one?

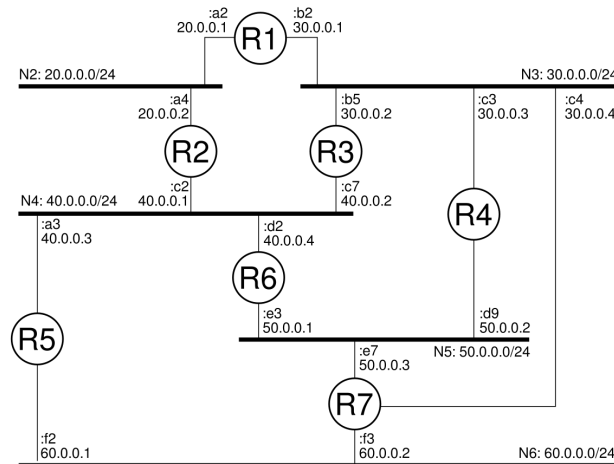
Extra addresses are 104.12.97.48 – 104.12.97.63, which may build a new /28 subnetwork, more concreteley 104.12.97.48 / 28. ☐

(e) Draw schematically the outline of the network

☐

17. (10p) Consider the following network topology, taking into account that:

- For each interface the IP address is shown, and for the sake of simplicity, just the last octet of the MAC address.
- Although not shown in the figure, there are multiple hosts connected in every network.
- For each request, we assume that ARP caches are empty initially.



(a) Host A (with IP 20.0.0.7) has sent an IP packet with destination 50.0.0.12. That has resulted in the following traffic:

- A sends an ARP request to N2 asking for the MAC of 20.0.0.1.
- R1 sends an ARP reply to A including MAC :a2.
- A sends an IP package to R1.
- R1 sends an ARP request to N3 asking for the MAC of 30.0.0.3
- R4 sends an ARP reply to R1 including MAC :c3.
- R1 sends the IP package received to R4
- R4 sends an ARP request to N5 asking for the MAC of the final destination.
- The destination sends an ARP reply to R4 including its MAC.
- R4 sends the IP package received to destination.

Write the routing tables of all devices involved in this communication..

(b) Write all messages that result from an ICMP ECHO request from 60.0.0.18 to 30.0.0.23.

(c) Write the routing tables of all devices involved in the ICMP ECHO request.