

**Universidade de Aveiro**  
**Mestrado Integrado em Engenharia de Computadores e Telemática**  
Exame Teórico de Recurso de Fundamentos de Redes  
29 de janeiro de 2018

Duration: 2h45m. Without consultation. Justify all the answers carefully.

Considering the attached corporate network where:

- The network has an Internet connection through Router 1, given by the ISP.
- The connections between all switches (Layer 2 or Layer 3) are made using trunk / inter-switch connections;
- Connections between Routers and between Layer 3 Switches and Routers are made using Layer 3 (routing) connections;
- All Switches (Layer 2 and Layer 3) have Spanning-Tree enabled.
- The Spanning-Tree priority (2 bytes in hexadecimal) and its MAC address are indicated next to each switch.
- Next to each switch port is indicated its number and in parenthesis its spanning-tree cost.
- RIPv2 and RIPv6 protocols are active on all networks (does not include ISP connection);
- Internet access Router 1 is announcing (by RIPv2 and RIPv6) a default route and has NAT / PAT properly configured;
- All interfaces have a RIPv6 cost of 1.

1. For VLAN 1 Spanning-tree process (SW11 to SW16, and SW Layer 3 B), indicate and justify the root switch / bridge, what is the root path cost of each switch / bridge, which are the root ports and which ports are blocked on each switch / bridge. Justify your answer. (2.0 points)
2. Assuming that most VLAN 1 traffic is to and from the Internet, indicate which switch is best suited to be the root of the Spanning-tree process of VLAN 1, and why. Describe the changes to make in equipment configurations to ensure this requirement. Properly justify your answer. (1.0 points)
3. Assuming that the corporation has acquired the range of public IPv4 addresses 200.0.0.128/25, present a possible partition of the same assuming that the following terminals require public IPv4 addresses: in VLAN 1 there are 16 video conferencing systems, in the LAN B there are 50 servers, and NAT is active on Router 1 where you will need some addresses in this range. (2.0 points)
4. Describe how two servers (on VLAN 11) with only private IPv4 addresses (with active ports TCP 80 and TCP 22, respectively) are accessible from outside the network (Internet) only for active services. (1.5 points)
5. Write the IPv4 routing table for Router 3. (2.5 points)
6. Using only the RIPv6 protocol, it is possible to make IPv6 traffic from the Internet (Router 1) to VLAN 1 be routed preferentially by Router 3, and only in case of failure along the path the traffic is routed through Router 2 ? Justify. (1.0 points)
7. Assume that the corporation wants to acquire the domain name Company2018.pt and has a DNS server, an e-mail server and four HTTP servers (WebMail, Webpage, Videos, OwnCloud) in a network with IPv4 and IPv6 support. Explain, from the system manager's point of view, the steps to deploy the DNS service on the corporation with the new domain and present a generic configuration of the DNS zone (with the required records). (2.0 points).
8. An application on a terminal on LAN 11 opened a TCP session to a terminal on LAN 12 with an initial Sequence Number of 1200 using TCP Reno.
  - a) What is the source MAC address of the Ethernet frames arriving at the VLAN 12 terminal? Indicate the MAC address based on the interface / equipment name. (1.0 points)
  - b) If the initial congestion window of the VLAN 11 terminal is 2 MSS, the MSS is 1400 bytes, and the receiving window of the VLAN 12 terminal is 1000 bytes, how many packets of 100 bytes of data can be sent soon after the establishment of the TCP session, before receiving an Acknowledgment from the other terminal? (1.0 points)

- c) How and when does the VLAN 11 terminal consider one of the TCP packets sent as lost, and retransmit it? (1.0 points)
  - d) In the above mentioned TCP session, and assuming successful termination, if the Acknowledgment number of the last packet sent by the VLAN 12 terminal is 8700, how many bytes of data were sent from the VLAN 11 terminal? (1.0 points)
9. On a server with two IPv4 addresses, an application has opened a Socket at address 100.0.0.1 and local port TCP 3000. Is it possible for another application on this same server to open a TCP Socket on port 3000 and listen? Justify. (1.0 points)
  10. An HTTP server (Apache2) sent, in a short period of time, a high number of HTTP messages with response 200, indicate if this fact reveals a problem in the network / service. (1.0 points)
  11. Describe the concept of "simple parity check code" and present a possible application of it. (1.0 points)
  12. Describe the difference between a guided transmission system and an unguided transmission system. Give an example for each. (1.0 points)

Name: \_\_\_\_\_ Number: \_\_\_\_\_

