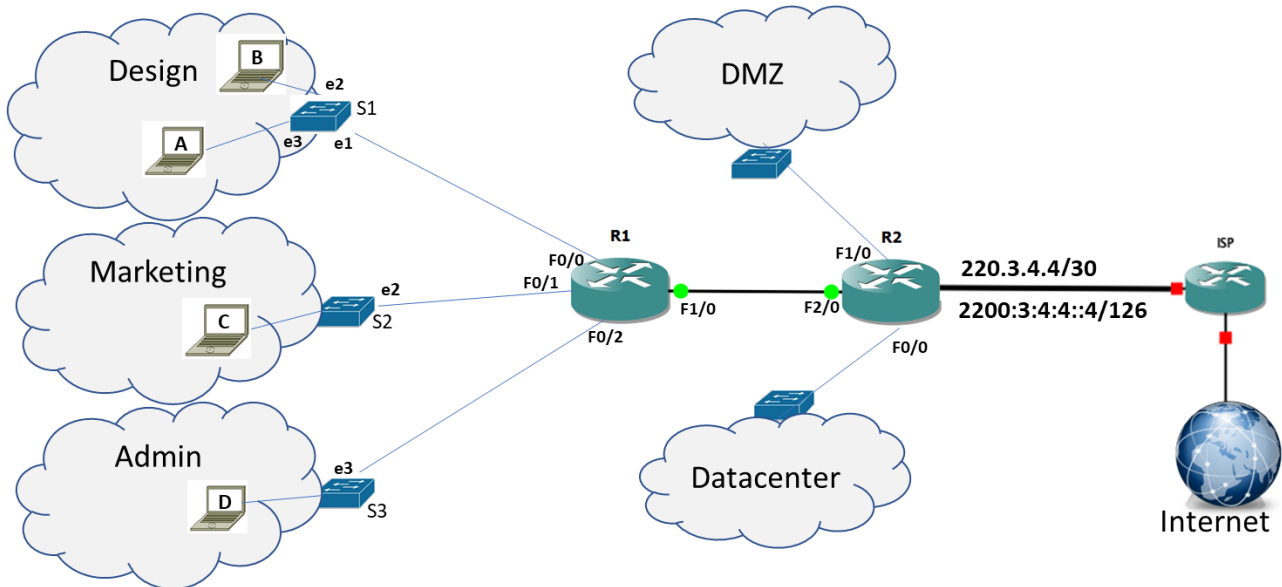# Universidade de Aveiro
Licenciatura em Engenharia de Computadores e Informática
Exame Final de Redes de Comunicações 1 – 19 de Janeiro de 2023

Duration: 2:00 hours. No additional reading. Carefully justify all answers.

Consider that you were hired to be the manager of a company communication network. The characteristics of the network are the following:

• The company network infrastructure is divided in several networks/sub-networks with global IPv6 addressing, private IPv4 addressing and, in some departments, public IPv4 addressing;

• R1 has a DHCP server to allocate addresses in the sub-networks (Design, Marketing and Admin) that are directly connected;

• Internal routing is performed through static routes;

• The connection to the Internet can be obtained through R2;

• R1 has default routes (IPv4 and IPv6) through R2;

• R2 has default IPv4 and IPv6 routes (to the Internet) through ISP, has NAT/PAT correctly configured, and has routes (IPv4 and IPv6) to the networks of R1;

• O ISP has routes (IPv4 and IPv6) for the company networks.

1. Consider that the company contains:
■ Range of IPv4 public addresses 185.222.66.0/23;
■ Range of IPv4 private addresses 10.0.0.0/8;
■ Range of IPv6 global addresses 2345:9754:EF::/56.

a. Define sub-networks IPv4 private of class B for all networks (identifier and mask), including the point-to-point networks between routers. (1.5 points)

b. Define sub-networks IPv4 public (identifier and mask) for the sub-networks Admin, DMZ and Datacenter, including the NAT addressing in R2, assuming that there are terminals/servers that require IPv4 public addresses, namely:
■ sub-network Admin has a maximum of 64 terminals/PCs that require public addressing;
■ sub-network DMZ has a maximum of 70 terminals/PCs that require public addressing;
■ sub-network Datacenter requires 38 public addresses;
■ NAT/PAT pool requires 18 public addresses.

(1.5 points)

c.   Define sub-networks IPv6 for all networks (identifier and mask), including the point-to-point networks between routers. (1.5 points)

2.   Considering that *switches* have their routing table empty, what is the content of the table of *switch* S1 after *pings* between PCs A and C, and between PCs B and D. Justify. (1.5 points)

3.   In the previous communications, identify the ARP packets travelling each connection, and their origin and destination. Justify. (1.5 points)

4.   Considering that the overall network is operational (including NAT/PAT), which networks (can be aggregated) one can find in the IPv4 and IPv6 routing table of the ISP Justify. (1.5 points)

5.   If you wish to include a wireless network in the Admin network, and considering that it is a very loaded network, would you opt to activate MACA mechanism with signalling packets RTS/CTS? What are its advantages? Justify. (1.5 points)

6.   For the PCs in the previous network to its Communication in an automatic way, how can they acquire the default gateway address in IPv4 and IPv6, respectively? Justify? (1.5 points)

7.   In the transmission of a file through TCP between PCs A and D, with a maximum size of the packet of 1200 bytes, a congestion window of 35 packets, and a reception window of 40 packets:

a)   If a packet is lost and the network is much congested, how will the sender have information about the loss? Justify. (1.0 points)

b)   In the above case, what is the next value of the window (after the loss identification), considering TCP-Reno? Justify. (1.0 points)

8.   A transmission of UDP and TCP services occupies all the bandwidth connection. Considering that the number of TCP session duplicates, what will happen to both services, TCP and UDP? Justify. (1.5 points)

9.   In a communication between terminals in which DNS servers of the several levels are very apart, do you prefer a resolution mode iterative or recursive? Justify. (1.5 points)

10.   What is the relationship between the types of connection HTTP persistent and non-persistent, and the TCP connections? Justify. (1.5 points)

11.   Describe how the sample frequency and the precision of the voice have impact in the bandwidth of the voice service. (1.5 points)