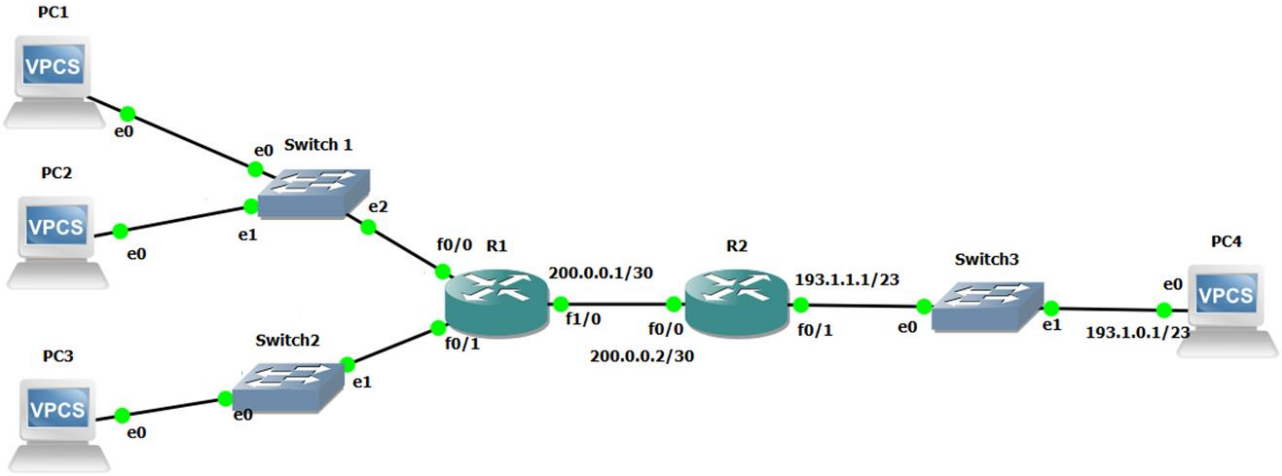
Universidade de Aveiro
Licenciatura em Engenharia de Computadores e Informática
Exame de Recurso de Redes de Comunicações 1 – 25 de Fevereiro de 2022

Duration: 2:00 hours. With no extra reading. Carefully justify your answers.

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

- The company network has 2 sub-networks and a connection to the outside through R1, with the connection to the Internet emulated by R2;
- In each switch port and in each router interface there is an identifier;
- In each terminal or network interface at the right of R1 there is an IP address;
- When their IP addresses are configured, terminals will also have a default gateway through R1;
- R1 has a DHCP server to allocate addresses to the network;
- R1 has a default route to the internet and has NAT/PAT correctly configured;
- R2 has a route for the company network through R1.



1. Considering that the private network addressing 192.168.2.64/27 is available, allocate addresses to the terminals and to the router sub-network interfaces to provide connectivity between all. (2.0 points)
2. Considering the ARP and switching tables empty, who initiates the ARP process for a complete communication from PC1 to PC3? Justify. (1.5 points)
3. Considering the communication in question 2, what is the information that the switches learn in the several directions of communication? Justify. (1.5 points)
4. Considering that PC1 initiates a communication with the address 200.0.0.5, explain which packets are transmitted in the links PC1-R1 and R1-R2. Justify. (1.5 points)
5. Considering a wireless sub-network beyond the ones already in the company, and knowing that the transmission of RTS and CTS packets can also generate collisions, why shall they be used to avoid collisions in an overloaded network? Justify. (2.0 points)
6. Considering an available pool of public addressing 200.2.3.128/28 and:
   a) PC1 and PC2 want to communicate with the outside,
   b) PC3 has a server that needs to be accessed from the outside,
   Propose a concrete solution that allows these different types of communication. (2.0 points)
7. Considering the communication in question 6, propose a solution for the IPv6 case, with a global prefix 2022:AFE2::/60. Justify. (1.5 points)

8. In a transmission of a file through TCP between PCs 1 and 4, with a maximum transmission unit of 1000 bytes, the sender can transmit up to a maximum of 20 packets without receiving confirmations (congestion window of 20 packets, and a reception window much higher). In this phase, the sender receives 3 duplicated acknowledgements with the value 55000. What will be the sender reaction and the next congestion window value? Justify. (2.0 points)
9. In a transmission of multimedia services through UDP (in unicast) between the company and the Internet, several services are trying to send traffic at a rate of 120% of the link bandwidth. What will happen to this traffic? Justify. (1.5 points)
10. Considering the situation of question 9, what would happen to a voice service and to a video service, respectively? Justify. (1.5 points)
11. In HTTP, which of the connection types, persistent or non-persistent, require more time to transmit the objects of a web page? Justify. (1.5 points)
12. To access to PC1, PC2 and PC3 through their names, present a concrete DNS solution for this purpose, considering the addressing of question 6. Justify (1.5 points)