Universidade de Aveiro
Licenciatura em Engenharia de Computadores e Informática

Theoretical Exam - Redes de Comunicações II

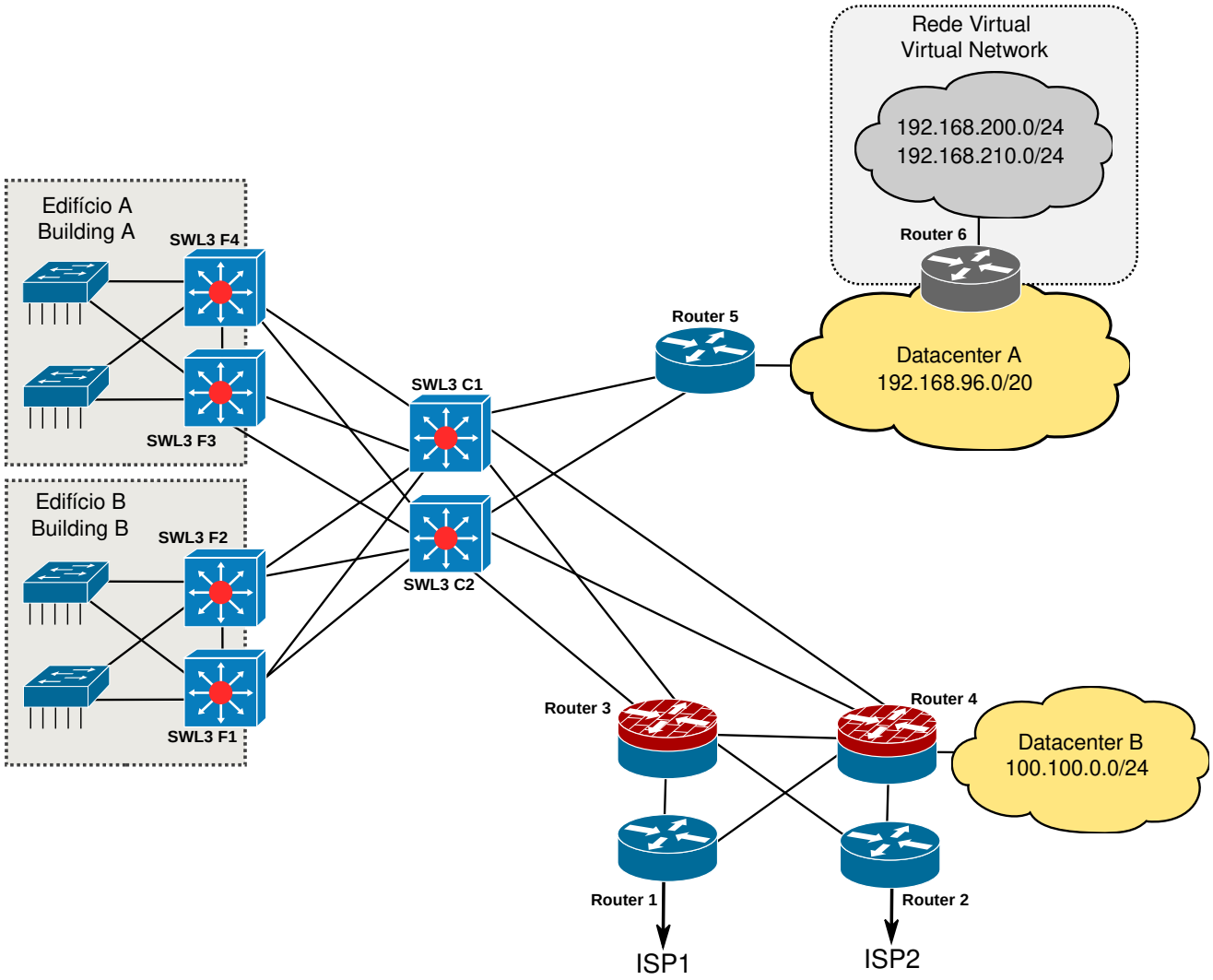
June 13th 2022

Duration: 2h30m. No consultation. Carefully justify all answers.

Considering the hierarchical network design model and the attached company network:

1. It is intended to create an end-to-end VLAN (VLAN 1) for remote management of all switches without relying on any IP routing process. Indicate how to proceed to create this end-to-end VLAN. (1.5 points)
2. Assuming VLAN 2 and 5 have different Spanning-Tree (SPT) processes active, identify for each of the SPT processes, which is the ideal Switch to be the root brodge/switch. Present the solution to ensure this result. (1.5 points)
3. In Router 3's IPv4 routing table, how many routes are there to Datacenter A's network (192.168.96.0/20) and what is their cost? (1.5 points)
4. Propose a possible change in the configurations of the OSPF protocols that guarantees that traffic to the Internet is preferentially forwarded to Router 1. (1.5 values)
5. Propose a possible change in the configurations of the OSPF protocols in order to guarantee that the traffic that arrives at Router 5 coming from Datacenter A or Virtual Networks, to an internal network of buildings A or B or external network, is preferably routed through SWL3 C1 (in detriment of SWL3 C2). (1.5 points)
6. Changing only the configuration of Router 5, propose a forwarding solution that guarantees bidirectional IPv4 connectivity to the IPv4 networks of the virtual network of Datacenter A (192.168.200.0/24 and 192.168.210.0/24). (1.5 points)
7. Propose a complementary IPv4 forwarding solution that ensures that UDP traffic from Datacenter B (100.100.0.0/24) to Amazon's AWS servers (the list of IP networks are known), is first forwarded to a company's Router/Server in Microsoft Cloud for traffic inspection, and only then forwarded to the destination. (2.0 points)
8. Based on the analysis, input and/or manipulation of MP-BGP advertisements and MP-BGP route attributes, explain how you can ensure the following routing requirements for this company/operator:
   a) AS2000 is a non-transit autonomous system for peer ISP1 (AS10001) and a transit autonomous system for peer ISP2 (AS10002). (1.5 points)
   b) AS2000 received advertisements via MP-BGP from a set of (specific) IP networks over several disjoint paths. It is intended that traffic forwarded by Router 1 and 2 to these networks is never sent by AS 10001 (ISP1). (1.5 points)
   c) AS2000 received MP-BGP advertisements from IP networks in Australia over several disjoint paths, some using satellite links and others just fiber-optic. The autonomous systems numbers (ASN) of operators using satellite data networks are known. It is intended that the traffic routed by Router 1 and 2, for all these networks in Australia, be preferably routed by operators that do not use satellite networks. (2.0 points)
9. Explain what changes you will have to make in the company's network configurations in order to create an MPLS tunnel for traffic between Datacenter A and Datacenter B (and vice versa), but whose traffic must pass through a path using Router 3. (2.0 points)
10. The company has installed a VoIP SIP system, however it can make calls to other companies (other SIP domains) but the other companies cannot make calls to the company. Explain the possible cause of the problem and how to fix the problem. (2.0 points)

- Access ports are configured on Layer 2 switches in Building A for VLANs 5,6,7. On Layer 2 switches in Building B, access ports are configured for VLANs 2,3,4;
- The interfaces between Layer 3 switches are Layer 2 ports (switching) and the interfaces between Layer 3 switches and routers are Layer 3 ports;
- Links between Layer2 switches and Layer3 switches F1 to F4 are made using trunk/inter-switch links with transport permission for all VLANs;
- Links between Layer3 switches F1 to F4 and Layer 3 switches C1 and C2 are made using trunk/inter-switch links with transport permission only for VLANs 101 and 102;
- There are two Datacenters (A and B). In Datacenter A, a virtual network with 2 IPv4 prefixes is implemented;
- Layer3 switches and routers 1 to 5 have OSPFv2 and OSPFv3 protocol processes (with identifier 1) active on all internal IP networks;
- All interfaces except the VLAN 101 and 102 interfaces are configured as passive in OSPF processes. VLAN 101 and 102 are the interconnection VLAN between the distribution and the core of the network, through which IP routes are dynamically exchanged and learned;
- Internet access routers (Routers 1 and 2) are advertising (by OSPF) default routes with a base metric of 100 (type E2);



- All interfaces have an OSPF cost of 1;
- Router 6 is a virtual machine and only supports the RIPv2 dynamic forwarding protocol, which is active for virtual networks and for Datacenter A's network.
- Routers 1 through 5 and Layer 3 switches do not have static routes configured.
- This company is an MP-BGP autonomous system (AS2000) and has MP-BGP peering agreements with ISP1 (AS10001) and ISP2 (AS10002).