Duration: 1h30min Template

Name:.....

- Write your name in the header of all the exam sheets you submit;
- Respond to Group I on these statement sheets;
- Write the answers to Groups II and III on the exam sheets provided, in the corresponding order of the statement;
- Read carefully the entire exam and try to answer clear and concisely.

Group I – (20%) Indicate for each of the statements if you consider it true or false; completely rewrite the false statements with the corrections necessary to be true; the correction of a false statement by simply denying it is not accepted.

☐ **1.** The *default gateway* of an IP network is a bridge that lets you route to the outside all traffic destined to the local network.

☐ **2.** The main advantage of the ARP protocol is to allow lower level protocols and applications to obtain, from the MAC address, the IP address of the network interface.

☐ **3.** An IPv6 address of a station has a length of 48 bits, grouped in octets and represented in decimal notation.

☐ **4.** The great advantage of the DNS service is to allow the decentralized administrative management of the settings (e.g. IP addresses, *default gateway*, domain name) of the stations of a network.

☐ **5.** OSPF is an external routing protocol and is characterized by having an algorithm based on the *distance vector* paradigm.

☐ **6.** The aggregation of the address block **`224.11.159.0 - 224.11.167.255`** results in the network **`224.11.159.0`** with the mask **`255.255.248.0`**.

☐ **7.** In Flow Analysis, a hierarchy and directionality characterize a *peer-to-peer* flow.

☐ **8.** MTBF is a parameter that has a percentage value and represents the time that a system/machine takes to recover from a failure.

☐ **9.** *In-band* monitoring of a network consists of monitoring based on probes placed on remotely located switches or routers.

☐ **10.** E-mail is an application that from the point of view of capacity requirements analysis can be classified as being of the real-time and interactive type .

Group II – (40%) Objectively and succinctly, answer the following questions, justifying all the answers:

1. Characterize the operation of a RMON probe, what features are available and any advantages or disadvantages in its use.

2. Present the functional areas of the OSI model of network management and describe the possible interrelationship between the procedures of the different areas.

3. Describe the main features of the SNMPv3 management protocol, referring to the evolution or changes of previous versions.

4. Answer the following Planning questions:

a) Why analyze the performance of a network solely through the prism of capacity is insufficient?

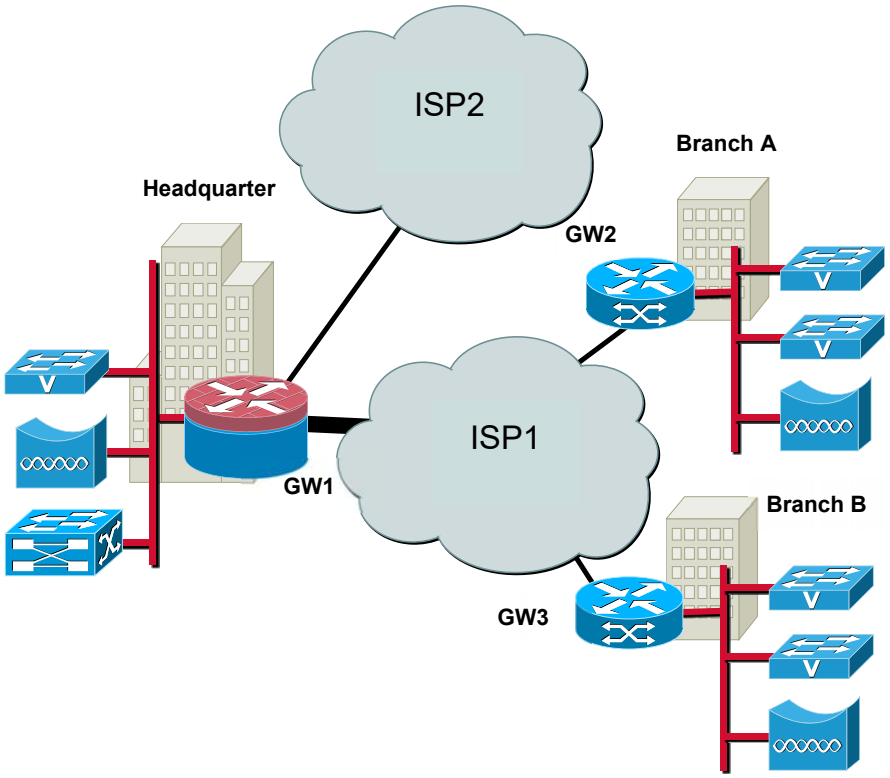
b) In the requirements analysis phase, how would you classify applications?

c) Taking into account the services currently available in an enterprise, discuss the distribution of flows of type 20/80 and 50/50?

d) Describe and comment on an Internet access service with 95.0% availability?

e) What does the MTBF mean? What is its relevance?

Group III – (40%) The company JAVIESTA Ltd has facilities, headquarters and branches, located in three different cities. The headquarters and branch offices communicate with each other in IP with direct Internet connections over Ethernet at 100 Mb/s and 20 Mb/s, respectively, over an VPN IP provided by ISP1. The VPN only allows the branches to access the Internet via the headquarters. Additionally, at the headquarter building has a second access to the Internet via another ISP, reserved for the *Disaster Recovery* service. The main characteristics of the network infrastructure of the company are listed below, taking into account the maximum number of stations used for each LAN:



- All services are supported in the TCP / IP protocol stack;
- All GW1, GW2 and GW3 routers dialogue with each other in OSPF;
- In each building of the branch offices are set out:

  - 8 Wi-Fi APs to provide access at any point in the building to 30 mobile stations;

  - 8 Ethernet switches with 24 RJ45 ports at 10/100 Mb/s, and support for *Power over Ethernet* (PoE);

- 5 VLANs (in addition to VLAN1 which is expected to be accessible) with 20 stations in VLAN10 for management and administrative services, 170 VoIP terminals in VLAN20, 10 local servers in VLAN30, 30 mobile stations in VLAN40 and 120 stations in VLAN41 for regular network users.

- At headquarters are planned:

  - 16 Wi-Fi APs to provide access at any point in the building to 120 mobile stations;

  - 12 Ethernet switches with 48 RJ45 ports at 10/100/1000 Mb/s, and support for PoE;

  - 5 VLANs (in addition to VLAN1 which is expected to be accessible) with 30 stations in VLAN10 for administrative and management services, 450 VoIP terminals in VLAN20, 60 stations in VLAN30 for all enterprise , 120 mobile stations in VLAN40 and 300 stations (included mobile) stations in VLAN41 for regular network users.

To solve the problem of addressing the company JAVIESTA Ltd, the entity responsible for assigning addresses delegation is due to public address blocks 200.16.120.0/21 and 200.16.128.0/22.

1. What is the minimum number of networks that used to resolve the address of the company? Explain why, pointing out the relative size of address blocks.
2. Assuming the assignment of addresses that you did in the previous answer, present the various addresses for the network, broadcast and their masks.
3. Considering the number of users indicated and assuming that each user has access to a workstation and a VoIP terminal, during working hours from 9:00 until 18:00, consider the following traffic patterns:

- E-mail – each user sends on average 20 Mbyte per day and receives 100 Mbyte. The E-mail servers are housed in the headquarters. Incoming traffic has the following pattern: about 80% comes from outside and the rest is internal to the company. Traffic sent have the following pattern: about 50% intended to address internal to the company, the remaining 50% to external recipients;
- Web access – Each user accesses on average to 20 Mbyte of enterprise content and 200 Mbyte external content;
- VoIP – On average each user consumes in total 6 MByte incoming and outgoing traffic, 40% is to outside;
- SAP Only 10% of users and 20% of the branches of the headquarters building using SAP; the average transaction data is 15 Kbyte. Each user makes an average of 20 transactions per day;

- Backup – a backup of the documents generated locally is transferred daily from 00:30 until 06:30, from the servers located in the headquarters building for the servers housed in the premises of a service provider, with the average total volume of 20 Gbyte.

a) Which is the flow model that characterizes each of these flows in the network?

b) Which are the important boundaries in the traffic flows of the corporate network?

c) Quantify to approximate values the flows of Email, web access, VoIP and SAP, between buildings.

d) Discuss the available bandwidth to access the Internet in the headquarters, taking into account the values obtained in the previous answer.

END