



SCHOOL OF COMPUTING AND ENGINEERING SCIENCES

Bachelor of Science in Computer Networks and Cyber Security

END OF SEMESTER EXAMINATION

CNS 2103–Data Network Design and Management I

Date: Tuesday, 1st August 2023

Time: 2 Hours (60 Marks)

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (Compulsory)** and any other **TWO** questions.
3. Do not write on the question paper.

Question 1 (30 Marks) – Compulsory

- a) *Figure Q1a* depicts a network topology of Tufunze Ltd. Examine it and use it to answer various questions that follow.

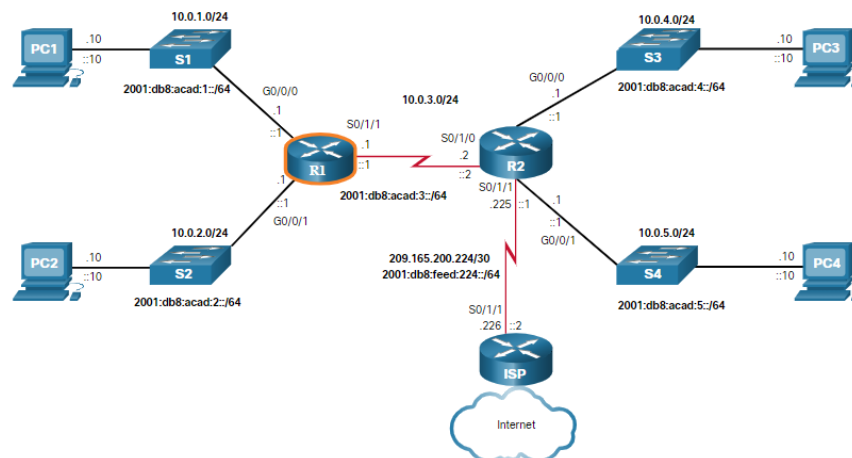


Figure Q1a: Tufunze Ltd

- i. From the topology, which are the *stub networks*? Support your answer? [2 marks]
- ii. Name two IPv4 networks routes that are remote to R1. [2 marks]
- iii. Name two IPv6 networks routes that are directly connected to R1. [2 marks]
- iv. R1 and R2 are using a common *dynamic routing protocol* to share network information using *network discovery*. Briefly discuss. [3 marks]

- b) Answer the questions below in reference to the topology in figure Q1a above.
- Write down the configurations for IPv4 and IPv6 static routes on R1 to reach network 10.0.4.0/24 and network 2001:db8:acad:4::/64 on R2. **[4 marks]**
 - Identify and describe the type of static route you have configured in i above. **[1 mark]**
 - Identify and describe any other TWO types of static routes that you could configure on the topology. **[2 marks]**
 - Explain three primary uses of static routing. **[3 marks]**
- c) The topology in Figure 1c below is using both RIP and OSPF. Study the topology and answer the questions that follow.

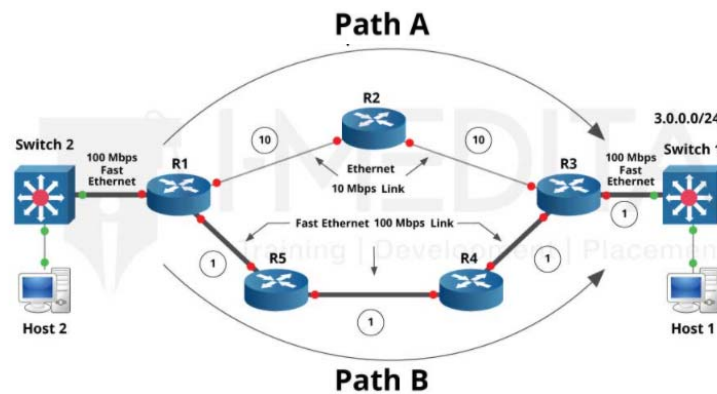


Figure Q1c: RIP and OSPF topology

- Calculate the Total Path Costs for A and B to reach Host 1. **[2 marks]**
- Calculate the Hop Counts Paths for A and B to reach Host 1. **[2 marks]**
- Which path between A and B will OSPF prefer? Why? **[2 marks]**
- Which path between A and B will RIP prefer? Why? **[2 marks]**
- If both RIP and OSPF are actively running in the topology at the same time, how will the routers determine the more *trustworthy* route and hence the more preferable routing protocol? **[3 marks]**

Question Two [15 marks] LAN Design

Just before the Data Network Design class, a debate ensued between Charlize and Lox on the role of *three-tier* switched LAN design architecture in a traditional data center. The lecturer finds them and asks each to explain their stand.

- Assuming you're supporting Charlize in her defense of the *three-tier* switched LAN design architecture, explain how this architecture was optimized and why. **[4 marks]**
- Use a clearly labelled sketch to describe the role of the discrete layers of the *three-tier* hierarchical switched LAN design. **[3.5 marks]**
- Assuming you're supporting Lox's perspective of a *two-tier* switched LAN design, explain this architecture highlighting key aspects and advantages. **[4 marks]**
- Use a clearly labelled sketch to describe the role of the layers of the *two-tier* hierarchical switched LAN design. **[3.5 marks]**

Question Three [15 marks] Wireless LAN

- a) After the Covid-19 pandemic diffused, the IT administrator of Tufunze Ltd (figure Q1a), added a wireless network to their topology. Explain two benefits that they will have from it. **[2 marks]**
- b) *Figure Q3b* below shows connection of nodes in a Wireless LAN (WLAN). Examine it and use it to answer the questions that follow.

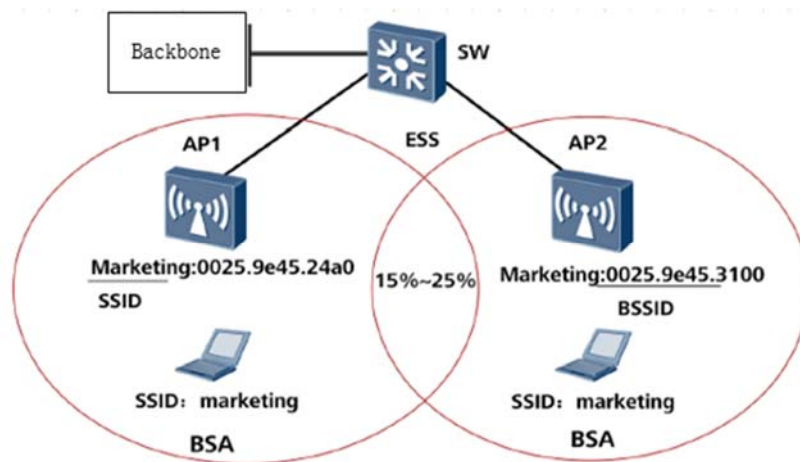


Figure Q3b: Wireless LAN (WLAN)

- i. Using the information in Figure Q3b above, describe the following WLAN concepts: BSS, ESS, BSSID, SSID **[4 marks]**
- ii. Explain any *two* of the several parameters that the laptops (clients) and the Access Points in Figure Q3b above must agree on for a successful connection to occur. **[2 marks]**
- c) Okwatch, in a Systems Analyst job interview, is asked to explain why *wireless Denial of Service (DoS) attacks* occur. Assuming you are Okwatch, write your answer. **[3 marks]**
- d) Mmbone, a novice IT administrator walks into your computer shop, Musumbi Machines, and wants to procure an *Access Point (AP)*. Explain to her the differences between *Autonomous Access Points* and *Controller-based APs*. Include sketches to make it easier to understand. **[4 marks]**

Question Four (15 Marks) Spanning Tree Protocol

Mutanu, a new network administrator at Atem Holdings, headquartered in Bujumbura is using the logical representation in Figure Q4 below to implement Spanning Tree Protocol (STP). Examine the topology and answer the questions that follow.

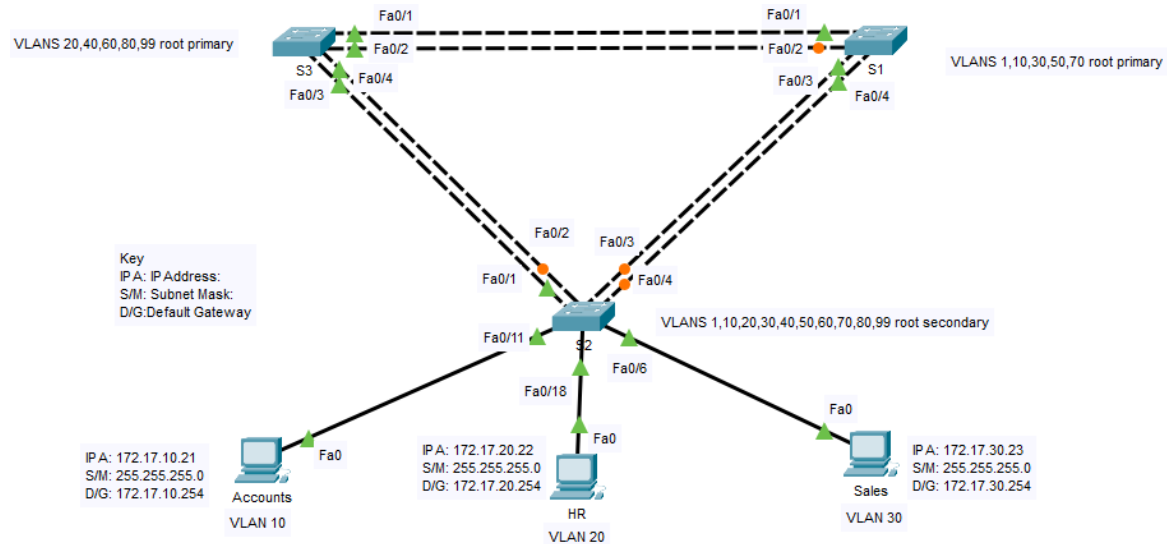


Figure Q4: Atem Holdings Topology A

- Which two-fold scenario is prevented by implementing STP? [2 marks]
- During the implementation, Mutanu reboots all switches. What will be the first step of the spanning-tree election process? [1 mark]
- After the election process in b) above, which switch is elected as the *root bridge* and which switch ports are *root ports*? [3 mark]
- Using the VLAN information given in the topology, briefly explain how Mutanu can configure and achieve Rapid Spanning Tree PVST+ *load balancing*. [2 marks]
- Which *two port states* are NOT actively used by Rapid PVST+? *Listening, Learning, Forwarding, Blocking, Discarding*. [1 mark]
- Mutanu also plans to *configure PortFast and BPDU Guard* on some switch ports.
 - Which ports should she configure with *PortFast and BPDU Guard* [2 marks]
 - What is the effect of configuring the switch ports in f(i) above with Portfast and to which *state* will the switch ports immediately transition to? [2 marks]
 - What is the effect of configuring the switch ports in f(i) above with *BPDU Guard*? [2 marks]

Question Five (15 Marks) Inter-VLAN routing, EtherChannel

Shukrani joins Mutanu as an assistant and is posted to a new branch of Atem Holdings in Kinshasa. They successfully link the departments in the Bujumbura HQ to their respective counterparts in the Kinshasa Branch by adding the PCs in the new office to the existing VLANs as shown in Figure 5. However, Atem the CEO requests them to allow communication across the various departments/VLANs too.

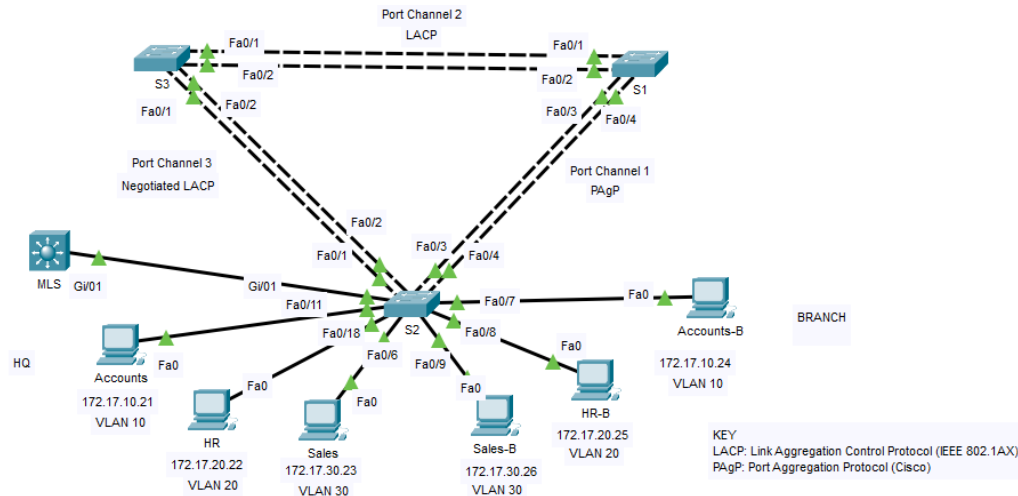


Figure Q5: Atem Holdings Topology B

- After doing some research, Shukrani discovers he has the three options he can use to implement inter-VLAN routing. He settles for the multilayer Switch (MLS). Identify and sketch the other two VLAN routing options. **[2 marks]**
- Mutanu asks Shukrani to defend his choice of using Layer 3 switches, whereas the other VLAN routing options were cheaper. Assuming you are Shukrani, defend yourself by briefly explaining three advantages of MLS InterVLAN routing over the other two. **[3 marks]**
- The next day, after a lengthy explanation on *EtherChannel*, Mutanu asks Shukrani, ‘So, how does *EtherChannel* work and how does it improve the network?’ Assuming you are Shukrani, show your understanding by briefly answering the question. Include a sketch to illustrate your answer. **[2 marks]**
- Shukrani further states five interface parameters that must match for an *EtherChannel* to form. Assuming you are Shukrani, state and support with brief explanations any *three* from the five. **[3 marks]**
- Mutanu further probes Shukrani on his knowledge on *LACP* (implemented between S1 and S3), and *Negotiated LACP* (implemented between S2 and S3). Assuming you are Shukrani, explain to Mutanu the difference of the two. **[2 marks]**
- Mutanu then points out to PAgP between S1 and S2 and asks Shukrani to write down the series of commands in their correct sequence to achieve PAgP from S1’s CLI. Assume you are Shukrani. (*Hint: Configure correct interface range, link-type, channel-group and mode*). **[3 marks]**