Strathmore UNIVERSITY

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: 27th July 2022 **Time:** 2 Hours **(60 Marks)**

Instructions

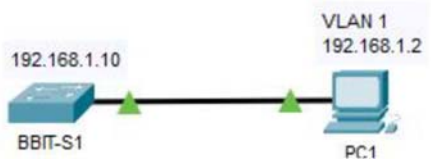
1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (A&B-COMPULSORY)** and any other **TWO** questions.
3. Do not write on the question paper.

Question 1 (30 Marks) - Sections A& B Compulsory

Section A (15 Marks) - Compulsory

i. Managed switches are designed to deliver the most comprehensive set of features. Which of the following are among such features? **[2 Marks]**
   a) neatest cabling
   b) highest levels of security
   c) most expensive wiring closets
   d) most precise control
   e) lowest configuration

ii. The figure below has telnet configured. Which series of commands will configure the VTY lines 0 15 to check the local username database for login credentials, only allow SSH for remote access and remove the existing vty line password at the global config mode S1(config)#? **[1 Mark]**



   a) line vty 0 15, login local, transport input ssh, no password 12345
   b) line vty 0 15, login local, transport input telnet, no password cisco
   c) line vty 0 15, login local, transport input telnet, no password class
   d) line vty 0 4, login local, transport input ssh, no password cisco
   e) line vty 1 15, login local, transport input ssh, no password class

iii. Michael, a network administrator is determining the best placement of VLAN trunk links. Which two types of point-to-point connections should he choose? **[2 Marks]**

a) Between two switches that utilize multiple VLANs
b) Between two switches that share a common VLAN
c) Between a switch and a server that has an 802.1Q NIC
d) Between a switch and a client PC
e) Between a switch and a network printer

iv. Match the correct type of VLAN with its attribute(s). *(A type can have more than 1 attribute)* **[3 Marks]**

	VLAN1	Data	Native	Management
Default VLAN	☐	☐	☐	☐
Untagged traffic on trunk link	☐	☐	☐	☐
Used SSH, Telnet VTY traffic	☐	☐	☐	☐
Dedicated to user-generated traffic	☐	☐	☐	☐
Used for trunk links only	☐	☐	☐	☐
Cannot be deleted or renamed	☐	☐	☐	☐

v. A PC is to access a web server on another network. Which inter-VLAN method will provide the highest bandwidth at Layer 3 and also provide a default gateway for the PC? **[1 Mark]**

a) multilayer switch with routing enabled
b) trunked interface between the router and the switch
c) multiple physical interfaces on the router, all connected to a Layer 2 switch
d) router on a stick

vi. Match the correct combination of LACP modes on S1 and S2 and the resulting channel establishment outcome. **[2 Marks]**

	Yes	No	Maybe	None
S1-On, S2-On	☐	☐	☐	☐
S1-On, S2-Active/Passive	☐	☐	☐	☐
S1-Active, S2- Passive	☐	☐	☐	☐
S1-Active, S2- Active	☐	☐	☐	☐

vii. Tony's laptop cannot connect to a wireless access point. Which two troubleshooting steps should be taken first? **[2 Marks]**
   a) Confirm that the wireless NIC is enabled.
   b) Confirm that the laptop antenna is attached.
   c) Confirm that the wireless SSID is selected.
   d) Confirm that the correct network media is selected.
   e) Confirm that the NIC is configured for the right frequency.

viii. Which two port states are NOT used by Rapid PVST+? **[2 Marks]**
   a) Listening
   b) Discarding
   c) Forwarding
   d) Blocking
   e) Learning

Section B (15 Marks) - Compulsory

a) Your consulting firm, Azimio Technologies has been contracted by Umoja University to design a network for two computer labs and two offices as follows.

Instructions

- The *number of hosts* for the labs and offices are 61, 27, 13 and 5
- Use the *network address 192.168.0.1*/24.

Use *Variable Length Subnet Masking (VLSM)* to write an *addressing table*. **[8 Marks]** *(Include all the components shown in **Table Q1-Ba** below).*

Table Q1-Ba: Addressing table template

Dept.	Subnet	First Host IP address	Last Host IP address	Broadcast Address	Custom Subnet Mask

b) Sketch a *logical topology* of the network.
   i. Use *one router* for the *whole network, and f*or *each subnet*, use *one switch* and *one PC (to represent the hosts).* **[1 mark]**
   ii. For *each subnet*, show the *default gateway*, *subnet IP address*, range of *host IP addresses* and *the broadcast address*. **[3 marks]**

c) Create a 48-bit MAC address and translate it into a 64-bit IPv6 interface ID. [**3 marks]**

Question Two (15 Marks) Spanning Tree Protocol

Kate, a new network administrator at Shembeteng Holdings, headquartered in Bujumbura is using the logical representation in **Figure Q2a** below to implement *Spanning Tree Protocol (STP)*. Examine the topology and answer the questions that follow.

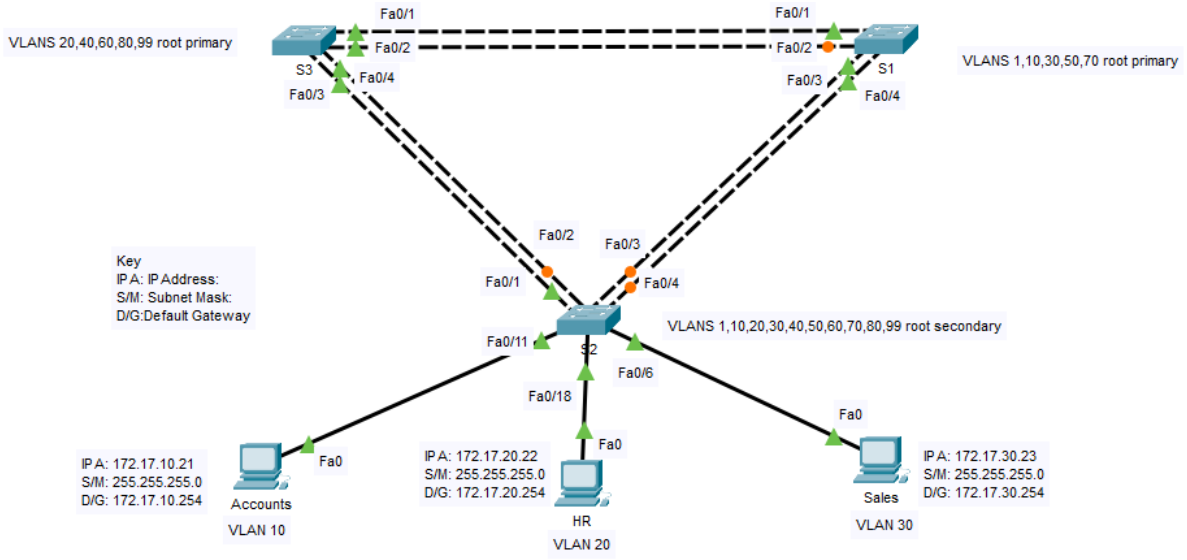


Figure Q2a: Shembeteng Holdings topology 1

a) Describe the role of the STP in the topology. **[1 mark]**

b) Without VLANs and STP, the network above may experience a broadcast storm. What is a broadcast storm? **[1 mark]**

c) During the implementation, Kate reboots all switches. What will be the first step of the spanning-tree election process? **[1 mark]**

d) After the election process in c) above, which switch is elected as the *root bridge and which switch ports* are *root ports?* **[3 mark]**

e) Using the VLAN information given in the topology, briefly explain how Kate can configure and achieve Rapid Spanning Tree PVST+ *load balancing*. **[2 marks]**

f) Which *two port states* from the following five are NOT actively used by Rapid PVST+? *Listening, Learning, Forwarding, Blocking, Discarding.* **[1 mark]**

g) Kate also plans to *configure PortFast and BPDU Guard* on some switch ports.

   i. Which ports should she configure with *PortFast and BPDU Guard* **[2 marks]**

   ii. What is the effect of configuring the switch ports in g(i) above with *Portfast* and to which *state* will the switch ports immediately transition to? **[2 marks]**

   iii. What is the effect of configuring the switch ports in g(i) above with *BPDU Guard?* **[2 marks]**

Question Three (15 Marks) Inter-VLAN routing**,** EtherChannel

Lekalja joins Kate as an assistant and is posted to a new branch of Shembeteng Holdings in Kisumu. They successfully link the departments in the Bujumbura HQ to their respective counterparts in the Kisumu Branch by adding the PCs in the new office to the existing VLANs as shown in **Figure Q3.** However, the CEO requests them to allow communication across the various departments too.

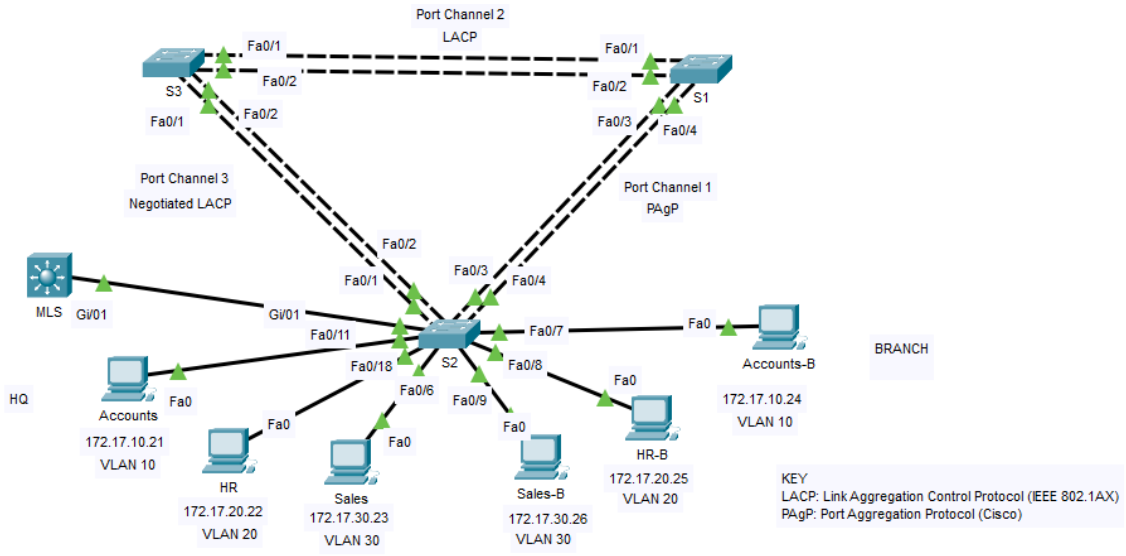


Figure Q3: Shembeteng Holdings topology 2

a) After doing some research, Lekalja discovers she 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]**

b) Kate asks Lekalja to defend his choice of using Layer 3 switches, whereas the other VLAN routing options were cheaper. Assuming you are Lekalja, defend yourself by briefly explaining three advantages of MLS InterVLAN routing over the other two. **[3 marks]**

c) The next day, after a lengthy explanation on *EtherChannel*, Kate ask Lekalja, 'So, how does *EtherChannel* work and how does it improve the network?' Assuming you are Lekalja, show your understanding by briefly answering the question. Include a sketch to illustrate your answer. **[2 marks]**

d) Lekalja further states five interface parameters that must match for an *EtherChannel* to form. Assuming you are Lekalja, state and support with brief explanations any *three* from the five. **[3 marks]**

e) Kate further probes Lekalja on his knowledge on *LACP* (implemented between S1 and S3), and *Negotiated LACP* (implemented between S2 and S3). Assuming you are Lekalja, explain to Kate the difference of the two. **[2 marks]**

f) Kate then points out to PAgP between S1 and S2 and asks Lekalja to write down the series of commands in their correct sequence to achieve PAgP from S1's CLI. Assume you are Lekalja. *(**Hint:** Configure correct interface range, link-type, channel-group and mode).* **[3 marks]**

Question Four [15 marks] LAN Design

Just before the Data Network Design class, a debate between Powell and Cynthia on the role *three-tier* switched LAN design *architecture* in a traditional data center. The lecturer finds them and asks each to explain their stand. Powell in his defense of the *three-tier* switched LAN design *architecture,* cites how they were enhanced for *resiliency* and concerned with *speed* into and out of the data centers. Cynthia in her defense, states that many companies are shifting to the *two-tier architecture* for their data centers, to meet the needs of modern applications.

a) Assuming you are Powell, use a clearly labelled sketch to describe the role of the discrete layers of the *three-tier* hierarchical switched LAN design. **[6 marks]**

b) Support Cynthia's statement in your own words, highlighting key aspects and advantages of the *two-tier architecture*. Include a sketch to illustrate your answer. **[5 marks]**

c) The lecturer shows the class **Figure Q4c**, a the *three-tier* hierarchical switched LAN design and asks them to collapse it into a *two-tier* hierarchical design. Assuming you are in the class, sketch the new design. *(**Hint:** Replace some core switches with layer 2 switches).* **[4 marks]**

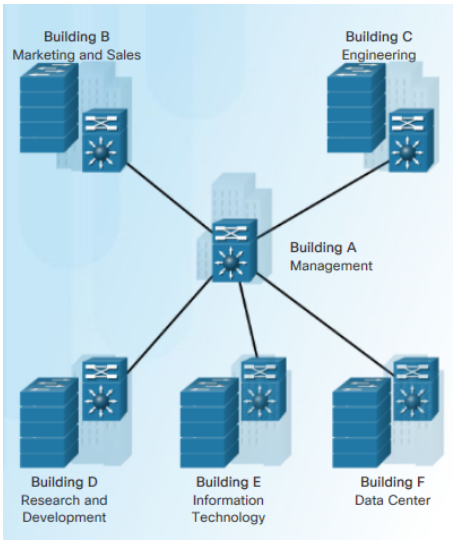


Figure Q4c: *three-tier* hierarchical switched LAN design

Question Five [15 marks] Wireless LAN

a) Explain two benefits that Strathmore University gains from having a wireless network. **[2 marks]**

b) Figure **Q5b** below shows connection of nodes in a Wireless LAN (WLAN). Examine it and use it to answer the questions that follow.

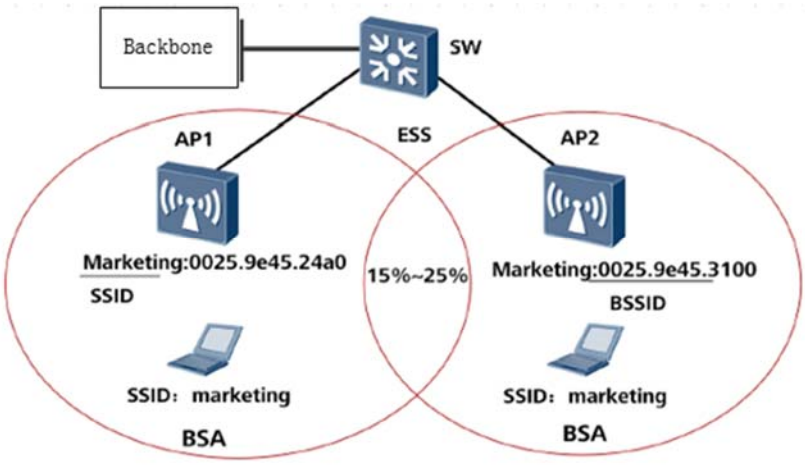


Figure Q5b: Wireless LAN (WLAN)

i. Using the information in **Figure Q5b** 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 Q5b** 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 Sevice (DoS) attacks* occur. Assuming you are Okwatch, write your answer. **[3 marks]**

d) Ismail, a novice IT administrator walks into your computer shop, Mwangombe Machines, and wants to procure an *Access Point (AP).* Explain to him the differences between *Autonomous Access Points* and *Controller-based APs.* Include sketches to make it easier to understand. **[4 marks]**