



Strathmore
UNIVERSITY

SCHOOL OF COMPUTING AND ENGINEERING SCIENCES (SCES)
BACHELOR OF SCIENCE IN COMPUTER NETWORKS AND CYBER SECURITY
END OF SEMESTER EXAMINATION
CNS 4107 – SPECIAL TOPICS IN COMPUTER NETWORKS

Date: Thursday, 27th July 2023

Time: 2 Hours (60 marks)

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question 1 (Sections A & B)-COMPULSORY** and any other **TWO** questions.

Question 1

Section A -Compulsory [15 marks]

- a) Explain how *EtherChannel* improves on a network's performance by overcoming the limitation posed by the Spanning Tree Protocol (STP). Include an illustration. [4 marks]
- b) Examine the topology in *figure Q1b* below and answer the questions that follow.

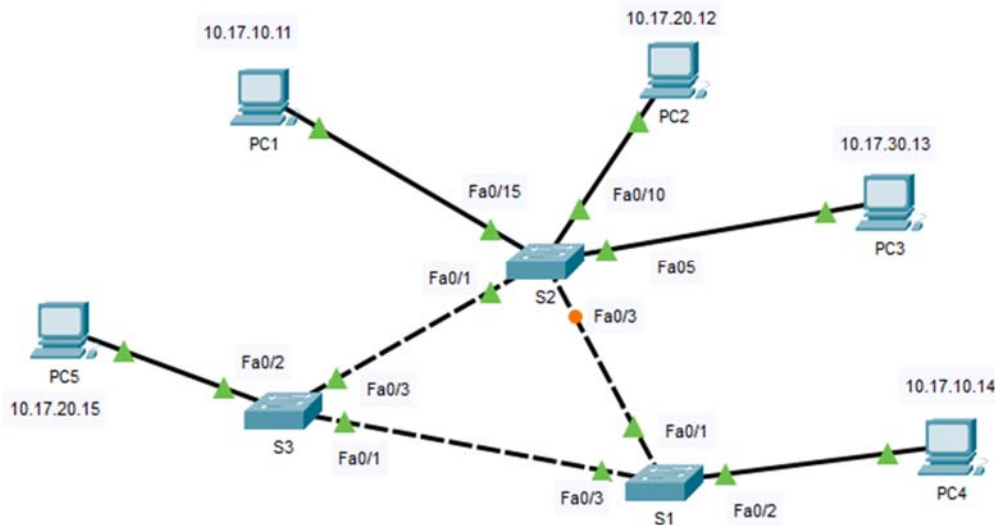


Figure Q1b

- i. The BIDs of the switches above are as follows, S1=32769.A111-F4EF-B3DE, S2=28673.D252-DE54-FE1E, S3=24577.F3A3-CA45-4E9A. After the election process, which switch will be elected as the *root bridge* and why? [2 marks]

- ii. Which *switch ports* on the other two switches are *root ports* and why? [3 marks]
- iii. Which ports on the three switches should the administrator configure with *PortFast* and *BPDU Guard* [3 marks]
- iv. What is the importance and effect of configuring the switch ports in Qb(iii) above with *PortFast* and to which *state* will the switch ports immediately transition to? [2 marks]
- v. What is the importance and effect of configuring the switch ports in Qb(iii) above with *BPDU Guard*? [2 marks]

Section B -Compulsory [15 marks]

- a) A 10000 bits frame is being through a 1000 metre link, operating at a data rate of 1Gbps and a propagation speed of 2×10^8 m/s.
 - i. What is the *transmission time* for the frame? [2 Marks]
 - ii. What is the *propagation delay* for the frame? [2 Marks]
 - iii. Assuming no acknowledgements are sent back, what is the time taken by the frame to reach the receiving end? [2 Marks]
 - iv. If an acknowledgement is sent back, what is the *round trip time* taken by the process? [2 Marks]
- b) Describe how either *Selective reject ARQ* or *Go-back-N OR* operate in the sliding window protocols. Include a diagram to illustrate whichever process you choose. [3 Marks]

Question 2 [15 marks] -Spanning Tree Protocol (STP)

- a) Figure Q2a shows a basic topology with four switches. STP has been implemented and S1 is the root bridge. S2 has two ports, F0/1 and F0/2 with equal cost paths to the root bridge. The Bridge IDs of all the switches are displayed. Study the diagram and answer the questions that follow.

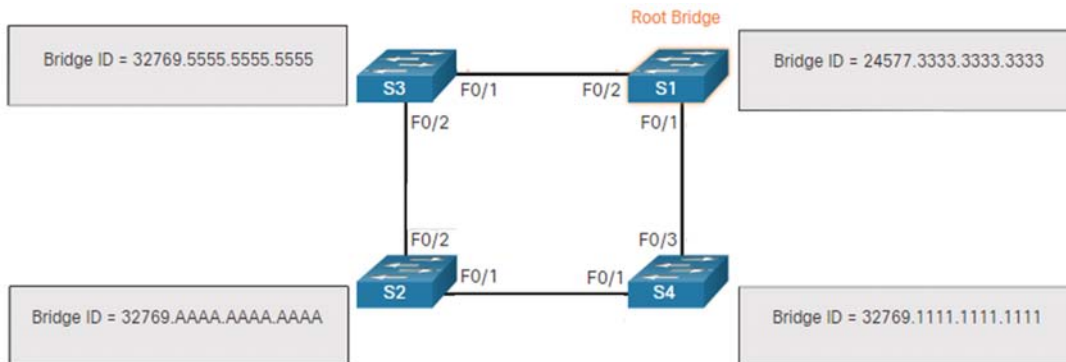


Figure Q2a

- i. Given that both paths to S1 from S2 have equal cost path, how can S3 and S4 be used to determine the better route? [2 marks]
- ii. Name all the root ports in the topology. [1.5 marks]
- iii. Name all the designated ports in the topology. [2 marks]
- iv. Name all the alternate ports in the topology. [0.5 marks]

- b) Figure Q2b shows a topology with two switches that are directly connected by two with equal cost paths. STP has been implemented and S1 is the root bridge. S4 has two ports with equal-cost paths to the root bridge, with both ports on S1 having a default port priority of 128. Study the diagram and answer the questions that follow.

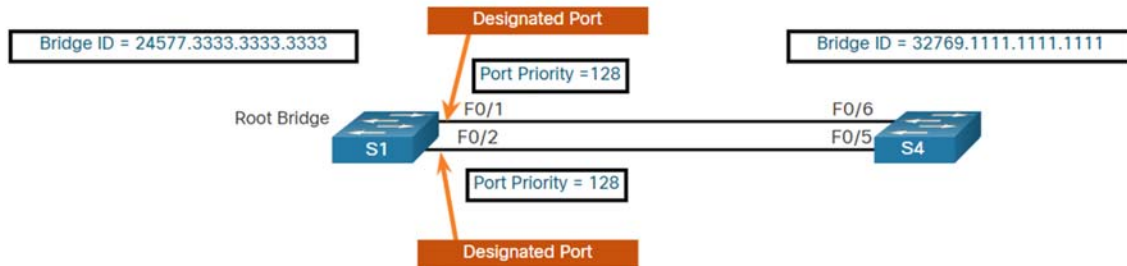


Figure Q2b

- Which is the *root port* between F0/5 (S4) and F0/6 (S4). Why? [2 marks]
- Which port is currently in *blocking state*? [1 mark]
- What change will occur, if any, if the *port priority* of F0/1 (S1) is lowered to 120 while F0/2 (S1) remains at 128? Explain. [2 marks]
- What change will occur, if any, if the *port priority* of F0/2 (S1) is lowered to 120 while F0/1 (S1) remains at 128. Explain [2 marks]
- What change will occur, if any, to F0/5 (S4) and F0/6 (S4) if the cables in ports F0/1(S1) and F0/2(S1) are interchanged? (NB: ALL ports are *default priority* = 128) [2 marks]

Question 3 [15 marks] EtherChannel

- a) Figure Q3a-x shows output from the *show etherchannel summary* command indicating that the EtherChannel is down (D). The error is corrected and the new output is as indicated in figure Q3a-y.

Group	Port-channel	Protocol	Ports
1	Po1(SD)	-	Fa0/1(D) Fa0/2(D)

Figure Q3a-x

```
S1(config)# no interface port-channel 1
S1(config)# interface range fa0/1 - 2
S1(config-if-range)# channel-group 1 mode desirable
Creating a port-channel interface Port-channel 1
S1(config-if-range)# no shutdown
S1(config-if-range)# exit
S1(config-if)# switchport mode trunk
S1(config-if)# end
```

Figure Q3a-y

- What is a possible cause of the EtherChannel being down (D)? [1 mark]
 - Explain the solution depicted in figure Q3a-y and highlight the importance of the *no interface port-channel 1* command [2 marks]
- b) Referring to *Figure Q1b*, Joyce, an IT Administrator asks Jotham, to states five interface parameters that must match for an *EtherChannel* to form between S1 and S2. State them and support your answer with brief explanations. [5 marks]

- c) Joyce implements *LACP* between S1 and S2, and *Negotiated LACP* between S2 and S3. Assuming you are Joyce, explain to Jotham the difference between the two implementations. **[3 marks]**
- d) Joyce then requests Jotham to implement *PAgP* between S1 and S2 and asks Jotham to write down the series of commands in their correct sequence to achieve *PAgP* from S1's CLI. Assume you are Jotham. (*Hint: Configure correct interface range, link-type, channel-group and mode*). **[4 marks]**

Question 4 [15 marks] - Multiarea OSPF

- a) Evans, a new intern, is implementing *Multiarea OSPF* and comes across the *Backbone Area*. Briefly explain to him what the *Backbone Area* in OSPF configuration is. **[1 mark]**
- b) He inquires the importance of *Multiarea OSPF*. Describe to him any *three benefits* derived from using *Multiarea OSPF* in a large multi-location company. **[3 marks]**
- c) Write down for him the steps required to change *Neighborship* into *Adjacency*. **[2 marks]**
- d) Nancy, a network expert, joins in and explains that routers participating in OSPF routing protocol maintain three OSPF tables. Name them and briefly describe them. **[3 marks]**
- e) She further describes to Evans figure Q4e below. To test his understanding, she asks him to study the figure and answer the questions that follow. Assume you are Evans.

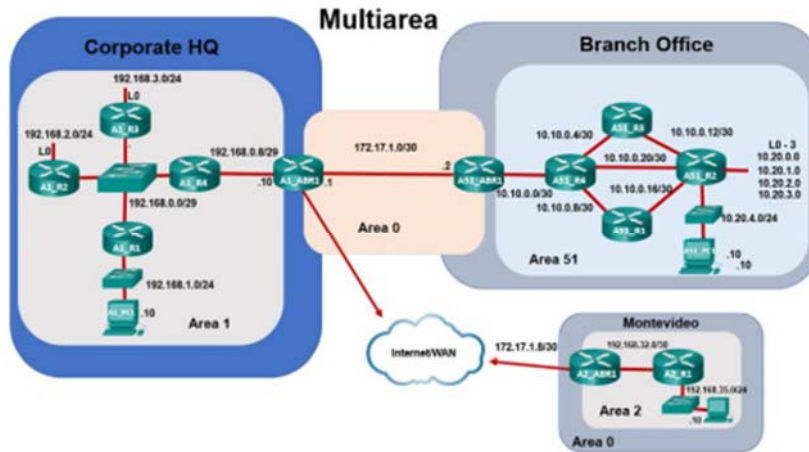


Figure Q4e

- i. Write down the syntax to enable OSPF on router *A2_ABR1* and set the router ID to 172.17.1.10. **[2 marks]**
- ii. Write down the syntax to configure the 192.168.32.0/32 network to be in *Area 2* and the 172.17.1.8/32 network to be in *Area 0*. **[2 marks]**
- iii. Configure summarization on *router A2_ABR1* so that it will advertise the summary network 192.168.32.0/19 into *Area 0*. **[2 marks]**

Question 5 [15 marks] -CRC Checksum

- a) A bit string $N=1101111$ is to be sent over a network using the generator polynomial (G) as 1010.

- i. Calculate the CRC checksum for N. Show your working. **[3 marks]**
 - ii. Now assume the bit string gets corrupted in transit to 1001110. Show by explanation and calculation, how the receiver can detect that there is a problem. Show your working. **[3 marks]**
 - iii. Assuming no error, show by explanation and calculation how you can prove that this is true. Show your working. **[3 marks]**
- b) The data (23, 12, 15, 18, 21) is to be sent via a network. This data is to be divided into units of m bits each. Using either $m=5$ or $m=6$, answer the below. Show your working.
- i. What is the checksum in binary? **[2 marks]**
 - ii. What data will be sent via the network? **[1 mark]**
 - iii. Assuming no error occurs, validate and explain the received data. **[3 marks]**