Strathmore
UNIVERSITY

SCHOOL OF COMPUTING AND ENGINEERING SCIENCES (SCES)
BACHELOR OF SCIENCE IN INFORMATICS AND COMPUTER SCIENCE
CONTINOUS ASSESSMENTT TEST II
ICS 2203 – Advanced Networking
MARKING GUIDE

Date: Tuesday 15th December, 2020 **Time:** 1.5 Hours **(30 Marks)**

Instructions

1. This assessment test consists of **FIVE** questions.
2. Answer **Question 1 (COMPULSORY)** and any other **TWO** questions.

Question 1 [20 marks]

a) Study Figure Q1a below and answer the questions that follow to show your understanding of how a switch learns and forwards frames.

Frame

Preamble	Destination MAC	Source MAC	Type / Length	Frame	End of Frame
	0B	0F			

MAC Table

Fa1	Fa2	Fa3	Fa4	Fa5	Fa6	Fa7	Fa8	Fa9		Fa10	Fa11	Fa12
0A				0C		0D		0E	0F			

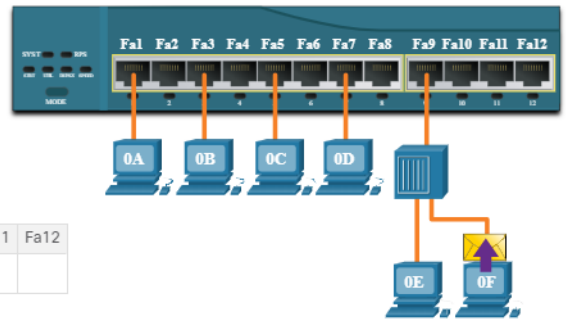


Figure Q1a

i. Which type of frame is being sent from the host with MAC address 0F? Why? **[2 marks]**
A unicast frame. The frame has a known destination MAC address.

ii. To which port(s) will the switch forward the frame? Why? **[3 marks]**
It will be flooded to all ports Fa1, Fa3, Fa5 and Fa7. Because it passing through a hub before reaching the switch. A hub is a layer1 device and does not decide where the message goes. It just repeats the message to all the ports .

iii. What would happen if you connected Fa10 to another switch - Switch2 and repeated ii above? **[1 mark]**
It will be flooded to all the ports mentioned in ii above plus Fa10 and all connected switchports of switch2.

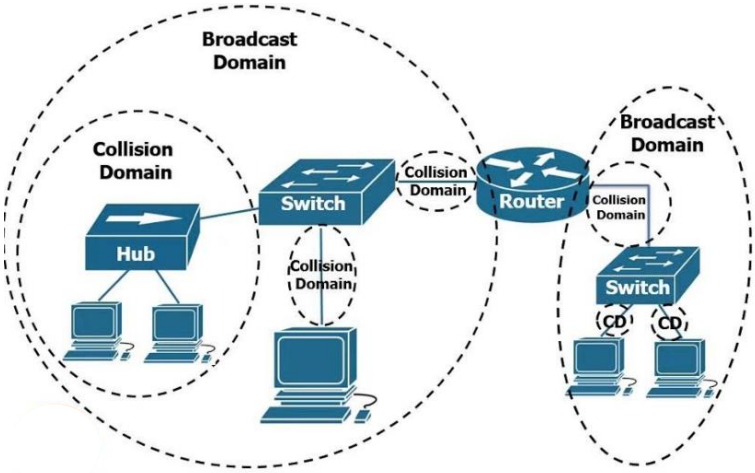
b) State and explain any four features of Open Shortest Path First(OSPF) link-state routing protocol. **[4 marks]**

1) Uses five message types/packet (Hello, Database Descpiron, Link-state request, link-state update, link state ackwoledgement)
2) *Hierarchical Routing:* It divides the network into different areas that can be used to control flooding of routing information
3) It uses cost as the metric. Cost is computed from a reference bandwidth
4) High resource requirements:– CPU Intensive due to Dijkstra Algorithm, – Higher bandwidth requirements before convergence is reached
5) Supports VLSM since updates are sent with subnet masks.
6) Supports CIDR and supernet routes
7) It is a complex protocol thus designing a network can be complicated
8) Fast to converge – Maintains backup pathways,– Uses triggered updates when the topology changes
9) Authentication: OSPF authenticates the source of routing messages
10) Enables load balancing: allows traffic to be split evenly across routes with equal cost
11) Sends partial, bounded updates
12) Relies on triggered updates when the topology changes

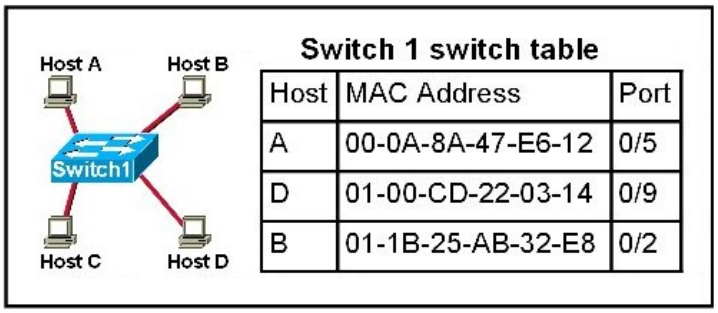
c) Differentiate, by defining and briefly explaining, *broadcast domains* and *collision domains.* Include a sketch to illustrate your answer. **[6 marks]**

A broadcast domain is a logical division of a computer network, in which all nodes can reach each other by broadcast at the data link layer. When a switch receives a broadcast frame, it forwards the frame out each of its ports, except the ingress port where the broadcast frame was received.

A collision domain in a network segment that share the same bandwidth between devices. When two or more devices within that the same collision domain try to communicate at the same time, a collision will occur.



d) Discuss with the aid of a simple topology, how a switch constructs its table. **[4 Marks]**



Switch 1 switch table

Host	MAC Address	Port
A	00-0A-8A-47-E6-12	0/5
D	01-00-CD-22-03-14	0/9
B	01-1B-25-AB-32-E8	0/2

Layer 2 switches have a MAC address table that contains a MAC address and port number. Switches follow this simple algorithm for forwarding packets:
When a frame is received, the switch compares the SOURCE MAC address to the MAC address table. If the SOURCE is unknown, the switch adds it to the table along with the port number the packet was received on. In this way, the switch learns the MAC address and port of every transmitting device.

The switch then compares the DESTINATION MAC address with the table. If there is an entry, the switch forwards the frame out the associated port. If there is no entry, the switch sends the packet out all its ports, except the port that the frame was received on (Flooding).

Question 2 [10 marks]

a) Cindy has the three options in figure Q2a below to implement inter-VLAN routing. Identify them, giving a pro and a con of each method. **[3 marks]**

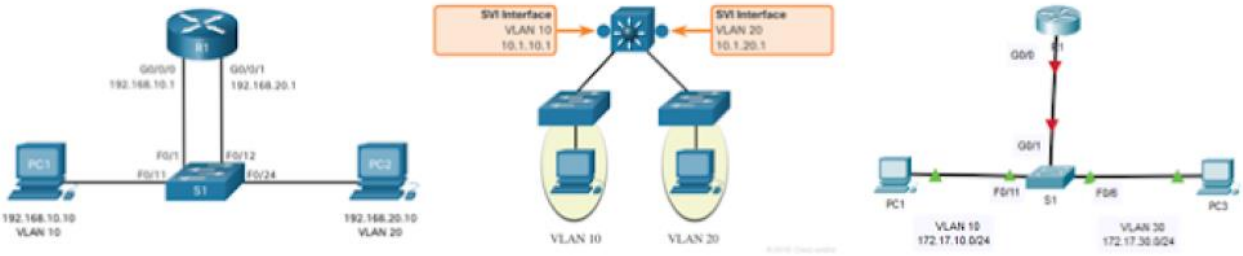


Figure Q4a

- **Legacy Inter-VLAN routing** - This is a legacy solution. Legacy inter-VLAN routing using physical interfaces works, but it has a significant limitation. It is not reasonably scalable because routers have a limited number of physical interfaces. Requiring one physical router interface per VLAN quickly exhausts the physical interface capacity of a router.
- **Router-on-a-Stick** - This is an acceptable solution for a small to medium-sized network. overcomes the limitation of the legacy inter-VLAN routing method. It only requires one physical Ethernet interface to route traffic between multiple VLANs on a network. configured subinterfaces are software-based virtual interfaces. Each is associated with a single physical Ethernet interface. Subinterfaces are configured in software on a router.

- **Layer 3 switch using switched virtual interfaces (SVIs)** - This is the most scalable solution for medium to large organizations. They are much faster than router-on-a-stick because everything is hardware switched and routed. There is no need for external links from the switch to the router for routing. They are not limited to one link because Layer 2 EtherChannels can be used as trunk links between the switches to increase bandwidth.

  Latency is much lower because data does not need to leave the switch in order to be routed to a different network. They more commonly deployed in a campus LAN than routers.

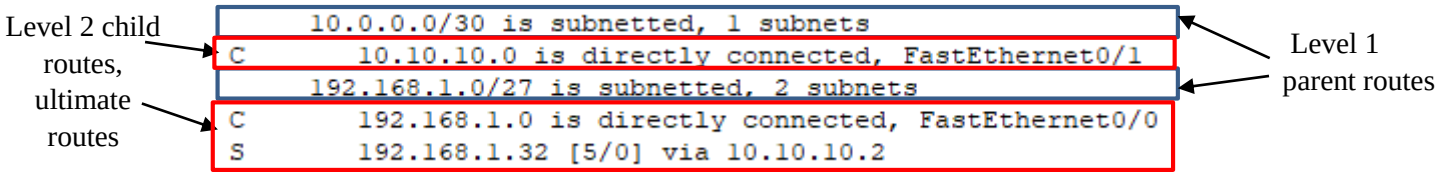
b) Figure Q2a below shows routing table entries. From the figure, identify

i. All level 1 parent routes **[1 mark]**
ii. All level 2 child routes **[1 mark]**
iii. All ultimate routes **[1 mark]**

```
     10.0.0.0/30 is subnetted, 1 subnets
C       10.10.10.0 is directly connected, FastEthernet0/1
     192.168.1.0/27 is subnetted, 2 subnets
C       192.168.1.0 is directly connected, FastEthernet0/0
S       192.168.1.32 [5/0] via 10.10.10.2
```

Figure Q2a

Answer



e) An IPv4 packet has the destination IPv4 address 10.10.100.10. The router has three route entries in its IPv4 routing table that match this packet: 10.10.100.0/12, 10.10.100.0/18, and 10.10.100.0/26.

i. Of the three routes, which one will be chosen to forward the packet? Why? **[1 mark]**
10.10.100.0/26 because it has the longest match.

ii. Show how you arrived at your answer in i above by comparing matching in binary the best match for 10.10.100.10 from the three route entries. **[3 marks]**

Destination IPv4 Address	**Address in Binary**
10.10.100.10	**10101100.00010000.00000000.00**001010

Route Entry	**Prefix/Prefix Length**	**Address in Binary**
1	10.10.100.0/**13**	**10101100.00010**000.00000000.00001010
2	10.10.100.0/**17**	**10101100.00010000.0**0000000.00001010
3	10.10.100.0/**28**	**10101100.00010000.00000000.0000**1010

Question 3 [10 marks]

a) Figure Q3a depicts a network topology of a small company. Examine it and use it to answer various questions that follow.

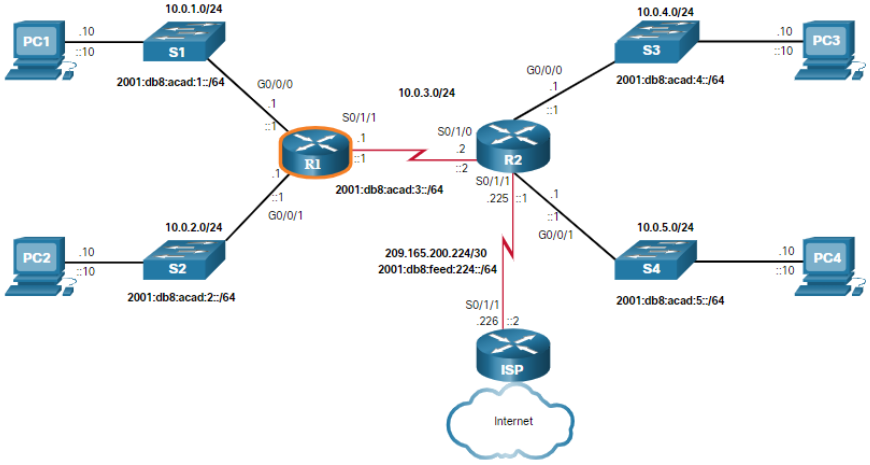


Figure Q3a

i. Which IPv4 networks routes are directly connected to R2? **[2 marks]**
10.0.3.0/24, 10.0.4.0/24, 10.0.5.0/24, 209.165.200.224/30,

ii. Which IPv6 networks are remote to R2? **[1 mark]**
2001:db8:acad:1::/64, 2001:db8:acad:2::/64

iii. From the topology, which is the stub router and why? **[2 marks]**
R1 is the stub router as it has the stub networks 10.0.1.0/24 and 10.0.2.0/24. Any network attached to R1 would only have one way to reach other destinations

b) Answer the questions below in reference to the topology in figure Qa above.

i. Write down the commands to configure IPv4 and IPv6 static routes on R2 reach the 10.0.1.0/24 and 2001:db8:acad:2::/64 networks on R1. **[2 marks]**
R1 (config)# ip route 10.0.1.0 255.255.255.0 10.0.3.1
R1 (config)# ipv6 route 2001.db8.acad.2::/64 2001.db8.acad.3::1

ii. Which static route have you just configured in (i) above? Defend your answer. **[1 mark]**
Standard static route. Consists of the destination network address and network mask, and the IP address of the next-hop gateway or exit interface.

iii. Identify and describe any other TWO types of static routes that you could configure on the topology. **[2 marks]**
Default static route: It is a route that matches all packets. It has all zeros in the network address and all zeros in the subnet mask
Summary static route: It identifies an aggregation of multiple networks (or gateways) which can be represented by a single summary address
**Floating static route: A route used to provide a backup path to a primary static or dynamic route, in the event of a link failure. (Back with explanation)*

Question 4 [10 marks]

In the topology in Figure Q4 below, the route via router DRC has been configured as the *primary route* that connects Rwanda and Niger networks. The Rwanda network is 192.168.1/027 and the Niger Network is 192.168.2/027. Study the topology and answer the questions that follow.

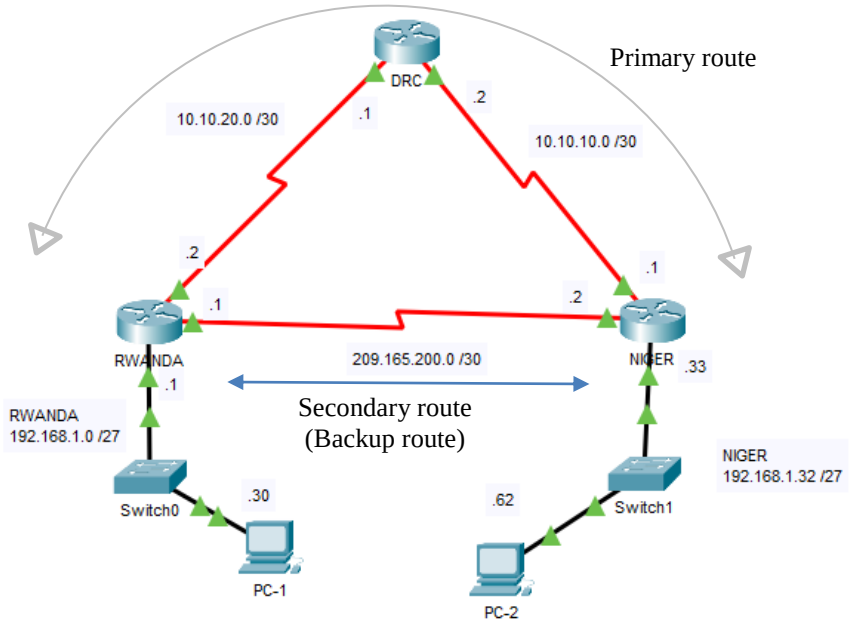


Figure Q4

a) In addition to the primary route described above, a secondary route has also been provided via 209.165.200.0/30. What is the function of this secondary link? **[1 mark]**
To provide a backup path to the primary static/ dynamic route, in the event of a link failure. F*loating static route to be only used when the primary route is not available*.

b) By default, the primary route will have an administrative distance (AD) of 1 and any other secondary/backup routes higher numbers than 1. Why is this important? **[1 mark]**
In case there's a secondary route, the primary toute has to be the default route thus having a lower AD.

c) On router Rwanda, write down the appropriate commands to configure a floating static route (backup route) on the secondary link via 209.165.200.0/30 for both the local network (Rwanda) and the remote network (Niger) Use an AD of 5. **[2 marks]**

RWANDA(config)# ip route 192.168.1.0 255.255.255. 224 209.165.200.2 5 (local n/w)
NIGER(config)# ip route 192.168.1.32 255.255.255.224 209.165.200.2 5 (remote n/w)

d) On router Niger, write down the appropriate commands to configure a floating static route (backup route) on the secondary link via 209.165.200.0/30 for both the local network (Niger) and the remote network (Rwanda) Use an AD of 5. **[2 marks]**

NIGER(config)# ip route 192.168.1.32 255.255.255.224 209.165.200.1 5 (local n/w)
RWANDA(config)# ip route 192.168.1.0 255.255.255. 224 209.165.200.1 5 (remote n)

e) What will happen when router DRC goes down? Explain in detail using IP network routes or the routers. **[1 mark]**

The secondary link via 209.165.200.0 will become the default route.

f) What will happen when the router DRC comes back up? Explain in detail using IP network routes or the routers. **[1 mark]**

The settings will revert to as before as static route via DRC on the serial interfaces.

g) Write down the appropriate commands to remove all floating static routes on Niger. **[2 marks]**

NIGER(config)# no ip route 192.168.1.32 255.255.255.224 209.165.200.1 5 (local)
NIGER(config)# no ip route 192.168.1.32 255.255.255.224 209.165.200.2 5 (remote)

Question 5 [10 marks]

The topology in Figure Q5 below is using both RIP and OSPF. Study the topology and answer the questions that follow.

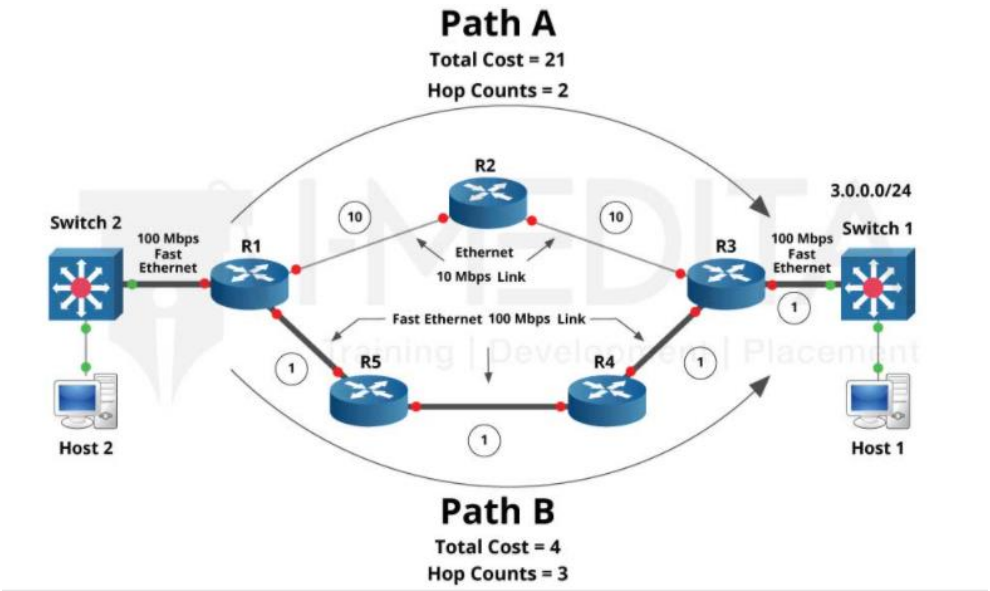


Figure Q5

a) Which path between Path A and Path B will be preferred by RIP to reach Host2 from Host1? Why? **[1 mark]**

Path A because it has fewer hop counts.

b) From the topology, which inefficiency is there in using hop count as a metric? **[1 mark]**

Although path A has fewer hop counts, path B has higher bandwidth.

c) Which path between Path A and Path B will be preferred by OSPF to reach Host2 from Host1? Why? **[2 marks]**

Path B because although it has fewer hop counts, it has lower total cost. OSPF uses a mechanism of allocating cost for each link where cost is inversely proportional to the bandwidth of the link.

d) If both RIP and OSPF are actively running in the topology, how will the routers determine which routing information source is more trustworthy and hence which routing protocol will be preferred? **[2 marks]**

By using Administrative Distance. AD is locally significant. Each router will only put the best route entry in the routing table. In this case, since OSPF has a lower AD value of 110

compared to RIP's AD value of 120, so routes learned via OSPF will be added to the routing table.

e) RIP is a Distance Vector protocol, name another protocol in the same category. **[1 mark]**
Enhanced Interior Gateway Routing Protocol (EIGRP)

f) OSPF is a Link-State protocol, name another protocol in the same category. **[1 mark]**
Intermediate System to Intermediate System (IS-IS)

g) To which broader category do all the protocols in e) and f) above belong? **[1 mark]**
IGP-Interior Gateway Protocols (Intra-Domain)

h) Which is the other broad category of routing protocols that complements g) above? Give an example. **[1 mark]** *EGP-Interior Gateway Protocols (Exta-Domain) e.g. BGP-Boarder Gateway Protocol*