Semester 1 Examinations 2016 / 2017

Exam Code(s)	3BCT
Exam(s)	Third Year Computer Science & Information Technology
Module Code(s)	CT3531
Module(s)	Networks and Data Communications 2
Paper No.	1
External Examiner(s)	Dr. J. Power
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Instructions: Answer any 4 questions.
All questions carry equal marks.

Duration	2 hrs
No. of Pages	5
Department(s)	Information Technology

Requirements   None

Question 1

    a) What are the main phases of network design as per the top-down network design approach?   5 MARKS

    b) How do bandwidth and throughput differ?   5 MARKS

    c) How can one improve network efficiency and what tradeoffs may be necessary in order to improve network efficiency?   5 MARKS

    d) When considering protocol behavior, what is the difference between relative network utilization and absolute network utilization?   5 MARKS

    e) Why should you characterize the logical structure of an internetwork and not just the physical structure?   5 MARKS

Question 2

Assume that you are working for a large corporation that is using the private IP address range 10.10.0.0/16 for its internal network. The company management wants to be able to accommodate at least 60 sites where each site has its own routed subnet with at least 1000 hosts per department subnet. You are requested to design the network layout. Answer the following questions and fully explain the logic behind each answer:

    a) What subnet mask will need to be used?   5 MARKS

    b) What is the maximum number of subnets that the company network can accommodate given that there are at least 1000 hosts per subnet?   5 MARKS

    c) What are the valid host addresses on the first and second subnets?   5 MARKS

    d) What other private IP ranges could the company use if needed?   5 MARKS

    e) When is it appropriate to use IP private addressing versus public addressing?   5 MARKS

Question 3

a) What are the three layers of a hierarchical network design? 3 MARKS

b) List and describe six different types of traffic flows.   6 MARKS

c) Why should you be concerned about broadcast traffic and how do Virtual LANs help control broadcast traffic? In this context explain the purpose of the 802.1Q protocol.   6 MARKS

d) What makes traffic flow in voice over IP networks challenging to characterize and plan for and why are wireless LANs often implemented as an individual VLANs?   5 MARKS

e) Describe the purpose and operation of the Spanning Tree Protocol.
                                                               5 MARKS

Question 4

a) How does a security plan differ from a security policy and why is it important to achieve buy-in from users, managers, and technical staff for the security policy?   6 MARKS

b) What are some methods for keeping hackers from viewing and changing router and switch configuration information? How can a network manager secure a wireless network?   7 MARKS

c) Outline briefly the three main functions provided by a Packet Filter in Linux. Which firewall chain is used in IPTABLES for packets that are destined for a local process running on the device itself? Explain in detail the purpose of the following firewall rules – the first one is defined using IPTABLES format while the second rule is defined using Mikrotik Router OS format:

   iptables -A FORWARD –p tcp –s 93.107.200.110 --syn –j DROP

   /ip firewall nat add chain=srcnat action=masquerade out-interface=ether2

                                                               12 MARKS

Question 5

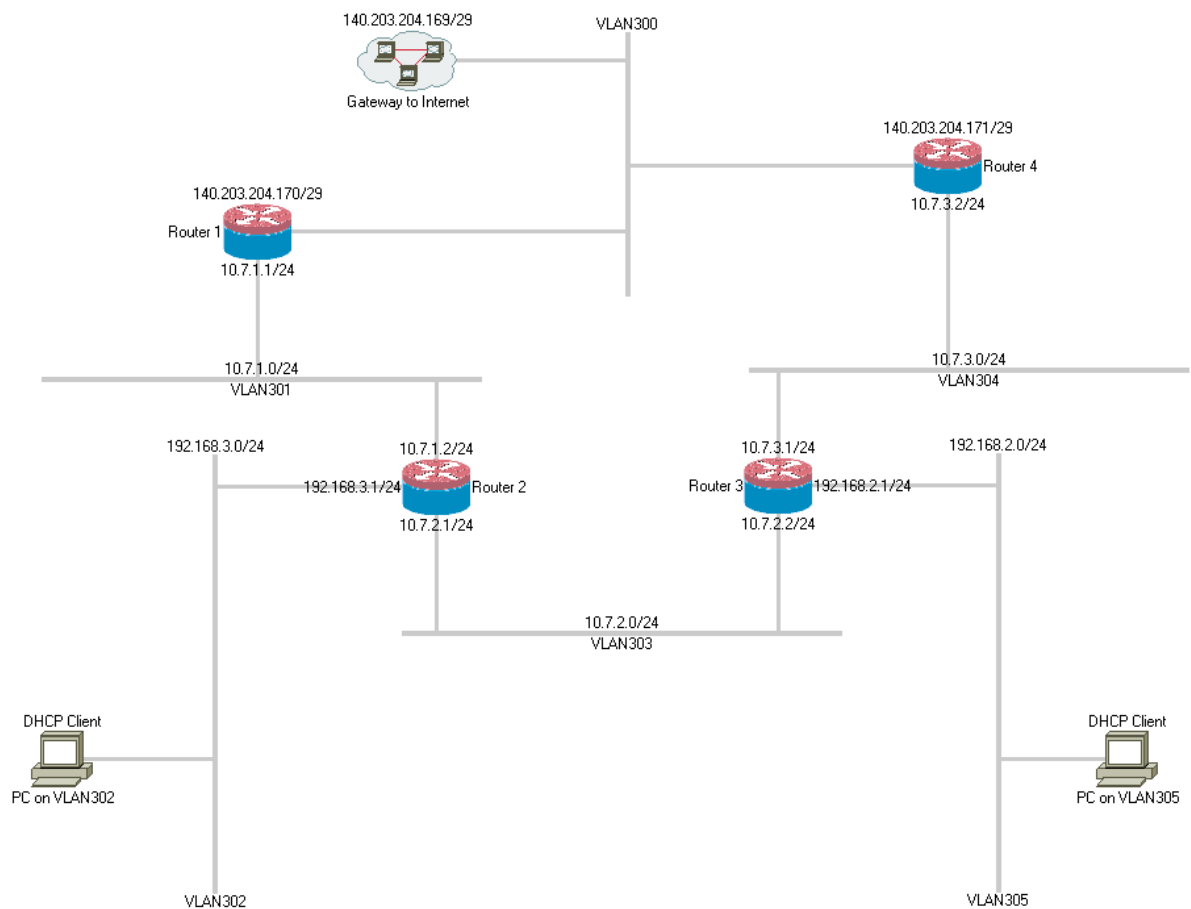Consider the example network shown in Figure 1 below:

Figure 1 - Example Network

Router 1 has two connected interfaces with the IP addresses shown in Figure 1. It has a NAT firewall rule for internal traffic routed to the internet via this router, as well as a default route to the internet via gateway 140.203.204.169. It has OSPF enabled on the interface connected to Router 2 and it redistributes its default route to other routers via OSPF. The OSPF cost of the interface linking to Router 2 uses the default value of 10.

Router 2 has three connected interfaces with the IP addresses shown in Figure 1. It acts as a DHCP Server for subnet 192.168.3.0/24 and has OSPF enabled on the interfaces connected to Router 1 and Router 3. It also redistributes connected networks so that other OSPF routers will have a route for the 192.168.3.0/24 subnet. The OSPF cost of the interfaces linking to Router 1 and Router 2 both use the default value of 10.

[Q5 continued overleaf]

Router 3 has three connected interfaces with the IP addresses shown in Figure 1. It acts as a DHCP Server for subnet 192.168.2.0/24 and has OSPF enabled on the interfaces connected to Router 2 and Router 4. It also redistributes connected networks so that other OSPF routers will have a route for the 192.168.2.0/24 subnet. The OSPF cost of the interfaces linking to Router 2 uses the default value of 10. However, the OSPF cost on the interface connecting to Router 4 has been set to 300.

Router 4 has two connected interfaces with the IP addresses shown in Figure 1. It has a NAT firewall rule for internal traffic routed to the internet via this router, as well as a default route to the internet via gateway 140.203.204.169. It has OSPF enabled on the interface connected to Router 3 and it redistributes its default route to other routers via OSPF. The OSPF cost on the interface linking to Router 3 has been set to 300.

Answer the following questions in relation to this network:

a: Describe the operation and purpose of the OSPF protocol in the network shown. What is the Link State Database and how is Dijkstra's Algorithm used by OSPF in this context?   8 MARKS

b: What route will a PC attached to VLAN302 and VLAN305 normally take to get to the internet? What would happen with OSPF if the interface between Router 1 and Router 2 became unavailable for some reason? How would the resulting Link State Announcements be disseminated throughout the network?   7 MARKS

c: What is an Autonomous System? In this context explain the purpose of the Border Gateway Protocol (BGP).   5 MARKS

d: Suppose a company was using the RIP dynamic routing protocol on its routers, what reasons would you give to persuade them to change to OSPF instead?   5 MARKS