NUI Galway
OÉ Gaillimh

Autumn Examinations 2018

Exam Code(s)	3BCT
Exam(s)	BSc Computer Science & Information Technology
Module Code(s)	CT3531
Module(s)	Networks and Data Communications 2
Paper No.	1
External Examiner(s)	Dr. J. Howe
Internal Examiner(s)	Prof. M. Madden
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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) What are some typical technical goals for organizations today when undertaking network design?   **5 MARKS**

    c) How is Availability typically measured or expressed? How might it be possible to achieve "Five Nines" in this context?   **5 MARKS**

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

    e) What architectural and environmental factors should you consider for a new wireless installation?   **5 MARKS**

Question 2

Assume that you are working for a large corporation that is using the private IP address range 10.1.0.0/16 for its internal network. The company management wants to be able to accommodate at least 30 departments with a subnet for each department and maximum number of 4000 hosts per 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 4000 hosts per subnet?
                      5 MARKS

    c) What are the valid host addresses on the first and last 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) When is it appropriate to use static versus dynamic addressing?

4 MARKS

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

c) Why should you be concerned about broadcast traffic? 5 MARKS

d) How do IETF specifications for QoS affect different types of network traffic?

5 MARKS

e) What are the advantages and disadvantages of the various options for multi-homing an Internet connection? 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 NOT destined for a local process running on the device itself? Explain in detail the purpose of the following two firewall rules that are defined using IPTABLES format:
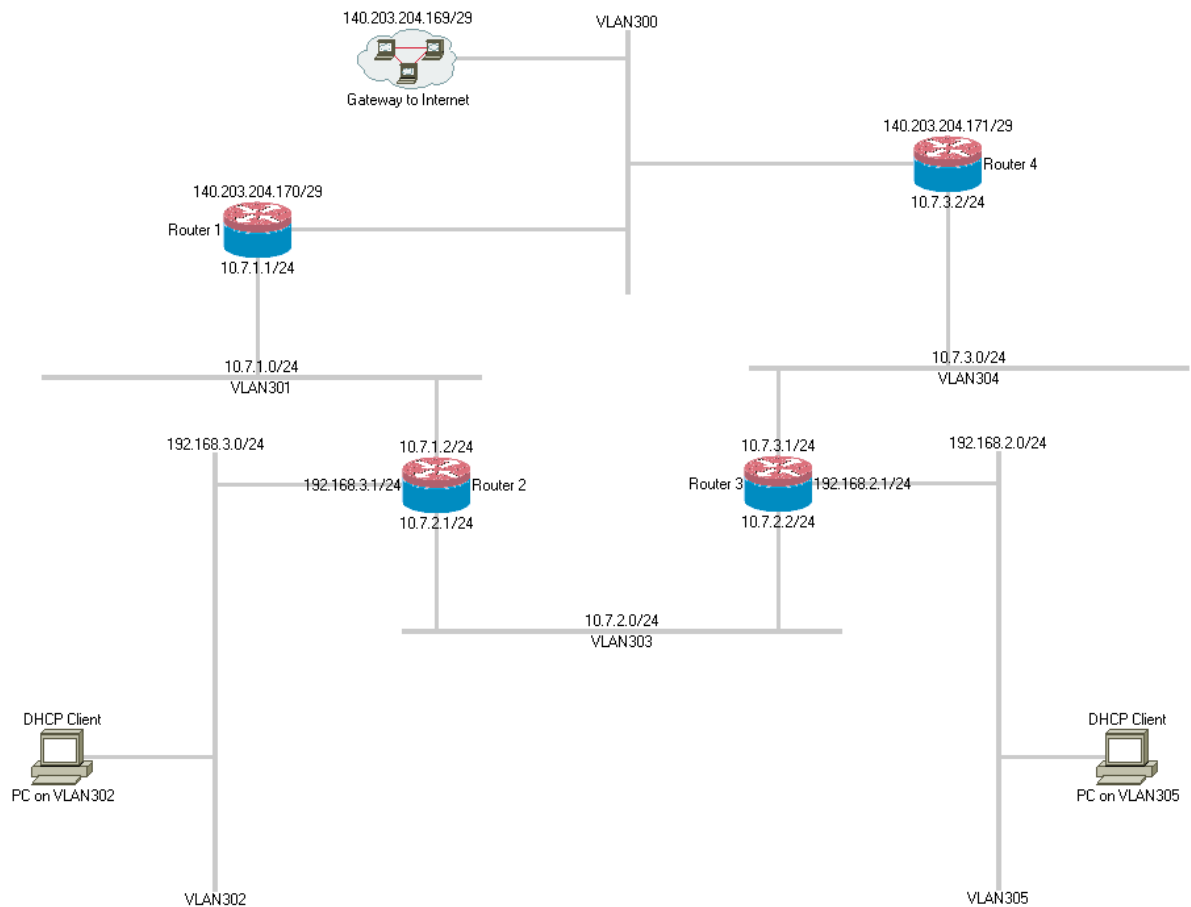
iptables -A FORWARD –p tcp –s 93.107.200.110 --syn –j DROP

iptables -A PREROUTING -t nat -p icmp -d 137.189.89.176 \
        -j DNAT --to 137.189.89.178

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**