Charles Darwin University

Final Examination

Family Name						
Given Name/s						
Student Number						
Teaching Period	Semester 1, 2018					

HIT174 – Network Engineering Concepts	DURATION	
	Reading Time:	**10** minutes
	Writing Time:	**180** minutes

INSTRUCTIONS TO CANDIDATES

The examination has **3** sections

Section A: Suggested Time:	**Multiple Choice Questions**: Answer ALL 20 questions 40 minutes (20 marks)
Section B: Suggested Time:	**Short Answer Questions**: Answer ALL 11 questions 95 minutes (50 marks)
Section C: Suggested Time:	**Case Study:** Answer ALL questions 45 minutes (30 marks)

Note that questions **ARE NOT** of equal value.
Read **ALL** questions carefully.
Do not commence writing until instructed to do so.

EXAM CONDITIONS

You may begin writing from the commencement of the examination session. The reading time indicated above is provided as a guide only.

This is a CLOSED BOOK examination

No calculators are permitted

No handwritten notes are permitted

No dictionaries are permitted

ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED
No additional printed material is permitted	1 x 20 Page Book 1 x Scrap Paper

THIS EXAMINATION IS PRINTED DOUBLE-SIDED.

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK.

Section A

Multiple Choice Questions

*Section B on following page

Section B

Short Answer Questions

Total No of Marks for this section: 50

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated.

Suggested Time allocation for Section B: 95 mins

Question 1

Convert the following: You are required to show all appropriate workings.

(a) Decimal to binary notation: 127.208.51.19

(b) Hexadecimal to Binary notation: A0:7E:9B:48:CD:F1

(4 marks)

Question 2

Complete the table below:

	Full IPv6	**Abbreviated IPv6**
a	FE80:0000:0000:0000:0200:0000:0000:0123	
b		3:A200:80:F0A:1000:C:815:9000
c	0200:0028:0000:0000:0000:0000:2001:0DB8	

(3 marks)

Question 3

Use either the Binary AND or Binary OR method to answer the following questions. You are required to show all appropriate workings.

(a) What is the network address of 192.168.30.143 with subnet mask of 255.255.255.192?

(b) What is the broadcast address of 200.100.17.158 with a prefix of /15?

(4 marks)

Question 4

Fill in the table below:

Acronym	Full name	Description	OSI layer
ICMP			
OSPF			
SMTP			
ARP			
UDP			
DNS			

(9 marks)

Question 5

Questions about the OSI Model

(a) Which layer resizes frames to match the receiving network?

(b) Which layer performs data compression?

(c) Which layer ensures data is received in the order it was sent?

(d) Which layer handles the data-carrying signal?

(e) Which layer provides file transfer services?

(f) Which layer enables routing?

(6 marks)

Question 6

What are the advantages of IPv6 over IPv4?

(3 marks)

Question 7

Given the network address of 10.10.10.0/24, you need to create 4 subnets. Answer the following questions and fill in the table:

a. Number of bits borrowed: _____

b. Total number of usable hosts/subnet: _____

c. Complete the table below:

Subnet	Network address	Prefix	1st usable host address	Last usable host address	Broadcast address
1st					
2nd					
3rd					
4th					

(10 marks)

Question 8

What is the purpose of the twists in UTP cable?

(1 mark)

Question 9

What is Active Directory and what services does it provide?

(4 marks)

Question 10

How does CSMA/CA work in a wireless network?

(3 marks)

Question 11

What are the advantages of using Network Address Translation (NAT)?

(3 marks)

Section C

Case Study

Total Number of Marks for this section: 30

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated. Suggested Time allocation for Section C: 45 mins

---

ABC is a large organisation that has employed you to setup the network for their company. They have the IP address of 138.105.20.0 / 22 and their staffs are divided into 5 groups as shown below.

- Administrative: 200 staff
- Marketing: 100 staff
- Technical: 50 staff
- Research: 30 staff
- Management: 3 staff

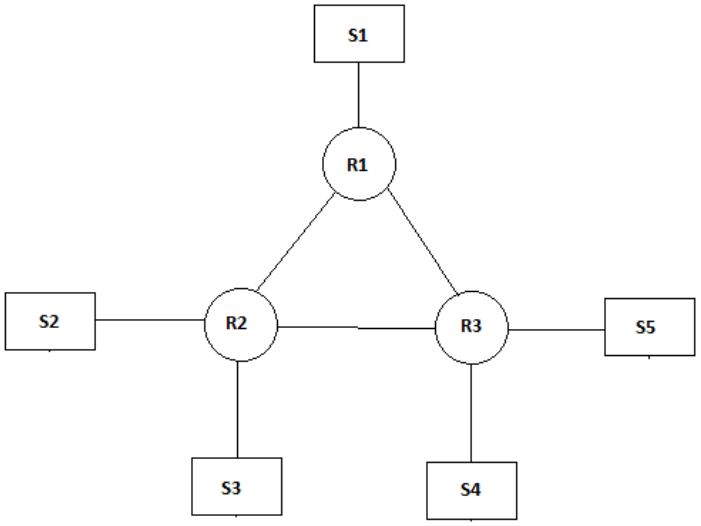
You are asked to create a LAN for each group and to set up the following:

- ABC has one server and is kept within the technical LAN. The server is allocated the last usable host address of that LAN
- There is a printer for each group and it is allocated the second usable host address of each LAN
- The gateway address is assigned the first usable IP address for each LAN
- Other devices connected to the network are allocated IP address via DHCP

Take note of the following:

- Only the research group is expected to increase in the number of staff in the near future.
- Each group should be in different subnets for security purposes.

Your colleague has come up with the following topology:



R1 to R3: Routers

S1: Switch 1 for the Administrative LAN

S2: Switch 2 for the Marketing LAN

S3: Switch 3 for the Research LAN

S4: Switch 4 for the Management LAN

S5: Switch 5 for the Technical LAN

Based on the above topology, answer the following questions:

1. What is the total number of networks? (1 mark)
2. Can the allocation of IP addresses be done without using VLSM? Why? (2 marks)
3. Using VLSM, allocate IP address in an efficient manner and answer the following:
    i. What is the IP address and subnet mask (in dotted decimal notation) of the server? (2 marks)
    ii. What is the IP address and subnet mask (in dotted decimal notation) of the printer for the management LAN? (2 marks)
    iii. What is the range of usable host address for the research LAN? (2 marks)
    iv. What is the gateway IP address and subnet mask (in dotted decimal notation) for the administrative LAN? (2 marks)
    v. How many unallocated host IP address are you left with? (2 marks)

4. The cable speed for the connections are as follows:
    - R1 to R2: 1 Gbps
    - R1 to R3: 100 Mbps
    - R2 to R3: 1 Gbps
    - All routers to switches: 1 Gbps
    - All switches to other devices: 1 Gbps

Which path will be taken to send a file from a computer in administrative LAN to another computer in the management LAN?

i. If RIP has been configured on all the routers? (1 mark)

ii. If OSPF (bandwidth has been set as the metric) has been configured on all the routers? (1 mark)

5. Come up with another topology and compare yours with the one proposed by your colleague. You should also consider the following:
   - Be able to allocate IP addresses to the five groups
   - No limitation on the number of routers used
   - Connection speed between the various devices

   (10 marks)

6. The company has decided to go with the topology given by your colleague. A new marketing employee has brought her laptop (with IP address: 138.105.20.162) and tried to connect to the network but she failed. What can be the problem and what can be the solution? (2 marks)

7. If the server is to be moved for security reason, where should it be? Why? What IP address and subnet mask will it have? (3 marks)

Section B

Short Answer Questions

Total No of Marks for this section: 50

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated.

Suggested Time allocation for Section B: 95 mins

Question 1

Convert the following: You are required to show all appropriate workings.

(c) Decimal to binary notation: 127.208.51.19

(d) Hexadecimal to Binary notation: A0:7E:9B:48:CD:F1

(4 marks)

Question 2

Complete the table below:

	Full IPv6	**Abbreviated IPv6**
a	FE80:0000:0000:0000:0200:0000:0000:0123	
b		3:A200:80:F0A:1000:C:815:9000
c	0200:0028:0000:0000:0000:0000:2001:0DB8	

(3 marks)

Question 3

Use either the Binary AND or Binary OR method to answer the following questions. You are required to show all appropriate workings.

(c) What is the network address of 192.168.30.143 with subnet mask of 255.255.255.192?

(d) What is the broadcast address of 200.100.17.158 with a prefix of /15?

(4 marks)

Question 4

Fill in the table below:

Acronym	Full name	Description	OSI layer
ICMP			
OSPF			
SMTP			
ARP			
UDP			
DNS			

(9 marks)

Question 5

Questions about the OSI Model

(g) Which layer resizes frames to match the receiving network?

(h) Which layer performs data compression?

(i) Which layer ensures data is received in the order it was sent?

(j) Which layer handles the data-carrying signal?

(k) Which layer provides file transfer services?

(l) Which layer enables routing?

(6 marks)

Question 6

What are the advantages of IPv6 over IPv4?

(3 marks)

Question 7

Given the network address of 10.10.10.0/24, you need to create 4 subnets. Answer the following questions and fill in the table:

d. Number of bits borrowed: _____

e. Total number of usable hosts/subnet: _____

f. Complete the table below:

Subnet	Network address	Prefix	1st usable host address	Last usable host address	Broadcast address
1st					
2nd					
3rd					
4th					

(10 marks)

Question 8

What is the purpose of the twists in UTP cable?

(1 mark)

Question 9

What is Active Directory and what services does it provide?

(4 marks)

Question 10

How does CSMA/CA work in a wireless network?

(3 marks)

Question 11

What are the advantages of using Network Address Translation (NAT)?

(3 marks)

Section C

Case Study

Total Number of Marks for this section: 30

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated. Suggested Time allocation for Section C: 45 mins

---

ABC is a large organisation that has employed you to setup the network for their company. They have the IP address of 138.105.20.0 / 22 and their staffs are divided into 5 groups as shown below.

- Administrative: 200 staff
- Marketing: 100 staff
- Technical: 50 staff
- Research: 30 staff
- Management: 3 staff

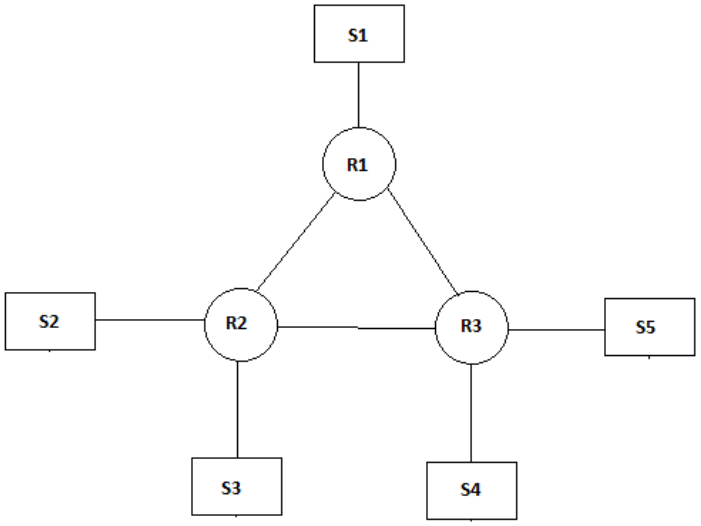
You are asked to create a LAN for each group and to set up the following:

- ABC has one server and is kept within the technical LAN. The server is allocated the last usable host address of that LAN
- There is a printer for each group and it is allocated the second usable host address of each LAN
- The gateway address is assigned the first usable IP address for each LAN
- Other devices connected to the network are allocated IP address via DHCP

Take note of the following:

- Only the research group is expected to increase in the number of staff in the near future.
- Each group should be in different subnets for security purposes.

Your colleague has come up with the following topology:



R1 to R3: Routers

S1: Switch 1 for the Administrative LAN

S2: Switch 2 for the Marketing LAN

S3: Switch 3 for the Research LAN

S4: Switch 4 for the Management LAN

S5: Switch 5 for the Technical LAN

Based on the above topology, answer the following questions:

8. What is the total number of networks? (1 mark)
9. Can the allocation of IP addresses be done without using VLSM? Why? (2 marks)
10. Using VLSM, allocate IP address in an efficient manner and answer the following:
    i. What is the IP address and subnet mask (in dotted decimal notation) of the server? (2 marks)
    ii. What is the IP address and subnet mask (in dotted decimal notation) of the printer for the management LAN? (2 marks)
    iii. What is the range of usable host address for the research LAN? (2 marks)
    iv. What is the gateway IP address and subnet mask (in dotted decimal notation) for the administrative LAN? (2 marks)
    v. How many unallocated host IP address are you left with? (2 marks)

11. The cable speed for the connections are as follows:
    - R1 to R2: 1 Gbps
    - R1 to R3: 100 Mbps
    - R2 to R3: 1 Gbps
    - All routers to switches: 1 Gbps
    - All switches to other devices: 1 Gbps

Which path will be taken to send a file from a computer in administrative LAN to another computer in the management LAN?

iii. If RIP has been configured on all the routers? (1 mark)

iv. If OSPF (bandwidth has been set as the metric) has been configured on all the routers? (1 mark)

12. Come up with another topology and compare yours with the one proposed by your colleague. You should also consider the following:
    - Be able to allocate IP addresses to the five groups
    - No limitation on the number of routers used
    - Connection speed between the various devices

    (10 marks)

13. The company has decided to go with the topology given by your colleague. A new marketing employee has brought her laptop (with IP address: 138.105.20.162) and tried to connect to the network but she failed. What can be the problem and what can be the solution? (2 marks)

14. If the server is to be moved for security reason, where should it be? Why? What IP address and subnet mask will it have? (3 marks)