Name & ID:_____Ahmed Abdullah Mujtaba am08402_____ **Date:** 19/11/2024_____

EE-424L Data Communication & Networking
Fall 2024

Habib University

Dhanani School of Science & Engineering

LAB 11: Subnetting

Lab #11 Marks distribution:

		LR2=10	LR4=15	LR5=15	AR2=05	AR4=05
In-Lab Tasks	**Task 1**		/05	/05	/05	/05
	Task 2	/10	/10	/10		
Marks Obt.	**/50**					

Objectives	**The objective of this Lab is to design an IP Addressing Scheme using subnetting and Assign IP Addresses to Network Devices and Verify Connectivity**

Task 1:

Exercise 1:

Now that you have an understanding of subnetting, put this knowledge to use. In this task, you are given two address / mask combinations, written with the prefix/length notation, which have been assigned to two devices. Your task is to determine if these devices are on the same subnet or different subnets. You can use the address and mask of each device in order to determine to which subnet each address belongs to.

Device A: 172.16.17.30/20

Device B: 172.16.28.15/20

Determine the Subnet for Device A:

11111111.11111111.11110000.00000000 In binary (subnet in binary)
255.255.240.0 in decimal
172.16.17.30 in binary is 10101100.00010000.00010001.00011110
Perform bitwise AND with the with the subnet mask
10101100.00010000.00010001.00011110 (device A)
11111111.11111111.11110000.00000000 (subnet mask)
10101100.00010000.00010000.00000000 (answer of bitwise and)
172.16.16.0 (ans in normal notation)
Subnet for device A is 172.16.16.0/20

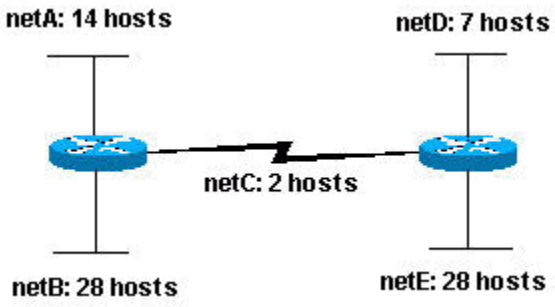
Determine the Subnet for Device B:

172.16.28.15 in binary 10101100.00010000.00011100.00001111
Performing bitwise AND with the binary form of the subnet
Gives 10101100.00010000.00010000.00000000
172.16.16.0
Subnet for device B is 172.16.16.0/20S

Exercise 2:

Given the Class C network of 204.15.5.0/24, subnet the network in order to create the network in Figure 1 with the host requirements shown.

Figure 1



Looking at the network shown in Figure 1, How many subnets are needed? _____5 subnets are needed for this_____

Is this possible with a Class C network? And if so, then how and assign subnets to topology in Fig. 1 as well **using VLSM**.

NetB :

Subnet Address: 204.15.5.0/27

Prefix: /27

Host range: 204.15.5.1—204.15.5.30

Broadcast: 204.15.5.31

NetE:

Subnet Address: 204.15.5.32/27

Prefix: /27

Host range: 204.15.5.33—204.15.5.62

Broadcast: 204.15.5.63

NetA:

Subnet Address: 204.15.5.64/28

Prefix: /28

Host Range: 204.15.5.65—204.15.5.78

Broadcast: 204.15.5.79

NetD:

Subnet Address: 204.15.5.80/29

Prefix: /29

Host Range: 204.15.5.81—204.15.5.86

Broadcast: 204.15.5.87

P

NetC:
Subnet Address: 204.15.5.88/30

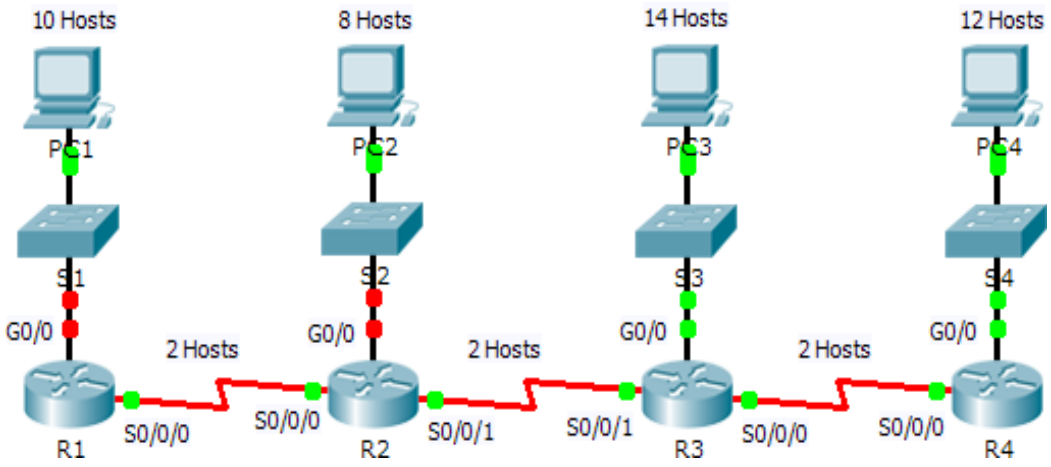
Prefix: /30

Host Range: 204.15.5.89—204.15.5.90

Broadcast: 204.15.5.91

Task 2: Design and verify connectivity

Topology



Scenario

In this task, you are given the network address of 172.31.1.0 /24 to subnet and provide the IP addressing for the network shown in the Topology. The required host addresses for each WAN and LAN link are labeled in the topology.

Note: you can use normal or serial cable to make connection from router to router.

Part 1: Design an IP Addressing Scheme

Step 1: Subnet the 172.31.1.0/24 network based on the maximum number of hosts required by the largest subnet.

a. Based on the topology, how many subnets are needed? ___7 subnets are needed 3 for Wans and 4 for LAN_____

b. How many bits must be borrowed to support the number of subnets in the topology table? ___3 bits must be borrowed to support the subnets in the topology_____

c. How many subnets does this create? ____8 subnets (used 8 because closest power to 7)_____

d. How many usable host addresses does this create per subnet? _____5 bits remaining for the hosts 2^5 = 32 32-2 = 30 because one is reserved for host and broadcast so total usable 30_____

e. Calculate the binary value for the first five subnets. Subnet zero is already shown.

Net 0: 172 . 31 . 1 . 0 0 0 0 0 0 0 0

Net 1: 172 . 31 . 1 . ___ ___ ___ ___ ___ ___ ___ ___

Net 2: 172 . 31 . 1 . ___ ___ ___ ___ ___ ___ ___ ___

Net 3: 172 . 31 . 1 . ___ ___ ___ ___ ___ ___ ___ ___

Net 4: 172 . 31 . 1 . ___ ___ ___ ___ ___ ___ ___ ___

Net 1: 172.31.1.32.00100000

Net2: 172.31.1.64.01000000

Net3:172.31.1.96.01100000

Net4:172.31.1.128.10000000

f. Calculate the binary and decimal value of the new subnet mask.

11111111.11111111.11111111. ___ ___ ___ ___ ___ ___ ___ ___

255 . 255 . 255 . ___

Binary subnet = 11111111.11111111.11111111.11100000

Decimal Subnet Mask: 255.255.255.224

g. Complete the Subnet Table, listing all available subnets, the first and last usable host address, and the broadcast address. The first subnet is done for you. Repeat until all addresses are listed.

   Note: You may not need to use all rows.

Subnet Table:

Subnet Number	Subnet IP	First Usable Host IP	Last Usable Host IP	Broadcast Address
0	**172.31.1.0**	**172.31.1.1**	**172.31.1.14**	**172.31.1.15**
1	172.31.1.32	172.31.1.33	172.31.1.46	172.31.1.47
2	172.31.1.64	172.31.1.65	172.31.1.78	172.31.1.79
3	172.31.1.96	172.31.1.97	172.31.1.110	172.31.1.111
4	172.31.1.128	172.31.1.129	172.31.1.142	172.31.1.143
5	172.31.1.160	172.31.1.161	172.31.1.174	172.31.1.175
6	172.31.1.192	172.31.1.193	172.31.1.206	172.31.1.207
7	172.31.1.224	172.31.1.225	172.31.1.238	172.31.1.239
8				

Step 2: Assign the subnets to the network shown in the topology.

When assigning the subnets, keep in mind that routing is necessary to allow information to be sent throughout the network.

a. **Assign Subnet 0 to the R1 LAN:** 172.31.1.1 – 172.31.1.14

b. **Assign Subnet 1 to the R2 LAN:** 172.31.1.33 – 172.31.1.46

c. **Assign Subnet 2 to the R3 LAN:** 172.31.1.65 – 172.31.1.78

d. **Assign Subnet 3 to the R4 LAN:** 172.31.1.97 – 172.31.1.110

e. **Assign Subnet 4 to the link between R1 and R2. 172.31.1.129 –172.31.1.130**

f. **Assign Subnet 5 to the link between R2 and R3. 172.31.1.161—172.31.1.162**

g. Assign Subnet 6 to the link between R3 and R4. 172.31.1.193—173.31.1.194

Step 3: Document the addressing scheme.

Assign the first usable IP addresses to routers interfaces for each of the links.

Use the following method to assign WAN link IP addresses:

- For the WAN link between R1 and R2, assign and mention the first usable IP address to R1 and last usable IP address to R2.

172.31.1.129-R1 172.31.1.130-R2

- For the WAN link between R2 and R3, assign and mention the first usable IP address to R2 and last usable IP address to R3.

172.31.1.161-R2 172.31.1.162-R3

- For the WAN link between R3 and R4, assign and mention the first usable IP address to R3 and last usable IP address to R4.

172.31.1.193-R3 172.31.1.194-R4

Assign the last usable IP addresses to the hosts.

Part 2: Assign IP Addresses to Network Devices and Verify Connectivity

Most of the IP addressing is already configured on this network. Implement the following steps to complete the addressing configuration.

Step 1: Configure IP addressing on R1 and R2 LAN interfaces, on S3 and PC4, including the default gateway.

Step 2: Configure Static or Dynamic Routing (RIP version 2 supports subnetting) on R1, R2, R3 and R4.

RIP Ver-2 syntax is below:

R(config)#router rip

R(config-router)#version 2

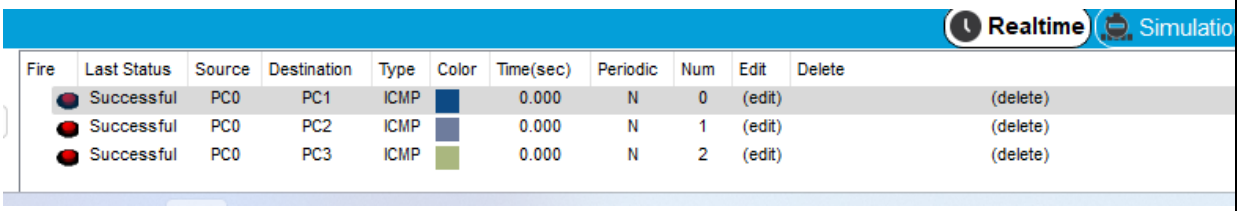
R(config-router)#network 1.2.3.4

R(config-router)#end

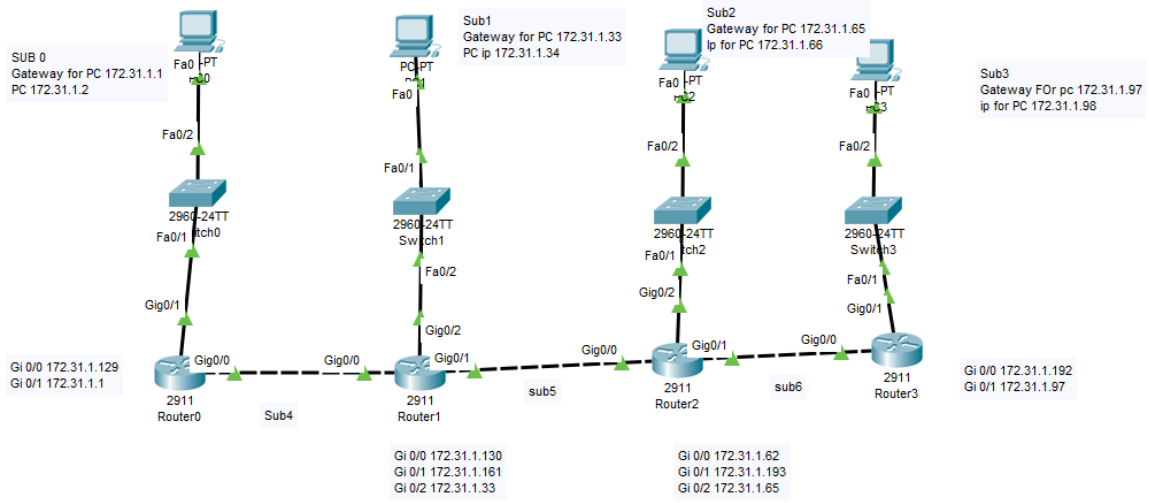
Step 3: Verify connectivity.

You can only verify connectivity from R1, R2, S3, and PC4. However, you should be able to ping every IP address listed in the Addressing Table. Check this to RA.

Showed to Miss Zareen



Attach the Network Topology, all configurations and verification results with the Lab manual.


SUB 0
Gateway for PC 172.31.1.1
PC 172.31.1.2
Sub1
Gateway for PC 172.31.1.33
PC ip 172.31.1.34
Sub2
Gateway for PC 172.31.1.65
Ip for PC 172.31.1.66
Sub3
Gateway FOr pc 172.31.1.97
ip for PC 172.31.1.98
Fa0
Fa0/2
Fa0/1
Gig0/1
Gig0/2
Gig0/0
2960-24TT
Switch0
Switch1
Switch2
Switch3
2911
Router0
Router1
Router2
Router3
Gi 0/0 172.31.1.129
Gi 0/1 172.31.1.1
Sub4
Gi 0/0 172.31.1.130
Gi 0/1 172.31.1.161
Gi 0/2 172.31.1.33
sub5
Gi 0/0 172.31.1.62
Gi 0/1 172.31.1.193
Gi 0/2 172.31.1.65
sub6
Gi 0/0 172.31.1.192
Gi 0/1 172.31.1.97

Lab Evaluation Assessment Rubric

EE-424 Lab 11

#	Assessment Elements	Level 1: Unsatisfactory Points 0-1	Level 2: Developing Points 2	Level 3: Good Points 3	Level 4: Exemplary Points 4
LR2	**Program/Code/ Simulation Model/ Network Model**	Program/code/simulation model/network model does not implement the required functionality and has several errors. The student is not able to utilize even the basic tools of the software.	Program/code/simulation model/network model has some errors and does not produce completely accurate results. Student has limited command on the basic tools of the software.	Program/code/simulation model/network model gives correct output but not efficiently implemented or implemented by computationally complex routine.	Program/code/simulation /network model is efficiently implemented and gives correct output. Student has full command on the basic tools of the software.
LR4	**Data Collection**	Measurements are incomplete, inaccurate and imprecise. Observations are incomplete or not included. Symbols, units and significant figures are not included.	Measurements are somewhat inaccurate and imprecise. Observations are incomplete or vague. Major errors are there in using symbols, units and significant digits.	Measurements are mostly accurate. Observations are generally complete. Minor errors are present in using symbols, units and significant digits.	Measurements are both accurate and precise. Data collection is systematic. Observations are very thorough and include appropriate symbols, units and significant digits and task completed in due time.
LR5	**Results & Plots**	Figures/ graphs / tables are not developed or are poorly constructed with erroneous results. Titles, captions, units are not mentioned. Data is presented in an obscure manner.	Figures, graphs and tables are drawn but contain errors. Titles, captions, units are not accurate. Data presentation is not too clear.	All figures, graphs, tables are correctly drawn but contain minor errors or some of the details are missing.	Figures / graphs / tables are correctly drawn and appropriate titles/captions and proper units are mentioned. Data presentation is systematic.
AR4	***Report Submission**	Late submission after 1 week and in between 2 weeks.	Late submission after 2 days and within a week.	Late submission after the lab timing and within 2 days of the due date.	Timely submission of the report and in the lab time.

***Report:** Report will not be accepted after due date