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College of Engineering CSIT Department

ITE 402 – Network Design & Implementations

Spring 2023-2024

Assignment One

**Problem 1.** Consider an Ethernet network with three hosts, Host A, Host B, and Host C as shown in Figure

1. No machine is configured as an IP router, and there is no IP router on this network. Assume that the IP addresses and subnet masks are as shown in the figure.

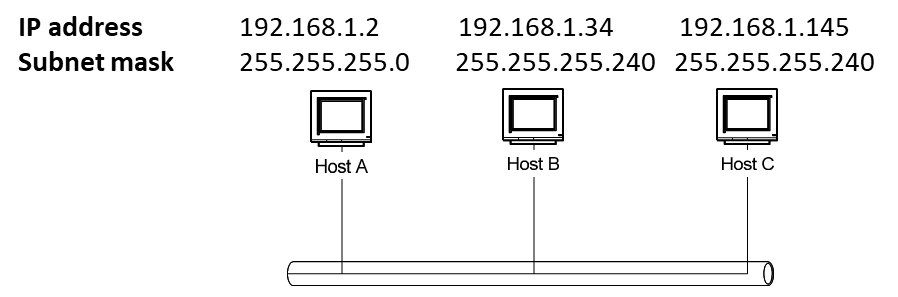


Figure 1: Network Topology

For each of the IP datagram transmissions listed below, indicate whether they will be successful. If a transmission is unsuccessful, provide an explanation.

1. Host C sends an IP datagram to Host A

Answer:

Since Host A, and Host C have different network prefixes, they are not in the same subnet. Therefore, Host C cannot directly send an IP datagram to Host A. The transmission will be unsuccessful without an IP router to forward the datagram.

1. Host A sends an IP datagram to Host B

Answer:

Host A:

IP address: 192.168.1.2

Subnet mask: 255.255.255.0

Network address: 192.168.1.0

Host B:

IP address: 192.168.1.34

Subnet mask: 255.255.255.240

Network address: 192.168.1.32

Since the network addresses of Host A and Host B are different, they are in

different subnets. Without a router to forward the IP datagram between

subnets, the transmission from Host A to Host B will be unsuccessful.

1. Host A sends an IP datagram to Host C

we need to compare their IP addresses and subnet masks to see if they are

in the same subnet.

Host A:

IP address: 192.168.1.2

Subnet mask: 255.255.255.0

Network address: 192.168.1.0

Host C:

IP address: 192.168.1.145

Subnet mask: 255.255.255.240

Network address: 192.168.1.144

Since the network addresses of Host A and Host C are different, they are in

different subnets. Without a router to forward the IP datagram between

subnets, the transmission from Host A to Host C will be unsuccessful.

1. Host B sends an IP datagram to Host A

Answer:

To determine if the transmission from Host B to Host A will be successful,

we need to compare their IP addresses and subnet masks to see if they are

in the same subnet.

Host B:

IP address: 192.168.1.34

Subnet mask: 255.255.255.240

Network address: 192.168.1.32

Host A:

IP address: 192.168.1.2

Subnet mask: 255.255.255.0

Network address: 192.168.1.0

Since the network addresses of Host B and Host A are different, they are in different subnets. Without a router to forward the IP datagram between subnets, the transmission from Host B to Host A will be unsuccessful.

1. Host B sends an IP datagram to Host C

Answer:

Host B:

IP address: 192.168.1.34

Subnet mask: 255.255.255.240

Network address: 192.168.1.32

Host C:

IP address: 192.168.1.145

Subnet mask: 255.255.255.240

Network address: 192.168.1.144

Since both Host B and Host C have IP addresses in the range

192.168.1.144 to 192.168.1.159 (which is the subnet defined by the subnet

mask 255.255.255.240), they are in the same subnet.

Therefore, the transmission from Host B to Host C will be successful as they are in the same subnet and can communicate directly without the need for a router.

**Problem 2.** Consider the 128.100.112.0/21 block of IP addresses. This block of addresses must be divided into **x** subnets that have IP addresses based on your ID and the formula shown below, where **x** is the number of digits in your student's ID excluding zeros.

**Each subnet has IP addresses based on 500 +/-** one digit of your id excluding zeros.

My ID: 1082759

Number of digits in ID excluding zeros: 6

Subnet 1: 500 - 9 = 491

Subnet 2: 500 - 7 = 493

Subnet 3: 500 - 5 = 495

Subnet 4: 500 + 8 = 508

Subnet 5: 500 + 2 = 502

Subnet 6: 500 + 1 = 501

*calculate the subnet information for each subnet:*

*Subnet 1:*

*Network address: 128.100.112.0*

*Network prefix: /23*

*Subnet mask: 255.255.254.0*

*First host: 128.100.112.1*

*Last host: 128.100.113.254*

*Broadcast IP address: 128.100.113.255*

*Subnet 2:*

*Network address: 128.100.114.0*

*Network prefix: /23*

*Subnet mask: 255.255.254.0*

*First host: 128.100.114.1*

*Last host: 128.100.115.254*

*Broadcast IP address: 128.100.115.255*

*Subnet 3:*

*Network address: 128.100.116.0*

*Network prefix: /23*

*Subnet mask: 255.255.254.0*

*First host: 128.100.116.1*

*Last host: 128.100.117.254*

*Broadcast IP address: 128.100.117.255*

*Subnet 4:*

*Network address: 128.100.118.0*

*Network prefix: /23*

*Subnet mask: 255.255.254.0*

*First host: 128.100.118.1*

*Last host: 128.100.119.254*

*Broadcast IP address: 128.100.119.255*

*Subnet 5:*

*Network address: 128.100.120.0*

*Network prefix: /23*

*Subnet mask: 255.255.254.0*

*First host: 128.100.120.1*

*Last host: 128.100.121.254*

*Broadcast IP address: 128.100.121.255*

*Subnet 6:*

*Network address: 128.100.122.0*

*Network prefix: /23*

*Subnet mask: 255.255.254.0*

*First host: 128.100.122.1*

*Last host: 128.100.123.254*

*Broadcast IP address: 128.100.123.255*

**Problem 3.** Given the network block 200.35.x.0/24, where 'x' represents the fourth digit of your student ID, address the following:

1. Create an extended network prefix that allows for 20 hosts on each subnet.

Answer:

Student ID: 1082759

Fourth digit: 2 (from the fourth position in the ID)

Given network block: 200.35.x.0/24

Subnet mask: 255.255.255.0 (24 bits for the network portion)

To create an extended network prefix that allows for 20 hosts on each subnet, we need to borrow enough bits from the host portion to accommodate at least 20 hosts. The closest power of 2 greater than 20 is 32, which requires 5 bits (2^5 = 32). Therefore, we need to borrow 5 bits from the host portion to create subnets with 32 addresses each.

New subnet mask: 255.255.255.224 (/27)

Extended network prefix: 200.35.x.0/27

1. Determine the maximum number of hosts that can be assigned to each subnet.

Answer:

The maximum number of hosts that can be assigned to each subnet is calculated as 2^(number of host bits) - 2 (for the network address and broadcast address). In this case, with 5 host bits (from the /27 subnet mask), the formula gives us 2^5 - 2 = 30 hosts.

1. Calculate the maximum number of subnets that can be defined.

Answer:

To calculate the maximum number of subnets that can be defined, we need to determine the number of bits borrowed for subnetting. Since we borrowed 5 bits for hosts in the /27 subnet mask, the remaining bits in the fourth octet (8 bits total) are used for subnetting. Therefore, the number of subnets is 2^5 = 32 subnets.

1. Provide the range of host addresses that can be assigned to Subnet #6

Answer:

Subnet #6 network address: 200.35.x.160

The range of host addresses that can be assigned to Subnet #6 would be from the first host address (network address + 1) to the last host address (network address + 30), which is:

Range: 200.35.x.161 to 200.35.x.190

1. Identify the broadcast address for subnet 200.35.x.192.

Answer:

The broadcast address for subnet 200.35.x.192 would be the last address in that

subnet's range, which is the broadcast address formula = network address + (2^n - 1), where n is the number of bits borrowed for host addressing (5 in this case).

Subnet #192 broadcast address: 200.35.x.191

**Problem 4.** Assume that you were given the duty of a junior network administrator. You were given a class C network taken the form of **200.x.y.0** with a subnet mask of 255.255.255.252, where 'x' and 'y' correspond to the digits in positions 3 and 5, respectively, of your student ID. The management asked you to provide the following details:

To solve this problem, we first need to determine the values of 'x' and 'y' from your student ID (1082759):

Student ID: 1082759

Third digit: 8 (from the third position in the ID)

Fifth digit: 7 (from the fifth position in the ID)

Given network block: 200.x.y.0/30

Subnet mask: 255.255.255.252 (30 bits for the network portion)

1. Number of networks

Answer: Since the subnet mask is /30, which provides 2 usable IP addresses per subnet (2^2 - 2), the total number of networks is 2^8 (since 'x' can range from 0 to 255) \* 2^8 (since 'y' can range from 0 to 255) = 65,536 networks.

1. Number of hosts per network

Answer: With a /30 subnet mask, there are 2 usable IP addresses per subnet (2^2 - 2), so there are 2 hosts per network.

1. Network address, First host IP, Last host IP, and Broadcast address for each of the first three subnetworks

Answer:

Subnet 1:

Network address: 200.8.7.0

First host IP: 200.8.7.1

Last host IP: 200.8.7.2

Broadcast address: 200.8.7.3

Subnet 2:

Network address: 200.8.7.4

First host IP: 200.8.7.5

Last host IP: 200.8.7.6

Broadcast address: 200.8.7.7

Subnet 3:

Network address: 200.8.7.8

First host IP: 200.8.7.9

Last host IP: 200.8.7.10

Broadcast address: 200.8.7.11

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| **Submission Rules** |
| * + Submissionis strictly via BB. Any other means of submission will be automatically rejected.   + The assignment is worth 5%   + The assignment is an individual task   + Make sure to submit the questions along with answers in one document   + Due on **24th March 2024**   + Late submissions will carry a reduction of 0.5 per extra day from the deadline. |