This submission template is a convenient document for you to provide your work and your answers for Lab 3. This submission template is intended to be used in conjunction with the Lab 3 Instructions document. The instructions document illustrates how to correctly derive the answers, explains important theoretical and practical details, and contains the complete set of instructions for this lab.

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2019/11/5

**Section One – Subnet Calculations**

2. Now you give this calculation a try with the following subnet entry:  
  
66.147.242.171/15  
  
Using the methodology listed in step 1, determine the number of hosts (usable IPv4 addresses) for this subnet.

We know that the network identifier spans 15 bits. That leaves 17 bits for the host identifier. To calculate the number of possible hosts for the network (66.146.0.0), we raise 2 to the power of 17, which comes to 131,072, then subtract 2 from that number, resulting in 131,070, to account for the network address and the broadcast address. So we conclude that the network represented by 66.147.242.171/15 has 131,070 usable IPv4 address. An alternative way to state this is that the network represented by 66.147.242.171/15 can have up to 131,070 hosts.  
  
4. Now you give it a try by calculating the broadcast address for the following CIDR entry using the methodology listed in step 3. Represent your answers in dotted decimal notation, and make sure to show your work.  
  
64.152.0.21/25

First we need determine the network address. We know that 25 bits fully the first three octets and the first bit of the fourth octet, so the network identifier is 64.152.0.X. We then convert the value in the fourth octet, 21 in decimal to binary, which is 0001 0101. The /25 indicated that 1 bit is spanned in this octet, so extracting the first 1 bit and zeroing out the remainder leaves us with 00000000, which is 0 in decimal. So we know that the network address is 64.152.0.0

Host identifier span 7 bits. So convert the last 7 bits to 1. So the broadcast address is 64.152.0.127

6. Now, you give this a try with the CIDR entry below. Give the range of assignable IPv4 addresses for that subnet, using the methodology listed in step 5. Make sure to show your work.

66.147.242.171/15

First the network identifier spans 15 bits. So we can calculate the network address is 66.146.0.0 and the broadcast network is 66.147.255.255. And the range of assignable IPv4 addresses is 66.146.0.1 through 66.147.255.254

8. Imagine that a network adapter on a subnet is represented with the CIDR entry 103.147.213.34/17, and that its subnet identifier spans 2 bits. Represent its network prefix and subnet identifier in binary using the methodology listed in step 7. Recall that from the perspective of a subnet, its network prefix and subnet identifier are both contained within its network identifier.

Because the network identifier spans 17 bits, so 01100111 10010011 1 in binary. And subnet identifier spans 2 bits. So network prefix is 01100111 1001001 and subnet identifier is 11.

10. Imagine that an organization is given a block of addresses represented with 139.93.40.0/22, and that it intends to use 4 subnets on its network. Give the number of bits needed for the subnet identifier for 4 subnets, and list the network identifiers for all four subnets, in binary, using the methodology listed in step 9.

Because it intends to use 4 subnets on its network, and 2^2 = 4. Thus the organization need 2 bits of its subnet.

First the network identifier spans 22 bits, so 10001011 01011101 001010 in binary. Then it would use 10001011 01011101 001010 as its network prefix, then the next two bits to uniquely identify each subnet. The subnet identifier would be 00 01 10 11.

First subnet: 10001011 01011101 00101000

Second subnet: 10001011 01011101 00101001

Third subnet: 10001011 01011101 00101010

Fourth subnet: 10001011 01011101 00101011

12. Imagine that an organization is assigned the range of addresses identified by CIDR entry 66.216.112.0/21, and that the organization has decided to use 8 subnets. Answer the following series of questions about this scenario. Make sure to show your work, using a tool to convert from binary to decimal and vice versa when necessary.   
  
a. How many bits are needed for the subnet identifier, to distinguish one subnet from another on this network?

Because there are 8 subnets, we would use 3 bits.  
b. What is the subnet mask for the 8 subnets in binary and in dotted decimal?

Since the network identifier for the organization is 21 bits, and the subnet identifier is 3 bits, the length of the network identifiers for both of the subnets is 24 bits. So we add 24 1 bits to the mask, followed by 8 0 bits, like so, to arrive at our subnet mask:

11111111 11111111 11111111 00000000 or 255.255.255.0 in dotted decimal.  
c. How many hosts are there per subnet?

Because the network identifiers are 24 bits, that leaves 8 bits for hosts. 2^8 = 256, and subtracting 2 from that gives 254 possible hosts.  
d. What are the network identifiers for each subnet, in binary?

First, we need to represent the network identifier for the organization, in binary, which is 01000010 11011000 01110. We obtained this by converting the first three octets to binary, and only selecting the first five bits from the third octet. Next, we append the two combinations of bits together to calculate the network identifier for each subnet.

First subnet: 01000010 11011000 01110000

Second subnet: 01000010 11011000 01110001

Third subnet: 01000010 11011000 01110010

Fourth subnet: 01000010 11011000 01110011

Fifth subnet: 01000010 11011000 01110100

Sixth subnet: 01000010 11011000 01110101

Seventh subnet: 01000010 11011000 01110110

Eighth subnet: 01000010 11011000 01110111  
e. What are the network addresses for each subnet in dotted decimal notation?

First subnet: 66.216.112.0

Second subnet: 66.216.113.0

Third subnet: 66.216.114.0

Fourth subnet: 66.216.115.0

Fifth subnet: 66.216.116.0

Sixth subnet: 66.216.117.0

Seventh subnet: 66.216.118.0

Eighth subnet: 66.216.119.0  
  
f. What are the broadcast addresses for each subnet in dotted decimal notation?

Because the last one of each subnet is the broadcast address. So it just use the next subnet network address minus 1.

First subnet: 66.216.112.255

Second subnet: 66.216.113.255

Third subnet: 66.216.114.255

Fourth subnet: 66.216.115.255

Fifth subnet: 66.216.116.255

Sixth subnet: 66.216.117.255

Seventh subnet: 66.216.118.255

Eighth subnet: 66.216.119.255

g. What are the assignable IP addresses for each subnet?

The first address that can be assigned is 1 higher than the network address and the last one is 1 lower than the broadcast network.

First subnet: 66.216.112.1-66.216.112.254

Second subnet: 66.216.113.1-66.216.113.254

Third subnet: 66.216.114.1-66.216.114.254

Fourth subnet: 66.216.115.1-66.216.115.254

Fifth subnet: 66.216.116.1-66.216.116.254

Sixth subnet: 66.216.117.1-66.216.117.254

Seventh subnet: 66.216.118.1-66.216.118.254

Eighth subnet: 66.216.119.1-66.216.119.254

13. In your own words, explain what a subnet is from a conceptual and a technical perspective, and also explain the advantages of using subnets versus using a single, monolithic computer network.

Each organization must assign the IP addresses it has received to specific computers on its networks. To make the IP addresses assignment more functional, we use an addressing hierarchy. The first part of the address defines the network, the second part of the address defines a particular computer or host on the network. However, it is not efficient to assign every computer to the same network. Rather, subnets designed on the network that subdivide the network into logical pieces.

Advantage: improve network performance and speed, reduce network congestion, boost network security, control network growth, ease administration.

Your lab submission will be evaluated according to the following rubric.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Letter Grade** | **Qualities Demonstrated by the Lab Submission** | **Grade Assigned** |
| **Answers and Methodology**  **Measures the correctness and completeness of the answers and methodology used for lab steps** | A+ 🡺 100 | The answers, and answer justifications where required, are entirely complete and correct for all steps. The methodologies used to derive the answers are entirely applicable to the given problems, and are implemented correctly, for all steps. There are absolutely no technical or other errors present. |  |
| A 🡺 96 | One insignificant technical or other error is present, but otherwise the answers, and answer justifications where required, are entirely complete and correct for all steps. Excluding the insignificant error, the methodologies used to derive the answers are entirely applicable to the given problems, and are implemented correctly, for all steps. |
| A- 🡺 92 | One or two technical or other errors are present, but otherwise the answers, and answer justifications where required, are entirely complete and correct for all steps. Excluding the one or two errors, the methodologies used to derive the answers are entirely applicable to the given problems, and are implemented correctly, for all steps. |
| B+ 🡺 88 | The answers, and answer justifications where required, are complete and correct for most steps. Likewise, the methodologies used to derive the answers are applicable to the given problems, and are implemented correctly, for most steps. |
| B 🡺 85 | The answers are correct or almost correct for most steps. Some answer justifications may be missing or incorrect, but most are present and correct where required. The methodologies used to derive the answers are applicable and implemented correctly for most steps. |
| B- 🡺 82 | The answers, and answer justifications where required, are complete and correct for about ¾ of the steps. Likewise, the methodologies used to derive the answers are applicable to the given problems, and are implemented correctly, for about ¾ of the steps. |
| C+ 🡺 78 | The answers are correct or almost correct for about ¾ of the steps. Some answer justifications may be missing or incorrect. The methodologies used to derive the answers are applicable to the given problems, and are implemented correctly, for about ¾ of the steps. |
| C 🡺 75 | The answers for about half of the steps are either missing or incorrect. Likewise, the methodologies used for about half of the steps are either inapplicable to the given problem, or are implemented incorrectly. Some answer justifications are missing or incorrect where required. |
| C- 🡺 72 | The answers for most of the steps are either missing or incorrect. Likewise, the methodologies used for most of the steps are either inapplicable to the given problem, or are implemented incorrectly. Some answer justifications are missing or incorrect where required. |
| D 🡺 67 | The answers for almost all of the steps are either missing or incorrect. Likewise, the methodologies used for almost all of the steps are either inapplicable to the given problem, or are implemented incorrectly. Some answer justifications are missing or incorrect where required. |
| F 🡺 0 | The answers for virtually all of the steps are either missing or incorrect. Likewise, the methodologies used for virtually all of the steps are either inapplicable to the given problem, or are implemented incorrectly. Some or all answer justifications are missing or incorrect where required. |

Use the **Ask the Facilitators Discussion Board** if you have any questions regarding how to approach this lab.

Save your assignment as ***lastnameFirstname\_lab3.doc*** and submit it in the *Assignments* section of the course.

For help uploading files please refer to the *Technical Support* page in the syllabus.

* + Use ALTER TABLE statements to add the foreign key constraints to the tables after all of them have been created.