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DCN455

Subnetting Exercise #1

You have been assigned the 132.45.0.0/16 network block.
You need to establish eight subnets.

1 3 _____ binary digits are required to define eight subnets.

2 Specify the extended network prefix that allows the creation of eight subnets.

/19 or 255.255.224.0

3 Express the subnets in binary format and dotted-decimal notation:

#0 10000100.00101101.00000000.00000000 = 132.45.0.0/19

#1 10000100.00101101.00100000.00000000 = 132.45.32.0/19

#2 10000100.00101101.01000000.00000000 = 132.45.64.0/19

#3 10000100.00101101.01100000.00000000 = 132.45.96.0/19

#4 10000100.00101101.10000000.00000000 = 132.45.128.0/19

#5 10000100.00101101.10100000.00000000 = 132.45.160.0/19

#6 10000100.00101101.11000000.00000000 = 132.45.192.0/19

#7 10000100.00101101.11100000.00000000 = 132.45.224.0/19

4 List the range of host addresses that can be assigned to Subnet #3 (132.45.96.0/19).

Subnet #3: 10000100.00101101.01100000.00000000 = 132.45.96.0/19
Host #1: 10000100.00101101.01100000.00000001 = 132.45.96.1/19
Host #2: 10000100.00101101.01100000.00000010 = 132.45.96.2/19
Host #3: 10000100.00101101.01100000.00000011 = 132.45.96.3/19
Host #4: 10000100.00101101.01100000.00000100 = 132.45.96.4/19
Host #8190: 10000100.00101101.01111111.11111110 = 132.45.127.254/19

5 What is the broadcast address for Subnet #3 (132.45.96.0/19)?

10000100.00101101.01111111.11111111= 132.45.127.255/19

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Subnetting Exercise #2

1 Assume that you have been assigned the 200.35.1.0/24 network block. Define an extended network prefix that allows the creation of 20 hosts on each subnet.

five bit need in order to define 20 hosts so the extender network perfix is:
/27 ** 32-5=27**

2 What is the maximum number of hosts that can be assigned to each subnet?

2 ^ 5 - 2 = 30

3 What is the maximum number of subnets that can be defined?

2 ^ 3 = 8

4 Specify the subnets of 200.35.1.0/24 in binary format and dotted-decimal notation.

#0: 11001000.00100011.00000001.00000000 = 200.35.1.0/27
#1: 11001000.00100011.00000001.00100000 = 200.35.1.32/27
#2: 11001000.00100011.00000001.01000000 = 200.35.1.64/27
#3: 11001000.00100011.00000001.01100000 = 200.35.1.96/27
#4: 11001000.00100011.00000001.10000000 = 200.35.1.128/27
#5: 11001000.00100011.00000001.10100000 = 200.35.1.160/27
#6: 11001000.00100011.00000001.11000000 = 200.35.1.192/27
#7: 11001000.00100011.00000001.11100000 = 200.35.1.224/27

5 List the range of host addresses that can be assigned to Subnet #6 (200.35.1.192/27).

Subnet #6: 11001000.00100011.00000001.11000000 = 200.35.1.192/27

#1: 11001000.00100011.00000001.11000001 = 200.35.1.193/27
#2: 11001000.00100011.00000001.11000010 = 200.35.1.193/27
#3: 11001000.00100011.00000001.11000011 = 200.35.1.193/27
#4: 11001000.00100011.00000001.11000100 = 200.35.1.193/27

#29: 11001000.00100011.00000001.11011101 = 200.35.1.193/27
#30: 11001000.00100011.00000001.11011110 = 200.35.1.193/27

6 What is the broadcast address for subnet 200.35.1.192/27?

11001000.00100011.00000001.11011111 = 200.35.1.223

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Subnetting Exercise #3

You have been allocated a 130.16.0.0/16 IP address for the network.
Subnet this into 13 even sized subnets, and allow for the expansion in the near future.
Devise an IP subnet plan, giving the network, first host, last host and broadcast IP addresses for each subnet. Also specify the subnet mask you would use.

Calculation of required number of bits to borrow for subnetting:
130 is a class B address so we can borrow bits from last 2 octets
4 bits borrowed give us (2^4) = 16 subnets (not much room for expansion)
5 bits borrowed give us (2^5) = 32 subnets (plenty room for expansion)
So we choose to borrow 5 bits for the host part of the class B address.
This leaves 11 bits for hosts = 2^{11}-2 hosts = 2046 hosts per subnet (all 0's and all 1's cannot be used)
(In this question, the number of hosts required per subnet has been specified to be of equal-sized but they may be of different as you will see in later labs)

Calculate the subnet mask:
Subnet mask has all 1's in the network+subnet part of the address.
Hence: 11111111 11111111 11111000 00000000
= 255. 255. 248. 0

Calculate all subnet network addresses:
In the 5 bits we have borrowed we count up sequentially from 00000 to 11111
0th subnet = 130.16.00000 000.00000000 = 130.16.0.0
1st subnet = 130.16.00001 000.00000000 = 130.16.8.0
2nd subnet = 130.16.00010 000.00000000 = 130.16.16.0
3rd subnet = 130.16.00011 000.00000000 = 130.16.24.0
4th subnet = 130.16.00100 000.00000000 = 130.16.32.0
5th subnet = 130.16.00101 000.00000000 = 130.16.40.0
6th subnet = 130.16.00110 000.00000000 = 130.16.48.0
7th subnet = 130.16.00111 000.00000000 = 130.16.56.0
8th subnet = 130.16.01000 000.00000000 = 130.16.64.0
9th subnet = 130.16.01001 000.00000000 = 130.16.72.0
10th subnet = 130.16.01010 000.00000000 = 130.16.80.0
11th subnet = 130.16.01011 000.00000000 = 130.16.88.0
12th subnet = 130.16.01100 000.00000000 = 130.16.96.0
13th subnet = 130.16.01101 000.00000000 = 130.16.104.0
14th subnet = 130.16.01110 000.00000000 = 130.16.112.0
15th subnet = 130.16.01111 000.00000000 = 130.16.120.0
16th subnet = 130.16.10000 000.00000000 = 130.16.128.0
17th subnet = 130.16.10001 000.00000000 = 130.16.136.0
18th subnet = 130.16.10010 000.00000000 = 130.16.144.0
19th subnet = 130.16.10011 000.00000000 = 130.16.152.0

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20th subnet = 130.16.10100 000.00000000 = 130.16.160.0
21th subnet = 130.16.10101 000.00000000 = 130.16.168.0
22th subnet = 130.16.10110 000.00000000 = 130.16.176.0
23th subnet = 130.16.10111 000.00000000 = 130.16.184.0
24th subnet = 130.16.11000 000.00000000 = 130.16.192.0
25th subnet = 130.16.11001 000.00000000 = 130.16.200.0
26th subnet = 130.16.11010 000.00000000 = 130.16.208.0
27th subnet = 130.16.11011 000.00000000 = 130.16.216.0
28th subnet = 130.16.11100 000.00000000 = 130.16.224.0
29th subnet = 130.16.11101 000.00000000 = 130.16.232.0
30th subnet = 130.16.11110 000.00000000 = 130.16.240.0
31st subnet = 130.16.11111 000.00000000 = 130.16.248.0

1. Calculate all address of the first host, last host and broadcast on each subnet both in binary and in decimal format. Do for all the subnets (the first one and the last one are done for you).

First host is 1 in the host ID field (11 bits) = 000 00000001
Last host is 1 less than all 1's in the host ID field (11 bits) = 111 11111110
Broadcast is all 1's in the host ID field (11 bits) = 111 11111111

```
Address=     130.16.0.0            10000010.00010000 .00000000.00000000
Netmask=     255.255.0.0           11111111.11111111 .00000000.00000000
Network=     130.16.0.0/16         10000010.00010000 .00000000.00000000 (Class B)
Broadcast=   130.16.255.255        10000010.00010000 .11111111.11111111
First Host=  130.16.0.1            10000010.00010000 .00000000.00000001
Last Host=   130.16.255.254        10000010.00010000 .11111111.11111110
Hosts/Net=   65534

Subnets

Netmask=     255.255.248.0 =  21    11111111.11111111.11111 000.00000000

0th
Network=     130.16.0.0/21         10000010.00010000.00000 000.00000000 (Class B)
Broadcast=   130.16.7.255          10000010.00010000.00000 111.11111111
First Host=  130.16.0.1            10000010.00010000.00000 000.00000001
Last Host=   130.16.7.254          10000010.00010000.00000 111.11111110
Hosts/Net=   2046
1st
Network=     130.16.8.0/21         10000010.00010000.00001 000.00000000 (Class B)
Broadcast=   130.16.15.255         10000010.00010000.00001 111.11111111
First Host=  130.16.8.1            10000010.00010000.00001 000.00000001
Last Host=   130.16.15.254         10000010.00010000.00001 111.11111110
Hosts/Net=   2046
```

2nd
Network: 130.16.16.0/21 10000010.00010000.00010000.00000000 (Class B)
Broadcast: 130.16.23.255 10000010.00010000.00010111.11111111
First Host: 130.16.16.1 10000010.00010000.00010000.00000001
Last Host: 130.16.23.254 10000010.00010000.00010111.11111110
Hosts/Net: 2046

3rd
Network: 130.16.24.0/21 10000010.00010000.00011000.00000000 (Class B)
Broadcast: 130.16.31.255 10000010.00010000.00011111.11111111
First Host: 130.16.24.1 10000010.00010000.00011000.00000001
Last Host: 130.16.31.254 10000010.00010000.00011111.11111110
Hosts/Net: 2046

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4th

Network:	130.16.32.0/21	10000010.00010000.00100000.00000000 (Class B)
Broadcast:	130.16.39.255	10000010.00010000.00100 111.11111111
First Host:	130.16.32.1	10000010.00010000.00100000.00000001
Last Host:	130.16.39.254	10000010.00010000.00100 111.11111110
Hosts/Net:	2046	

5th

Network:	130.16.40.0/21	10000010.00010000.00101 000.00000000 (Class B)
Broadcast:	130.16.47.255	10000010.00010000.00101 111.11111111
First Host:	130.16.40.1	10000010.00010000.00101 000.00000001
Last Host:	130.16.47.254	10000010.00010000.00101 111.11111110
Hosts/Net:	2046	

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28th

Network:	130.16.224.0/21	10000010.00010000.11100 000.00000000 (Class B)
Broadcast:	130.16.231.255	10000010.00010000.11100 111.11111111
First Host:	130.16.224.1	10000010.00010000.11100 000.00000001
Last Host:	130.16.231.254	10000010.00010000.11100 111.11111110
Hosts/Net:	2046	

29th

Network:	130.16.232.0/21	10000010.00010000.11101 000.00000000 (Class B)
Broadcast:	130.16.239.255	10000010.00010000.11101 111.11111111
First Host:	130.16.232.1	10000010.00010000.11101 000.00000001
Last Host:	130.16.239.254	10000010.00010000.11101 111.11111110
Hosts/Net:	2046	

30th

Network:	130.16.240.0/21	10000010.00010000.11110 000.00000000 (Class B)
Broadcast:	130.16.247.255	10000010.00010000.11110 111.11111111
First Host:	130.16.240.1	10000010.00010000.11110 000.00000001
Last Host:	130.16.247.254	10000010.00010000.11110 111.11111110
Hosts/Net:	2046	

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31st

Network=	130.16.248.0/21	10000010.00010000.11111 000.00000000 (Class B)
Broadcast=	130.16.255.255	10000010.00010000.11111 111.11111111
First Host=	130.16.248.1	10000010.00010000.11111 000.00000001
Last Host=	130.16.255.254	10000010.00010000.11111 111.11111110
Hosts/Net=	2046	

Subnets=	32
Hosts=	65472