



# VLSM

Variable-Length Subnet Mask

Workbook

Version 2.0

192.168

192.168.10.96

192.168.10.126

172.31.15.0

10.250.1.0

Student Name:

## IP Address Classes

Class A	1 – 127	(Network 127 is reserved for loopback and internal testing)	Leading bit pattern	0	00000000.00000000.00000000.00000000	Network . Host . Host . Host
Class B	128 – 191	Leading bit pattern	10	10000000.00000000.00000000.00000000	Network . Network . Host . Host	
Class C	192 – 223	Leading bit pattern	110	11000000.00000000.00000000.00000000	Network . Network . Network . Host	
Class D	224 – 239	(Reserved for multicast)				
Class E	240 – 255	(Reserved for experimental, used for research)				

## Private Address Space

Class A	10.0.0.0 to 10.255.255.255
Class B	172.16.0.0 to 172.31.255.255
Class C	192.168.0.0 to 192.168.255.255

## Default Subnet Masks

Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

This workbook assumes you already have a background in subnetting. If you don't you may want to consider completing the [IP Addressing and Subnetting Workbook](#).

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Special Thanks to Melvin Baker and Jim Dorsch  
for taking the time to check this workbook for errors.

### Workbooks included in the series:

IP Addressing and Subnetting Workbooks  
ACLs - Access Lists Workbooks  
VLSM Variable-Length Subnet Mask I Workbooks

# **Classful vs. Classless Subnetting**

When you're subnetting an IP address for a network you have two options: classful and classless. Classful subnetting is the simplest method. It tends to be the most wasteful because it uses more addresses than are necessary. In classful subnetting you use the same subnet mask for each subnet, and all the subnets have the same number of addresses in them.

Classless addressing allows you to use different subnet masks and create subnets tailored to the number of users in each group. This technique is referred to as VLSM, Variable Length Subnet Masks.

## **What is VLSM**

Variable Length Subnet Masks allow you a much tighter control over your addressing scheme. If you use a class C address with a default subnet mask you end up with one subnet containing 256 addresses. By using VLSM you can adjust the number of subnets and number of addresses depending on the specific needs of your network. The same rules apply to a class A or B addresses.

VLSM is supported by the following protocols: RIP version 2, OSPF, EIGRP, Dual IS-IS, and BGP. You need to configure your router for Variable Length Subnet Masks by setting up one of these protocols. Then configure the subnet masks of the various interfaces in the IP address interface sub-command.

## **Benefits of VLSM**

- Allows efficient use of address space
- Allows the use of multiple subnet mask lengths
- Breaks up an address block into smaller custom blocks
- Allows for route summarization
- Provides more flexibility in network design
- Supports hierarchical enterprise networks

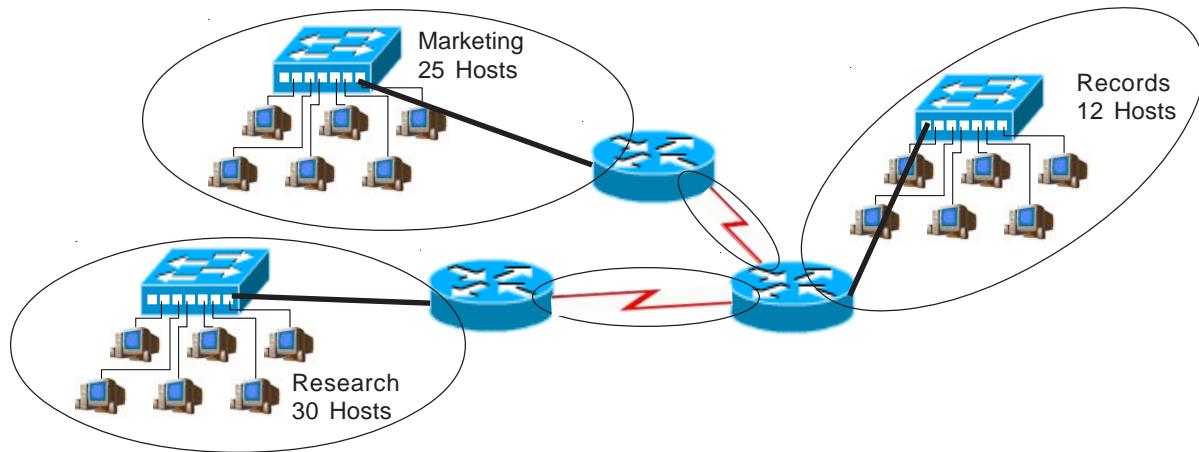
This workbook explores three different methods to figure out sub-subnets: the box method, the circle method, and a VLSM chart.

# Classful Subnetting Example

When you're subnetting an IP address for a network you have two options: classful and classless. Classful subnetting is the simplest method. It also tends to be the most wasteful because it uses more addresses than are necessary. In classful subnetting you use the same subnet mask for each subnet, and all the subnets have the same number of addresses in them.

In this example you need five subnets, each one containing 30 hosts. The serial connections only require two address each so you are wasting 28 usable addresses in each of the serial subnet ranges.

**IP Address: 192.168.1.0**



**The Box Method  
for visualizing subnets**

## Classful Subnet Ranges

192.168.1.0	to	192.168.1.31	/27
192.168.1.32	to	192.168.1.63	/27
192.168.1.64	to	192.168.1.95	/27
192.168.1.96	to	192.168.1.127	/27
192.168.1.128	to	192.168.1.159	/27
192.168.1.160	to	192.168.1.191	/27
192.168.1.192	to	192.168.1.223	/27
192.168.1.224	to	192.168.1.255	/27

/27  
255.255.255.224  
32 Hosts  
8 Subnets

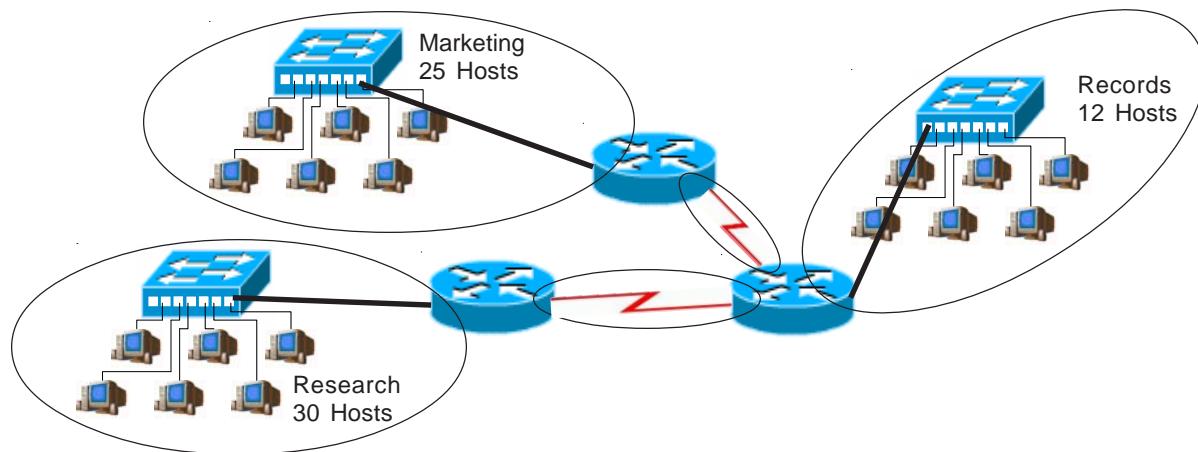
0	32	128	160
31	63	159	191
64	96	192	224
95	127	223	255

## Classless Subnetting Example

Classless addressing allows you to use different subnet masks and create subnets tailored to the number of users in each subnetwork. There are fewer wasted IP addresses using smaller subnets.

In this example you need at total of five subnets, two containing 30 hosts, one containing 12 hosts, and two serial connections that only require two usable addresses each.

**IP Address: 192.168.1.0**

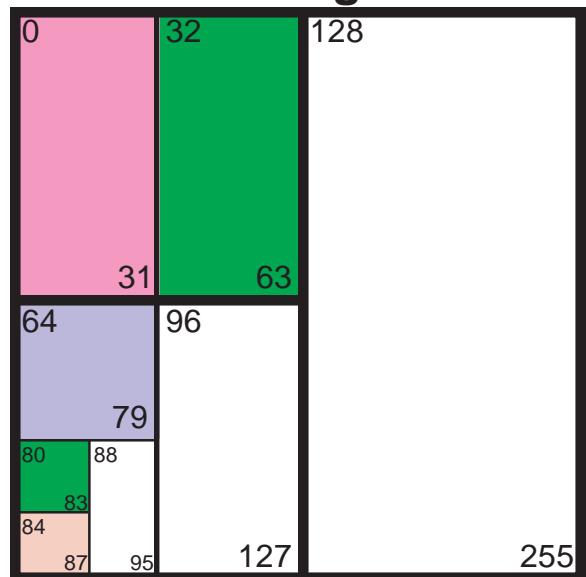


By adjusting the subnet masks you can cut your address usage by almost half in this example. This type of subnetting requires a network protocol which will support it such as: RIP version 2, EIGRP, OSPF, or BGP.

**The Box Method  
for visualizing subnets**

### Classless Subnet Ranges

192.168.1.0	to	192.168.1.31	/27
192.168.1.32	to	192.168.1.63	/27
192.168.1.64	to	192.168.1.79	/28
192.168.1.80	to	192.168.1.82	/30
192.168.1.84	to	192.168.1.87	/30
192.168.1.88	to	192.168.1.95	/29
192.168.1.96	to	192.168.1.127	/27
192.168.1.128	to	192.168.1.255	/25



# Visualizing Subnets Using The Box Method

The box method is a simple way to visualize the breakdown of subnets and addresses into smaller sizes. By shading or coloring in the boxes you can easily break up your subnets without overlapping your addresses. You adjust each subnet to the correct size needed.

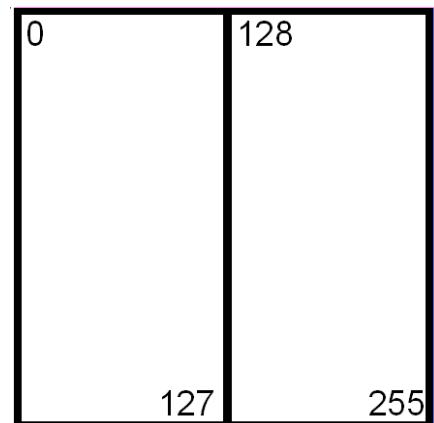
Start with a square. The whole square is a single subnet comprised of 256 addresses.

/24  
255.255.255.0  
256 Hosts  
1 Subnet



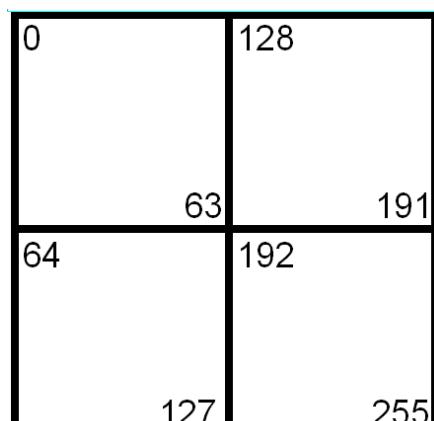
Split the box in half and you get two subnets with 128 addresses.

/25  
255.255.255.128  
128 Hosts  
2 Subnets



Divide the box into quarters and you get four subnets with 64 addresses.

/26  
255.255.255.192  
64 Hosts  
4 Subnets



Split each individual square and you get eight subnets with 32 addresses.

**/27**  
**255.255.255.224**  
**32 Hosts**  
**8 Subnets**

0	32	128	160
31	63	159	191
64	96	192	224
95	127	223	255

Split the boxes in half again and you get sixteen subnets with sixteen addresses.

**/28**  
**255.255.255.240**  
**16 Hosts**  
**16 Subnets**

0	32	128	160
15	47	143	175
16	48	144	176
31	63	159	191
64	96	192	224
79	111	207	239
80	112	208	240
95	127	223	255

The next split gives you thirty two subnets with eight addresses.

**/29**  
**255.255.255.248**  
**8 Hosts**  
**32 Subnets**

0	8	32	40	128	136	160	168
7	15	39	47	135	143	167	175
16	24	48	56	144	152	176	184
23	31	55	63	151	159	183	191
64	72	96	104	192	200	224	232
71	79	103	111	199	207	321	329
80	88	112	120	208	216	240	248
87	95	119	127	215	223	247	255

The last split gives sixty four subnets with four addresses each.

**/30**  
**255.255.255.252**  
**4 Hosts**  
**64 Subnets**

0	8	32	40	128	136	160	168
3	11	35	43	131	139	163	171
4	12	36	44	132	140	164	172
7	15	39	47	135	143	167	175
16	24	48	56	144	152	176	184
19	27	51	59	147	155	179	187
20	28	52	60	148	156	180	188
23	31	55	63	151	159	183	191
64	72	96	104	192	200	224	232
67	75	99	107	195	203	227	235
68	76	100	108	196	204	228	236
71	79	103	111	199	207	231	239
80	88	112	120	208	216	240	248
83	91	115	123	211	219	243	251
84	92	116	124	212	220	244	252
87	95	119	127	215	223	247	255

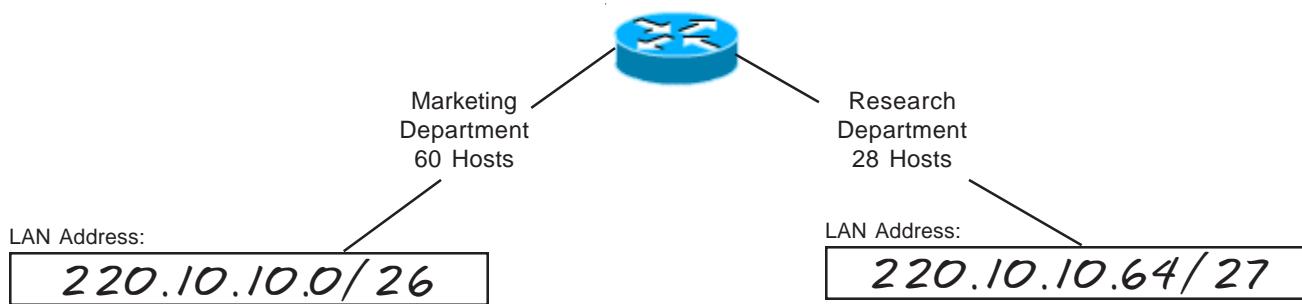
# VLSM Addressing

## Box Method

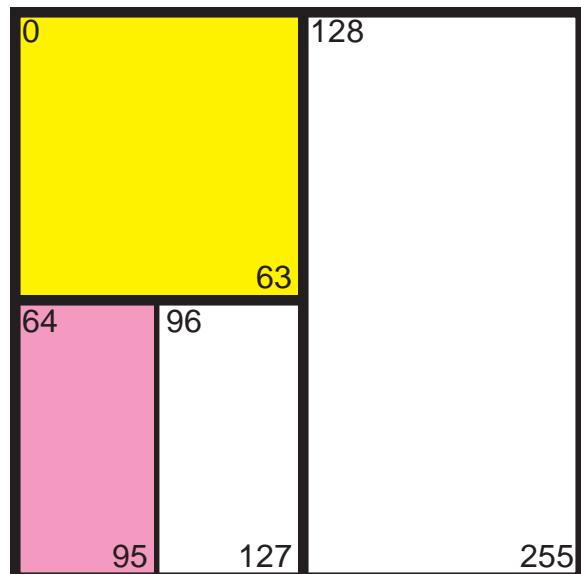
(Sample)

### Problem 1

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the box. This business will be using the class C address 220.10.10.0. Remember to start with your largest groups first.



Color in the squares used with different shades to highlight each subnet.



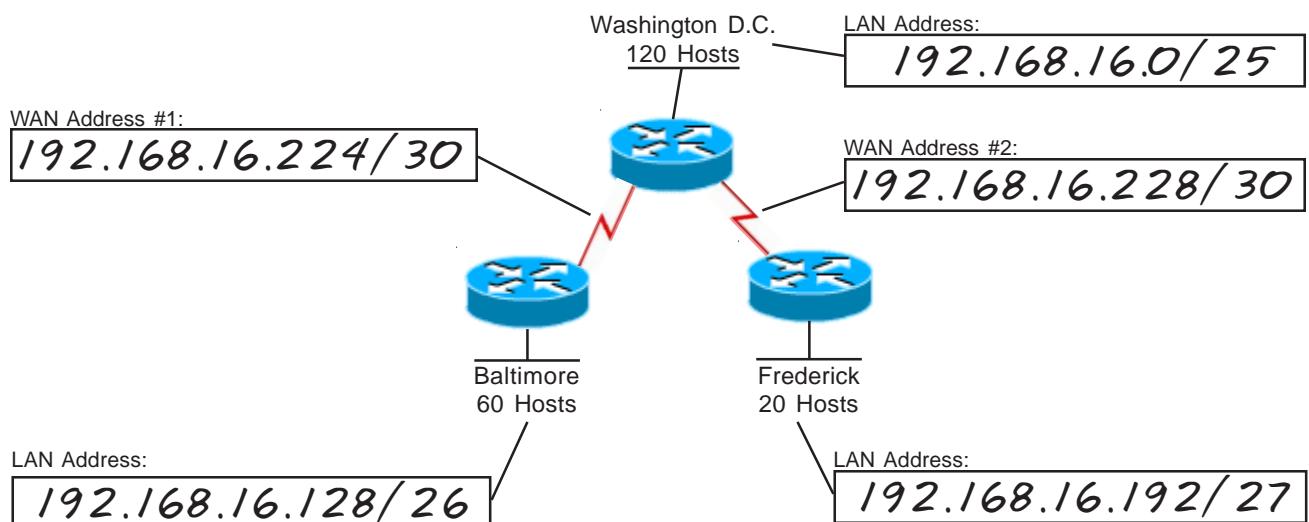
# VLSM Addressing

## Box Method

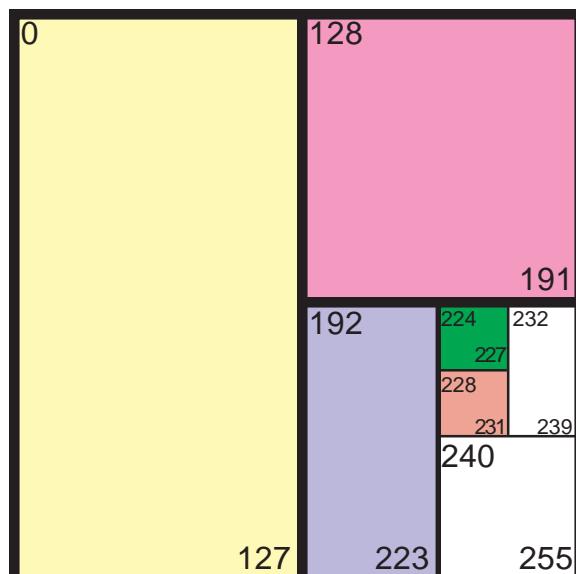
(Sample)

### Problem 2

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the box. This company will be using the class C address 192.168.16.0. Remember to start with your largest groups first.



Color in the squares used with different shades to highlight each subnet.

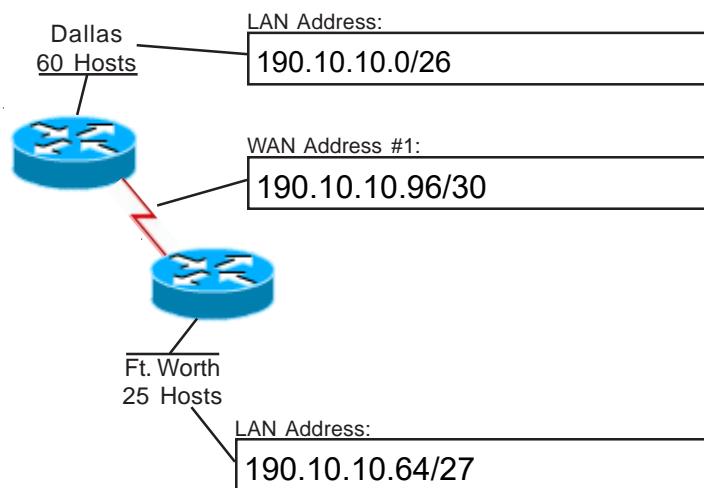


# VLSM Addressing

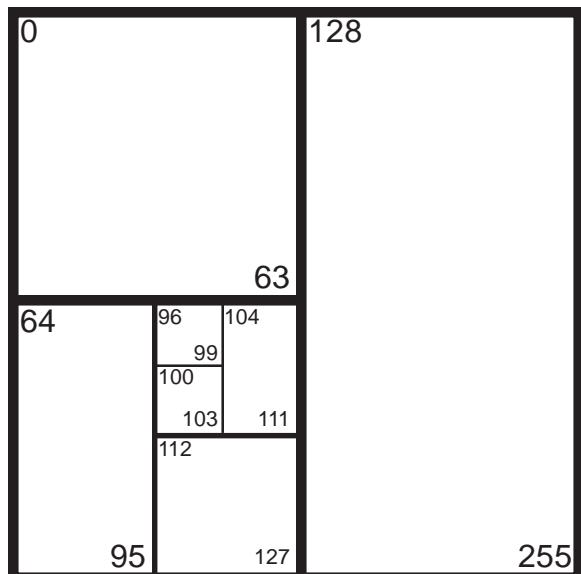
## Box Method

### Problem 3

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the box. This company will be using the class C address 190.10.10.0. Remember to start with your largest groups first.



Color in the squares used with different shades to highlight each subnet.

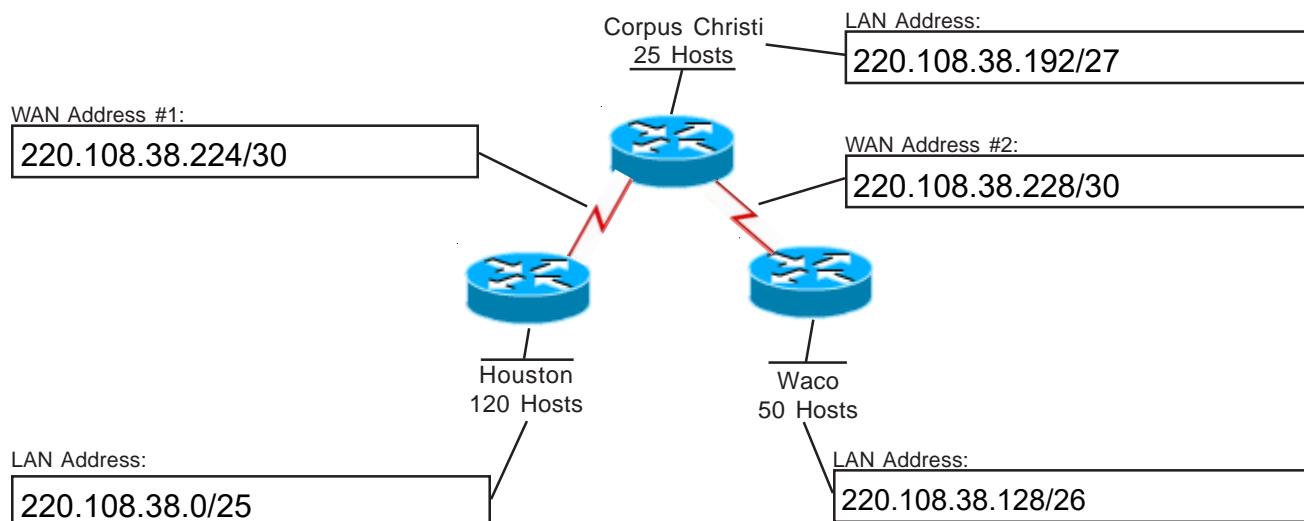


# VLSM Addressing

## Box Method

### Problem 4

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the box. This company will be using the class C address 220.108.38.0. Remember to start with your largest groups first.



Color in the squares used with different shades to highlight each subnet.

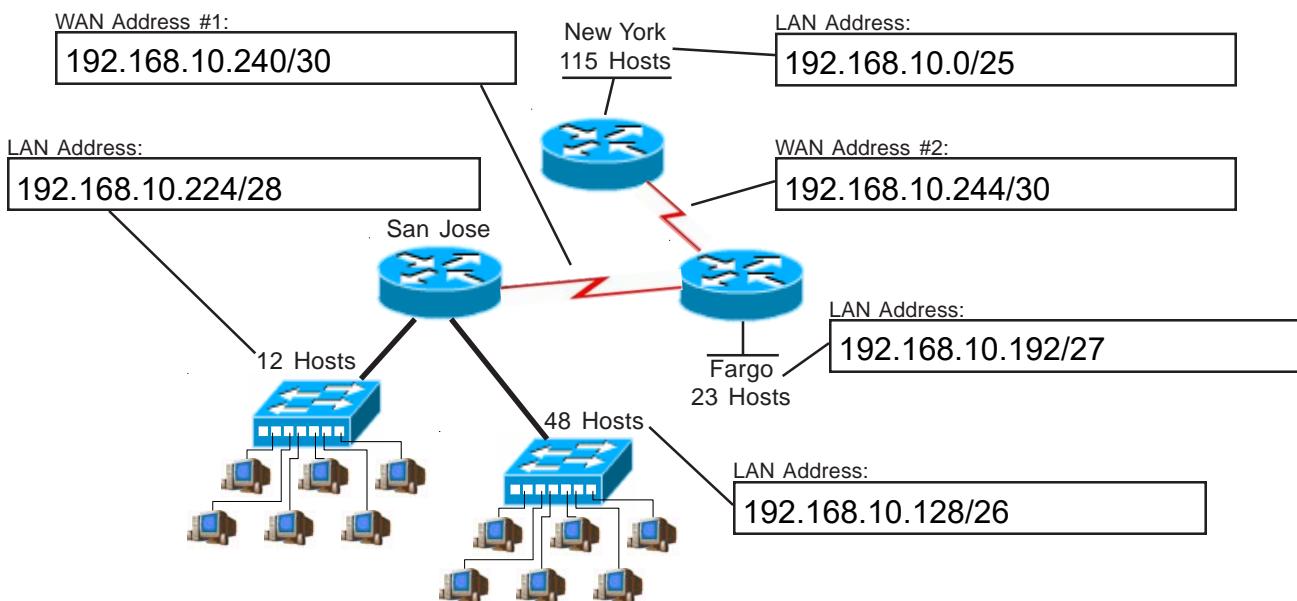
0	8	32	40	128	136	160	168
3	11	35	43	131	139	163	171
4	12	36	44	132	140	164	172
7	15	39	47	135	143	167	175
16	24	48	56	144	152	176	184
19	27	51	59	147	155	179	187
20	28	52	60	148	156	180	188
23	31	55	63	151	159	183	191
64	72	96	104	192	200	224	232
67	75	99	107	195	203	227	235
68	76	100	108	196	204	228	236
71	79	103	111	199	207	231	239
80	88	112	120	208	216	240	248
83	91	115	123	211	219	243	251
84	92	116	124	212	220	244	252
87	95	119	127	215	223	247	255

# VLSM Addressing

## Box Method

### Problem 5

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the box. This company will be using the class C address 192.168.10.0. Remember to start with your largest groups first.



Color in the squares used with different shades to highlight each subnet.

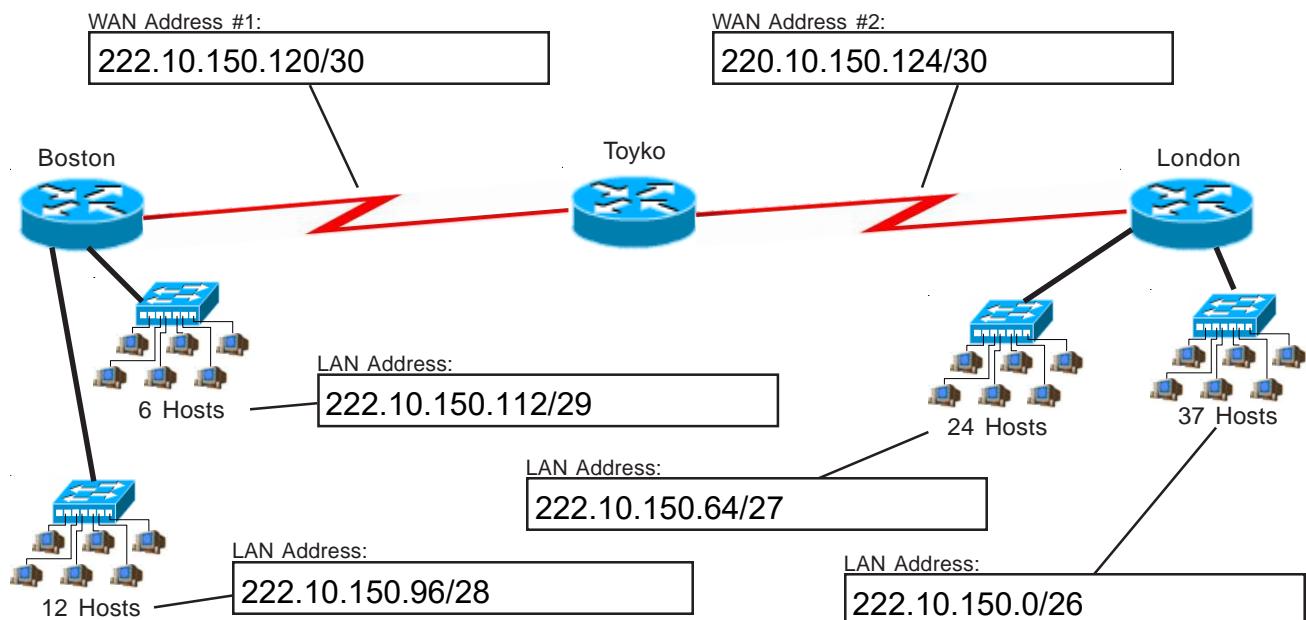
0	8	32	40	128	136	160	168
3	11	35	43	131	139	163	171
4	12	36	44	132	140	164	172
7	15	39	47	135	143	167	175
16	24	48	56	144	152	176	184
19	27	51	59	147	155	179	187
20	28	52	60	148	156	180	188
23	31	55	63	151	159	183	191
64	72	96	104	192	200	224	232
67	75	99	107	195	203	227	235
68	76	100	108	196	204	228	236
71	79	103	111	199	207	231	239
80	88	112	120	208	216	240	248
83	91	115	123	211	219	243	251
84	92	116	124	212	220	244	252
87	95	119	127	215	223	247	255

# VLSM Addressing

## Box Method

### Problem 6

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the box. This company will be using the class C address 222.10.150.0. Remember to start with your largest groups first.



Draw the necessary lines and color in the used squares with different shades to highlight each subnet.

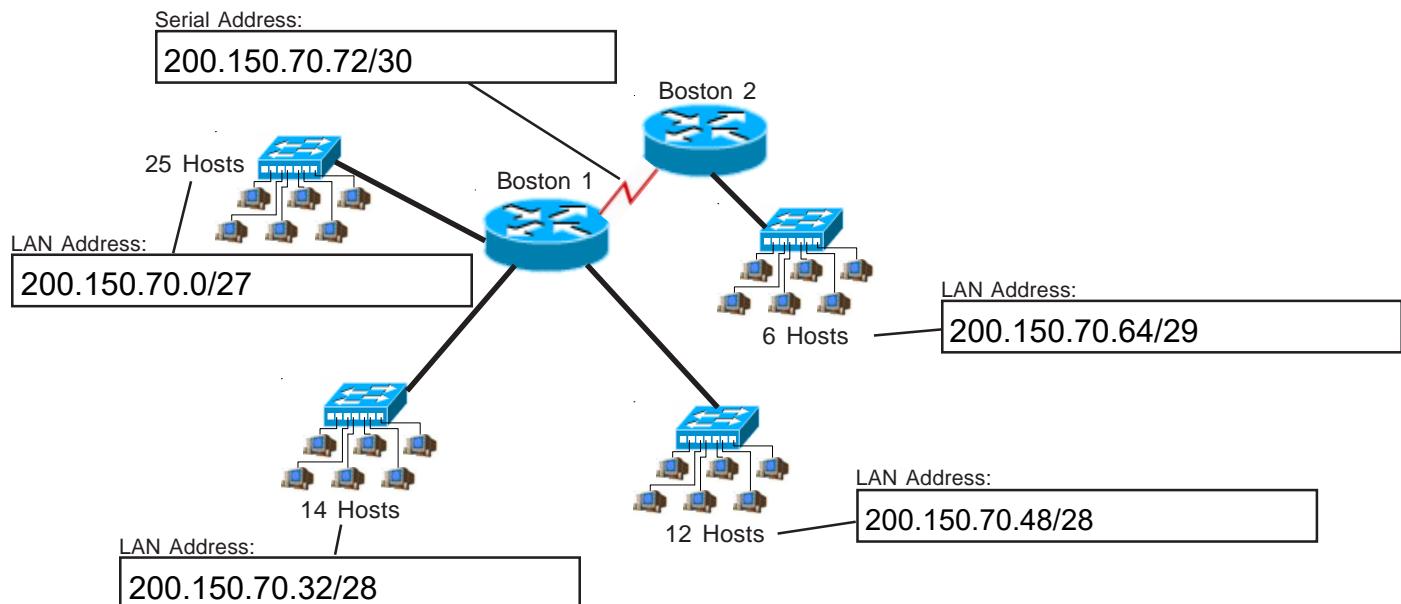
0	32	128	160
31	63	159	191
64	96	192	224
95	127	223	255

# VLSM Addressing

## Box Method

### Problem 7

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and subnet mask in the boxes below, color or shade the sub-subnets used in the box. This company will be using the class C address 200.150.70.0. Remember to start with your largest groups first.



Draw the necessary lines and color in the used squares with different shades to highlight each subnet.

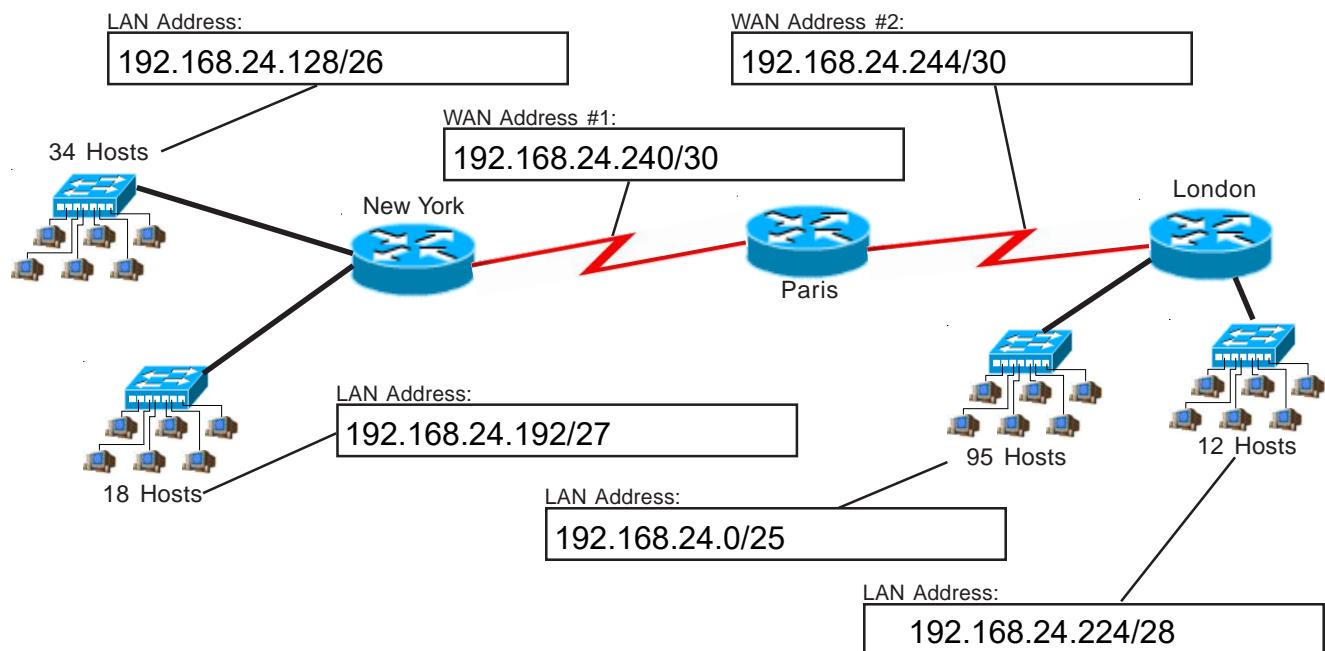
0	128
63	191
64	192
127	255

# VLSM Addressing

## Box Method

### Problem 8

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and subnet mask in the boxes below, color or shade the sub-subnets used in the box. This company will be using the class C address 192.168.24.0. Remember to start with your largest groups first.



Draw the necessary lines and color in the used squares with different shades to highlight each subnet.

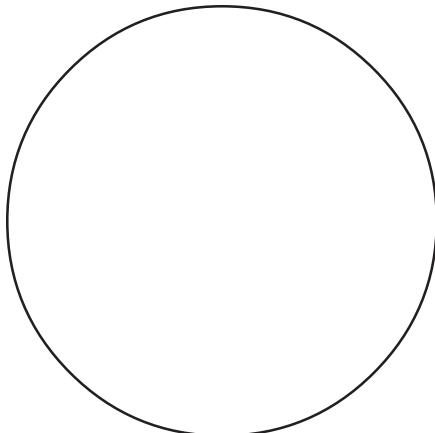
0
255

## Visualizing Subnets Using The Circle Method

The circle method is another method used to visualize the breakdown of subnets and addresses into smaller sizes. By shading or coloring in the different sections of the circle you can easily break up your subnets without overlapping your addresses. You adjust each subnet to the correct size needed.

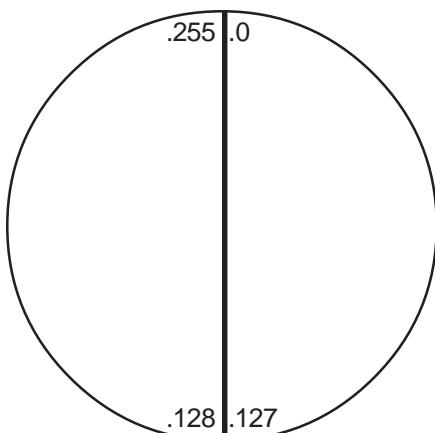
Start with a circle. The whole circle is a single subnet comprised of 256 addresses.

/24  
255.255.255.0  
256 Hosts  
1 Subnet



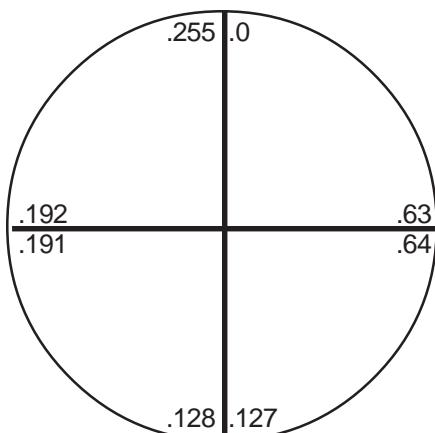
Split the circle in half and you get two subnets with 128 addresses.

/25  
255.255.255.128  
128 Hosts  
2 Subnets



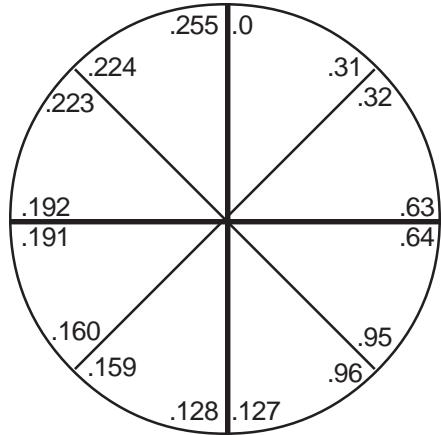
Divide the circle into quarters and you get four subnets with 64 addresses.

/26  
255.255.255.192  
64 Hosts  
4 Subnets



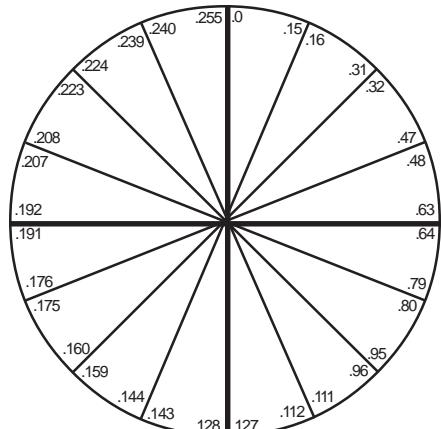
Split each quarter and you get eight subnets with 32 addresses.

**/27**  
**255.255.255.224**  
**32 Hosts**  
**8 Subnets**



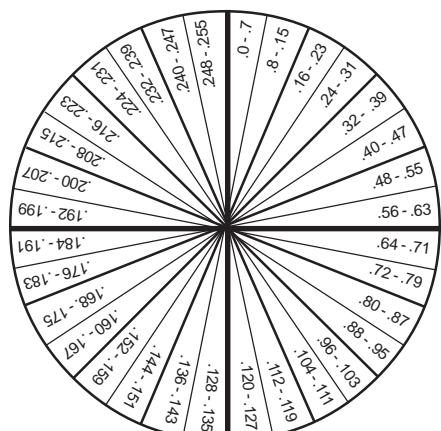
Split the boxes in half again and you get sixteen subnets with sixteen addresses.

**/28**  
**255.255.255.240**  
**16 Hosts**  
**16 Subnets**



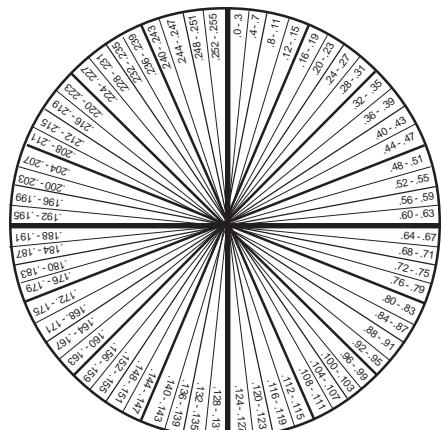
The next split gives you thirty two subnets with eight addresses.

**/29**  
**255.255.255.248**  
**8 Hosts**  
**32 Subnets**



The last split gives sixty four subnets with four addresses each.

**/30**  
**255.255.255.252**  
**4 Hosts**  
**64 Subnets**



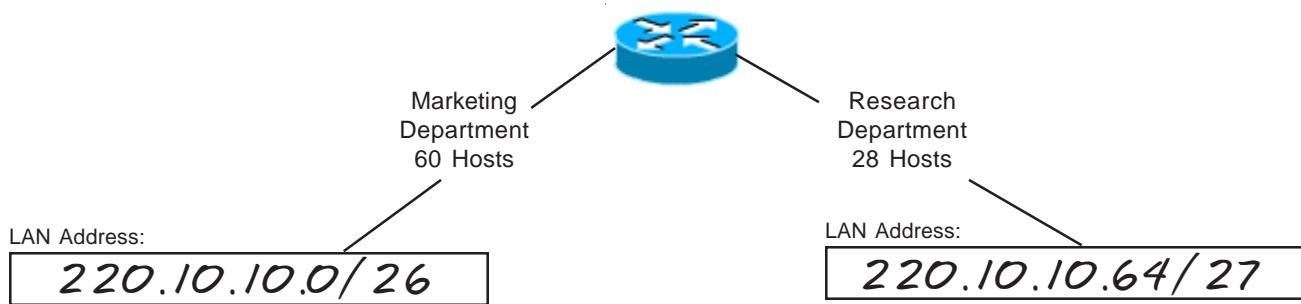
# VLSM Addressing

## Circle Method

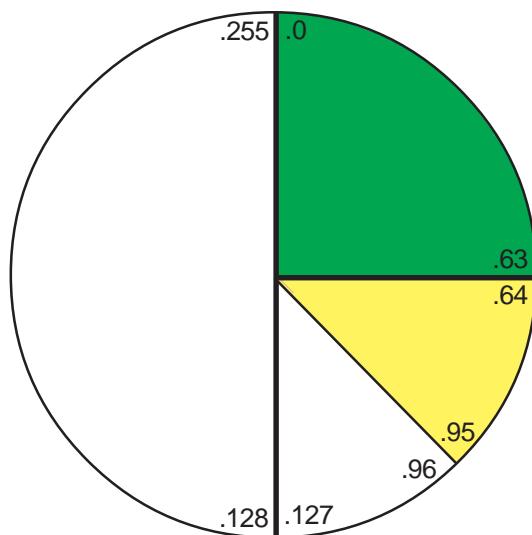
(Sample)

### Problem 9

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the circle below, color or shade the sub-subnets used. This business will be using the class C address 220.10.10.0. Remember to start with your largest groups first.



Color in the necessary circle sections used with different shades to highlight each subnet.



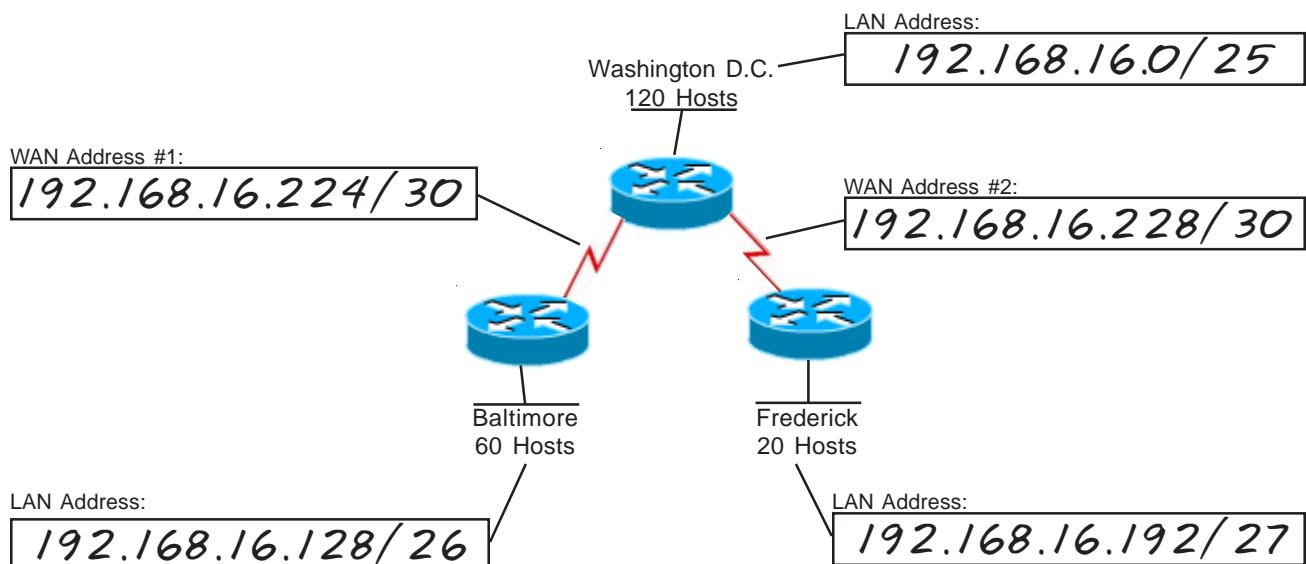
# VLSM Addressing

## Circle Method

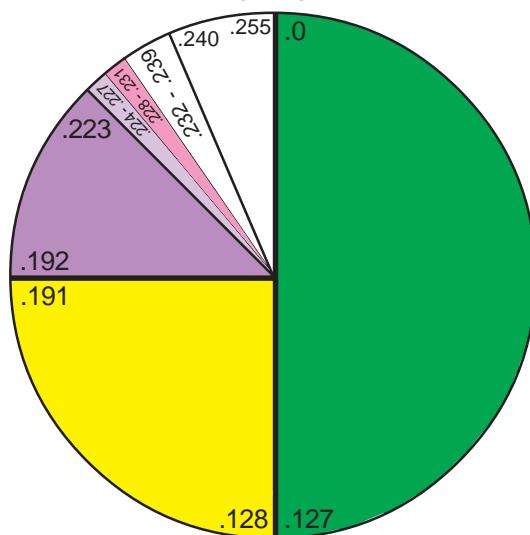
(Sample)

### Problem 10

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the circle below, color or shade the sub-subnets used. This company will be using the class C address 192.168.16.0. Remember to start with your largest groups first.



Color in the necessary circle sections used with different shades to highlight each subnet.

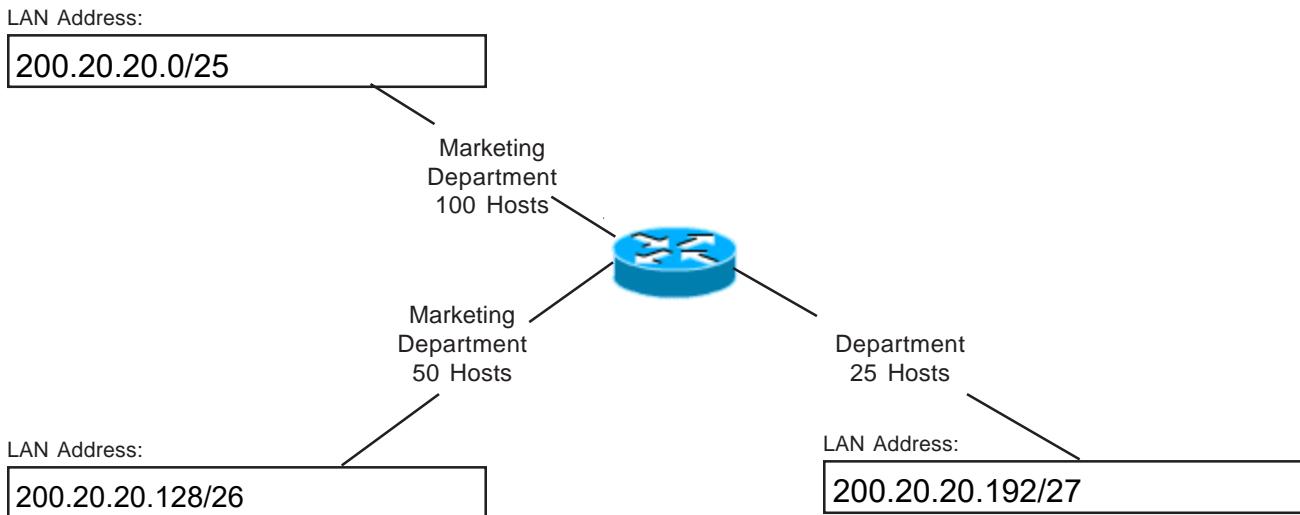


# VLSM Addressing

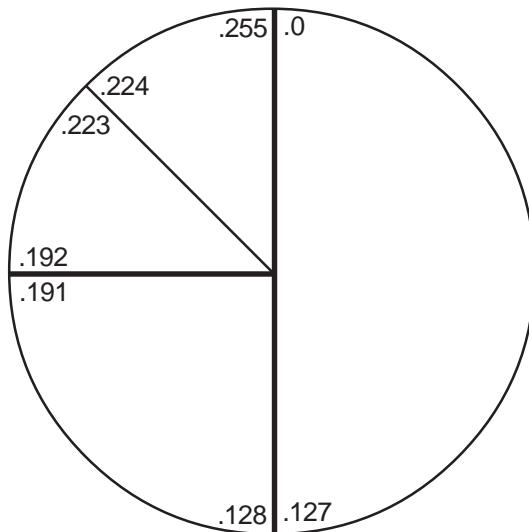
## Circle Method

### Problem 11

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the circle below, color or shade the sub-subnets used. This business will be using the class C address 200.20.20.0. Remember to start with your largest groups first.



Color in the necessary circle sections used with different shades to highlight each subnet.

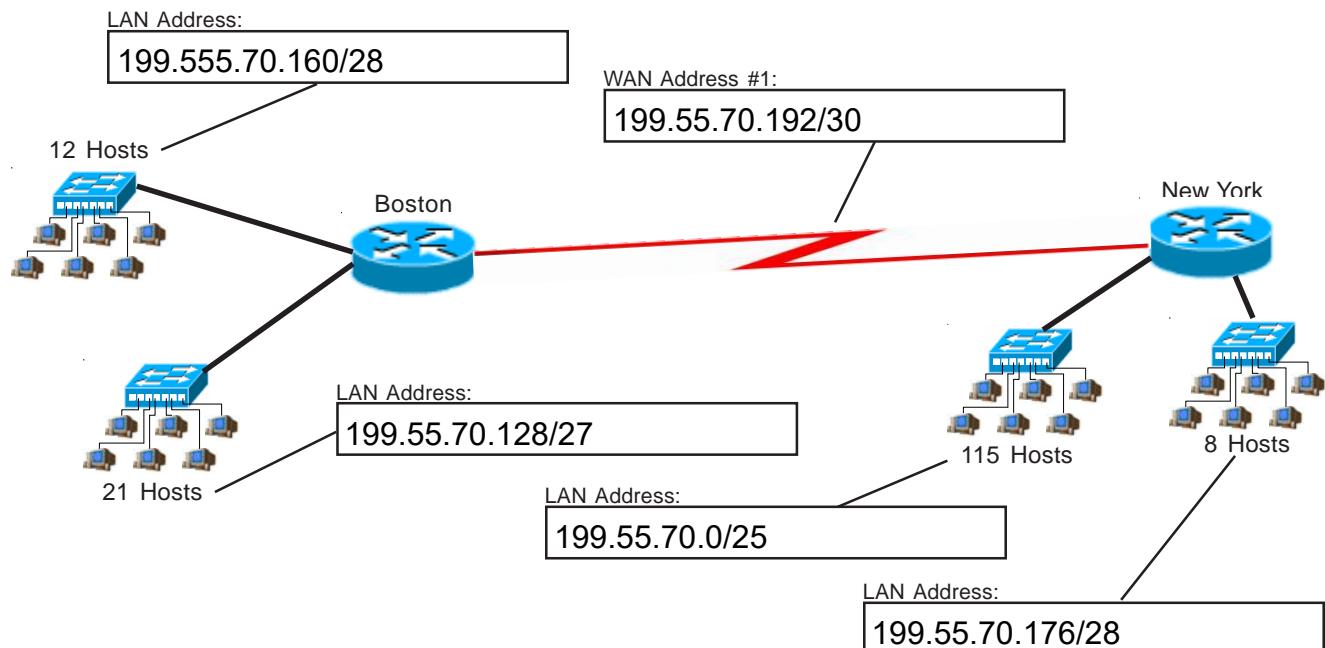


# VLSM Addressing

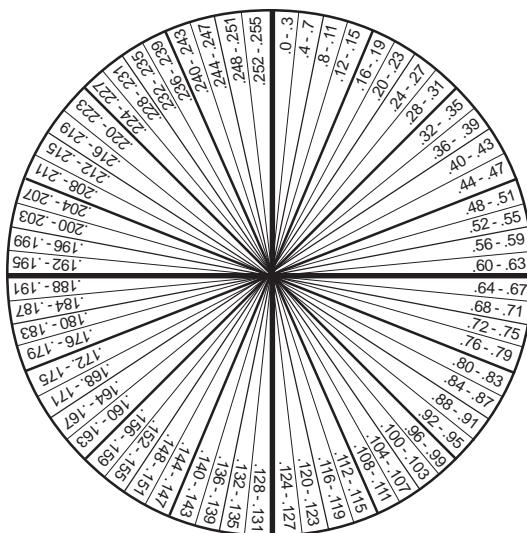
## Circle Method

### Problem 12

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the circle below, color or shade the sub-subnets used. This company will be using the class C address 199.55.70.0. Remember to start with your largest groups first.



Color in the necessary circle sections used with different shades to highlight each subnet.

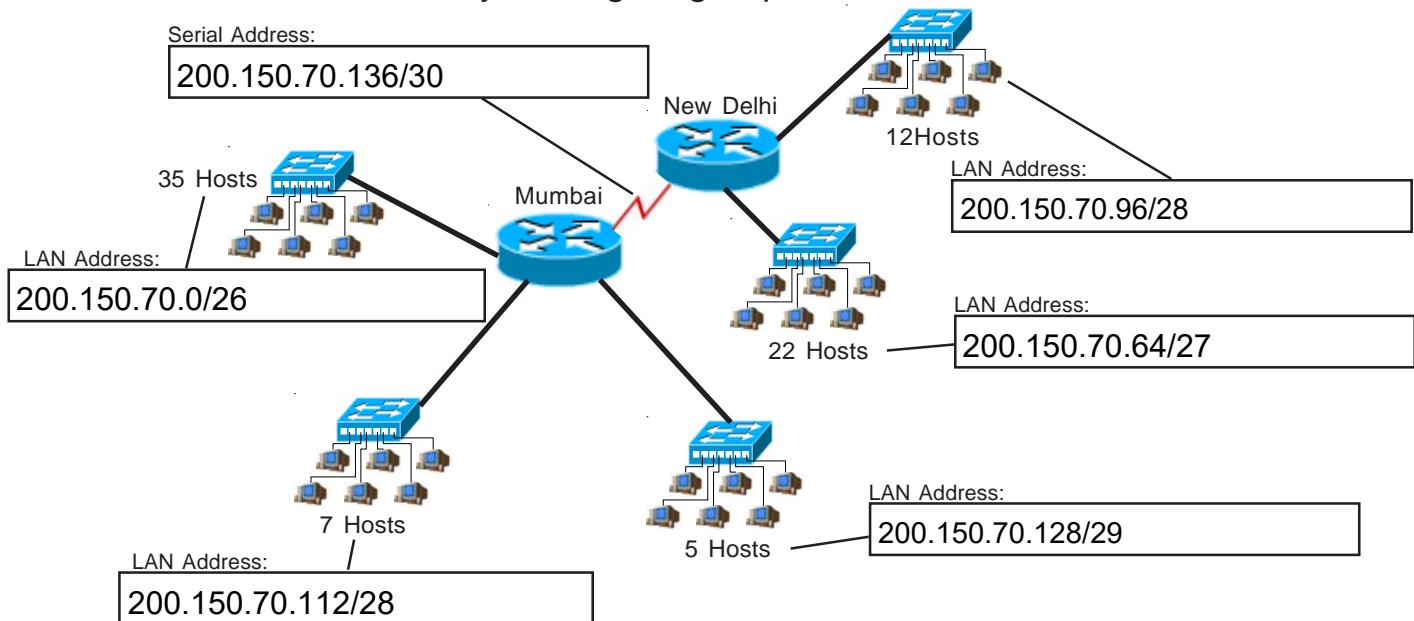


# VLSM Addressing

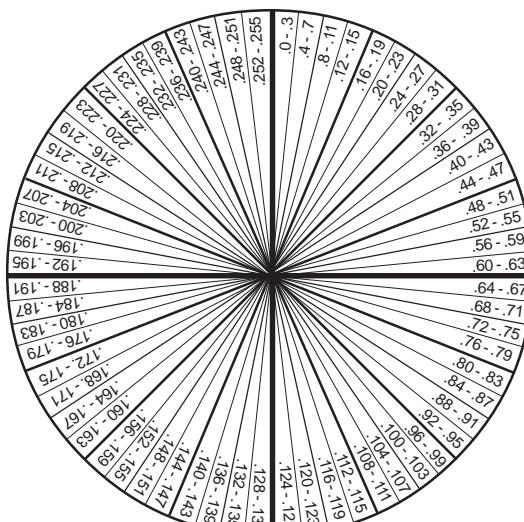
## Circle Method

### Problem 13

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the circle below, color or shade the sub-subnets used. This company will be using the class C address 200.150.70.0. Remember to start with your largest groups first.



Color in the necessary circle sections used with different shades to highlight each subnet.

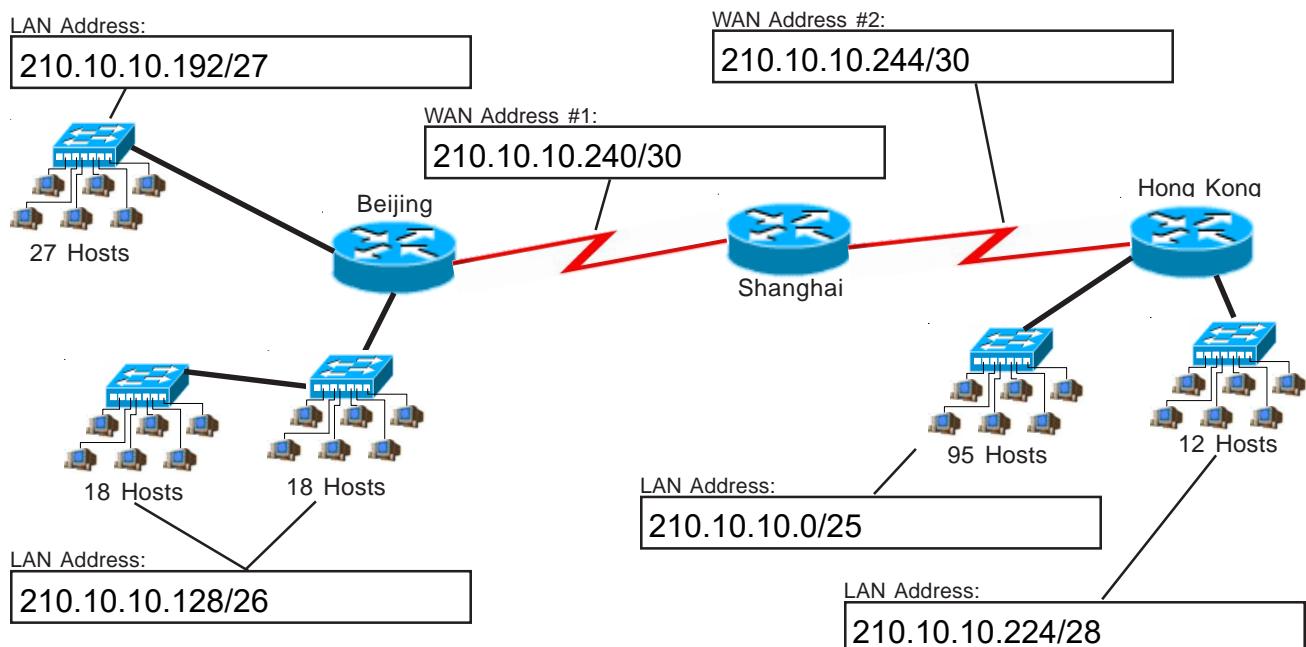


# VLSM Addressing

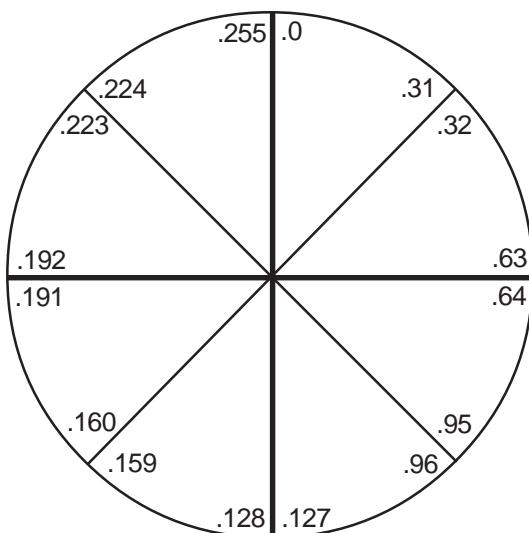
## Circle Method

### Problem 14

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the circle below, color or shade the sub-subnets used. This company will be using the class C address 210.10.10.0. Remember to start with your largest groups first.



Draw the necessary lines and color in the used circle sections with different shades to highlight each subnet.

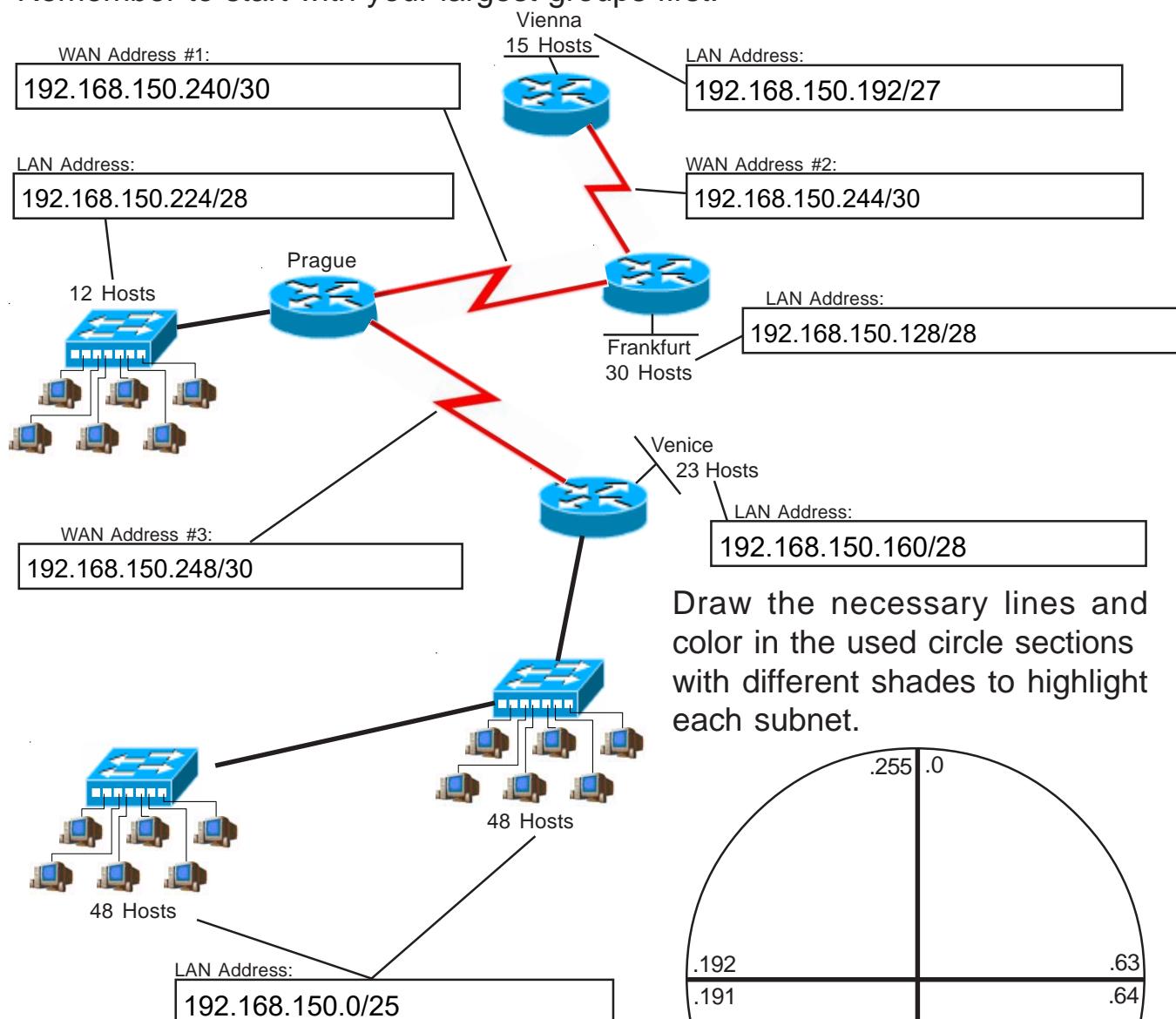


# VLSM Addressing

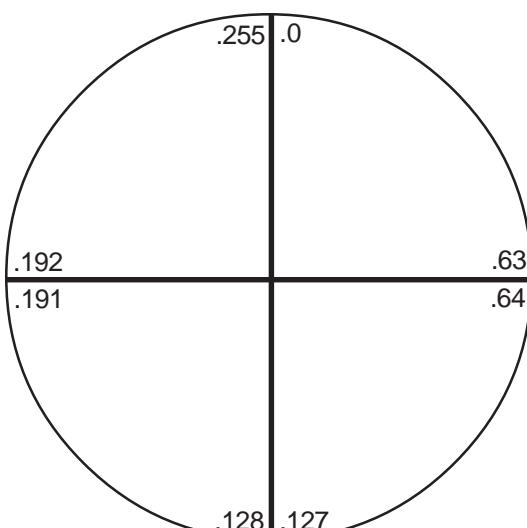
## Circle Method

### Problem 15

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the circle. This company will be using the class C address 192.168.150.0. Remember to start with your largest groups first.



Draw the necessary lines and color in the used circle sections with different shades to highlight each subnet.

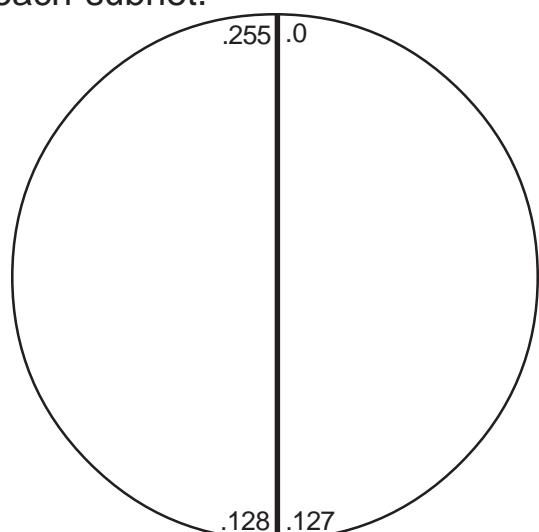
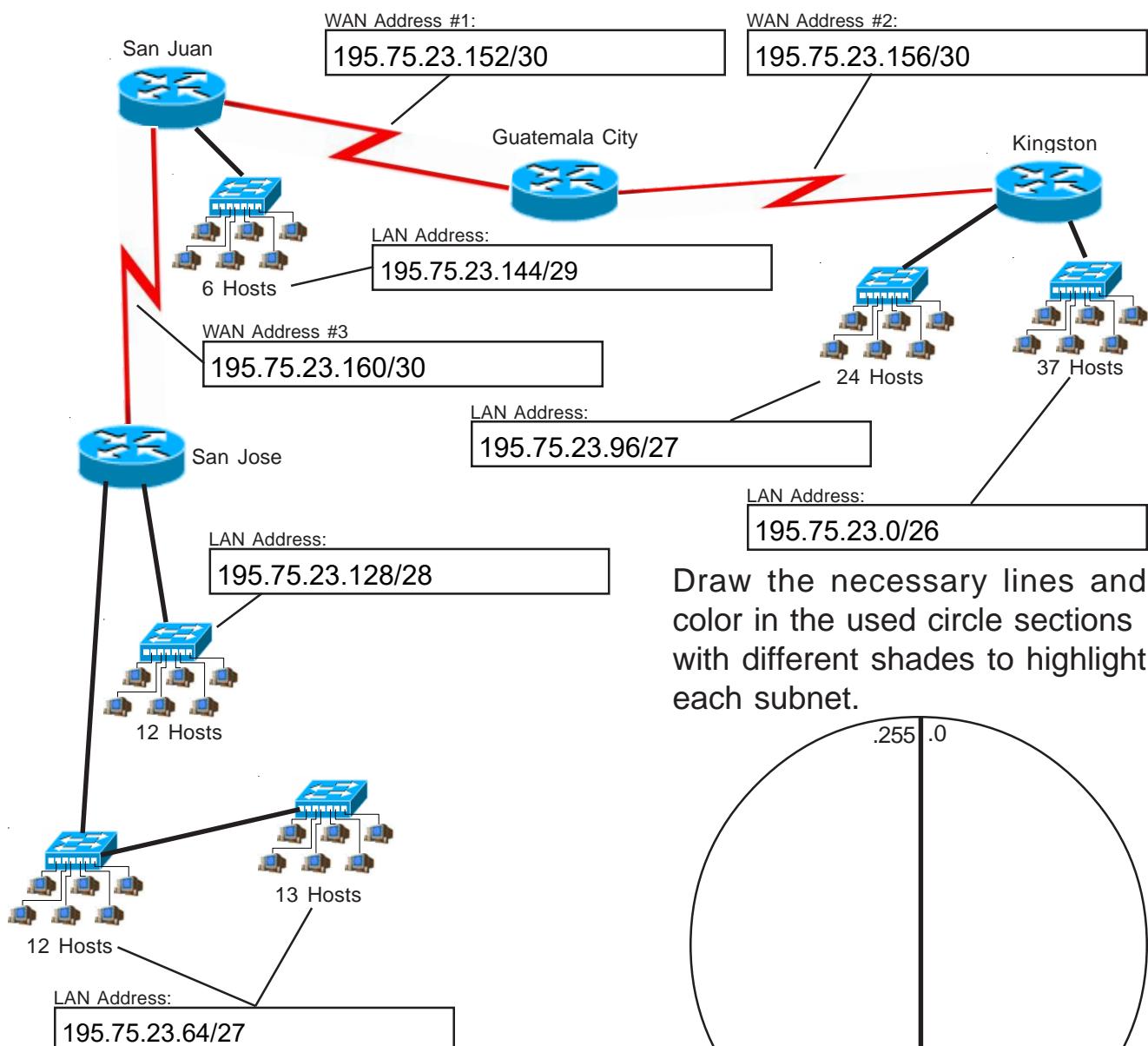


# VLSM Addressing

## Circle Method

### Problem 16

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the circle. This company will be using the class C address 195.75.23.0. Remember to start with your largest groups first.



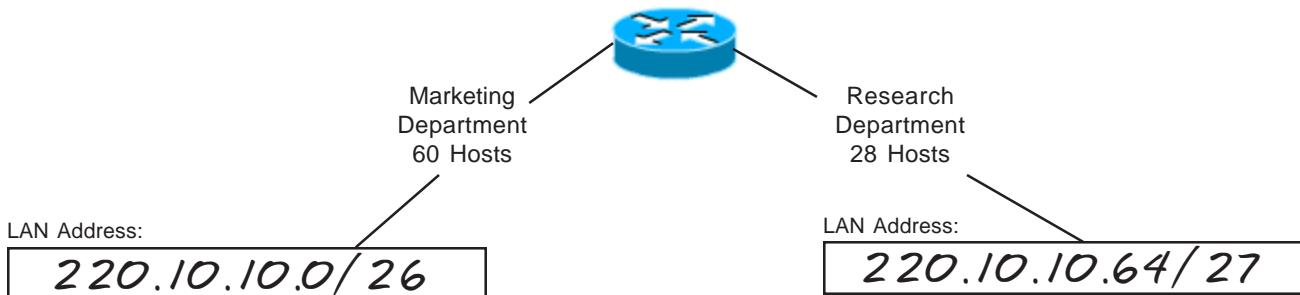
# Visualizing Subnets Using a VLSM Chart

The VLSM chart is the third method used to visualize the breakdown of subnets and addresses into smaller sizes. By shading or coloring in the boxes you can easily break up your subnets without overlapping your addresses. You can adjust each sub-subnet to the correct size needed.

## VLSM Addressing VLSM Chart Method (Sample)

### Problem 17

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This business will be using the class C address 220.10.10.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0-127	0-63	0-31	0-15	0-7	0-3	0-3
64-127	64-95	32-63	8-15	8-15	4-7	4-7
128-255	128-191	160-191	16-31	16-23	8-11	8-11
192-255	192-223	208-223	24-31	24-31	12-15	12-15
224-255	224-239	224-239	32-39	32-39	16-19	16-19
			40-47	40-47	20-23	20-23
			48-55	48-55	24-27	24-27
			56-63	56-63	28-31	28-31
			64-71	64-71	32-35	32-35
			72-79	72-79	36-39	36-39
			80-87	80-87	40-43	40-43
			88-95	88-95	44-47	44-47
			96-103	96-103	48-51	48-51
			104-111	104-111	52-55	52-55
			112-119	112-119	56-59	56-59
			120-127	120-127	60-63	60-63
			128-135	128-135	64-67	64-67
			136-143	136-143	68-71	68-71
			144-151	144-151	72-75	72-75
			152-159	152-159	76-79	76-79
			160-167	160-167	80-83	80-83
			168-175	168-175	84-87	84-87
			176-183	176-183	88-91	88-91
			184-191	184-191	92-95	92-95
			192-199	192-199	96-99	96-99
			200-207	200-207	100-103	100-103
			208-215	208-215	104-107	104-107
			216-223	216-223	108-111	108-111
			224-231	224-231	112-115	112-115
			232-239	232-239	116-119	116-119
			240-247	240-247	120-123	120-123
			248-255	248-255	124-127	124-127
					128-131	128-131
					132-135	132-135
					136-139	136-139
					140-143	140-143
					144-147	144-147
					148-151	148-151
					152-155	152-155
					156-159	156-159
					160-163	160-163
					164-167	164-167
					168-171	168-171
					172-175	172-175
					176-179	176-179
					180-183	180-183
					184-187	184-187
					188-191	188-191
					192-195	192-195
					196-199	196-199
					200-203	200-203
					204-207	204-207
					208-211	208-211
					212-215	212-215
					216-219	216-219
					220-223	220-223
					224-227	224-227
					228-231	228-231
					232-235	232-235
					236-239	236-239
					240-243	240-243
					244-247	244-247
					248-251	248-251
					252-255	252-255

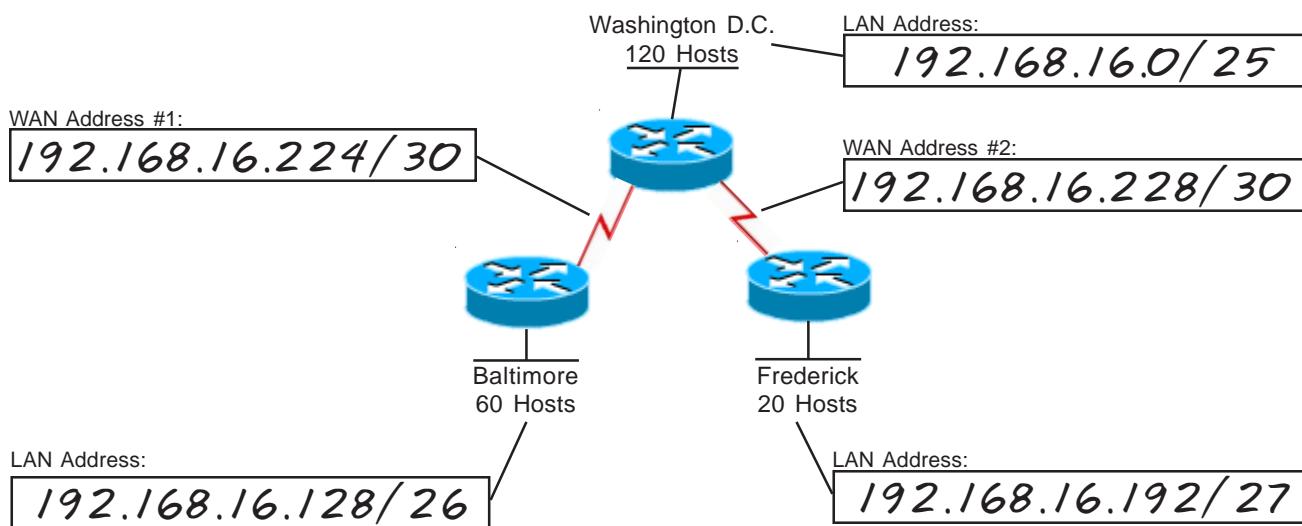
# VLSM Addressing

## VLSM Chart Method

(Sample)

### **Problem 18**

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This company will be using the class C address 192.168.16.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

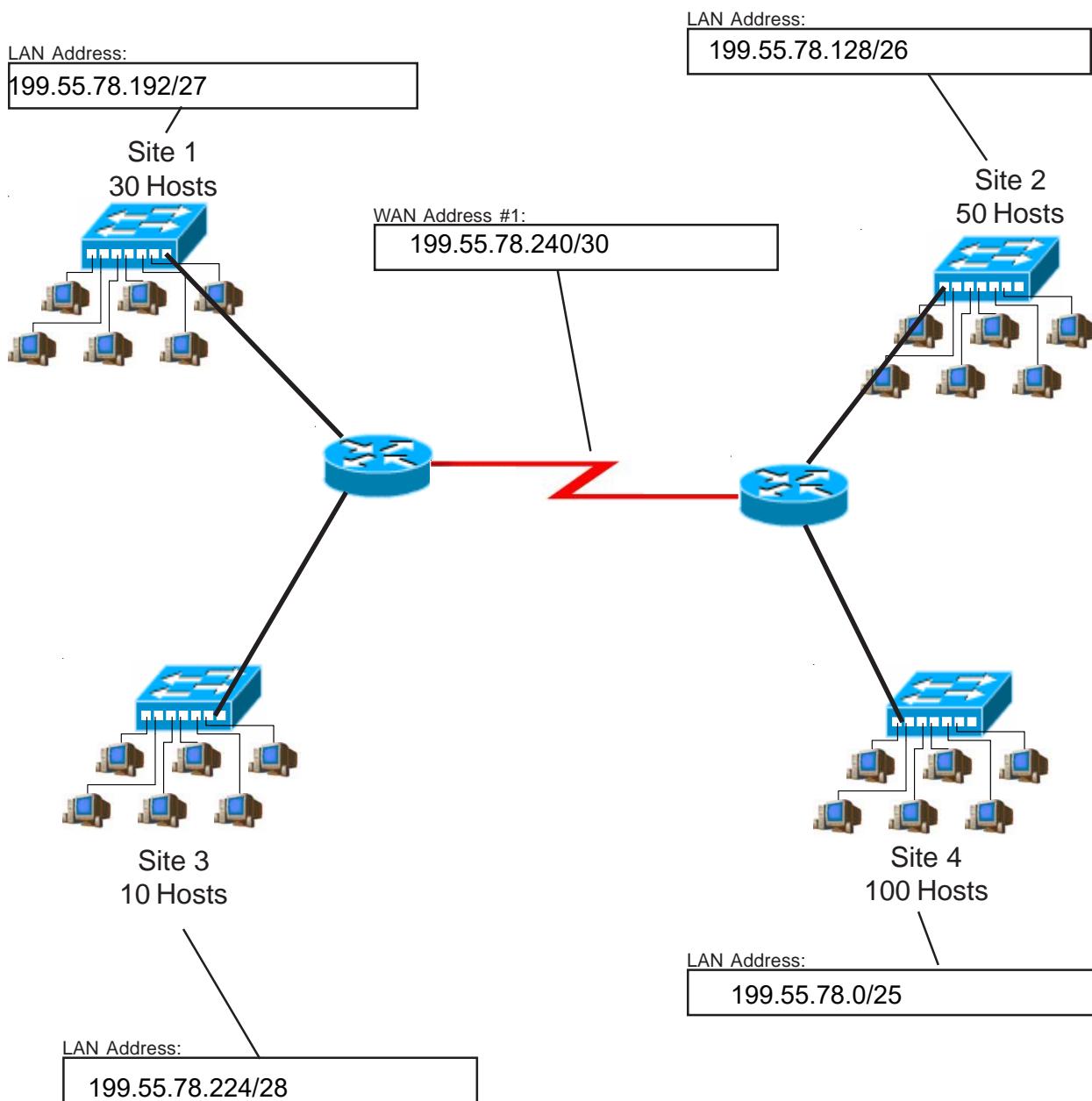
<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
128-255	128-191	32-63	16-31	8-15	8-11	4-7
192-255	192-223	48-63	24-31	16-23	12-15	11-15
224-255	224-239	56-63	32-39	32-47	20-23	16-19
		48-55	40-47	48-51	24-27	16-19
		56-63	48-55	52-55	28-31	16-19
		64-95	64-79	64-71	32-35	0-3
	64-127	80-95	72-79	72-75	36-39	4-7
		96-111	80-87	80-83	40-43	11-15
		96-127	88-95	88-91	44-47	11-15
		128-159	96-103	96-99	48-51	11-15
		144-159	104-111	100-103	52-55	11-15
		160-191	112-119	104-107	56-59	11-15
		176-191	120-127	108-111	60-63	11-15
				112-119	120-123	11-15
				116-119	124-127	11-15
				120-127	128-131	11-15
				128-135	132-135	11-15
				136-143	136-139	11-15
				144-151	140-143	11-15
				152-159	144-147	11-15
				160-167	148-151	11-15
				168-175	152-155	11-15
				176-183	156-159	11-15
				184-191	160-163	11-15
				192-199	164-167	11-15
				200-207	168-171	11-15
				208-215	172-175	11-15
				216-223	176-179	11-15
				224-231	180-183	11-15
				232-239	184-187	11-15
				240-247	188-191	11-15
				248-255	192-195	11-15
					196-199	11-15
					200-203	11-15
					204-207	11-15
					208-211	11-15
					212-215	11-15
					216-219	11-15
					220-223	11-15
					224-227	11-15
					228-231	11-15
					232-235	11-15
					236-239	11-15
					240-243	11-15
					244-247	11-15
					248-251	11-15
					252-255	11-15

# VLSM Addressing

## VLSM Chart Method

### Problem 19

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This company will be using the class C address 199.55.78.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

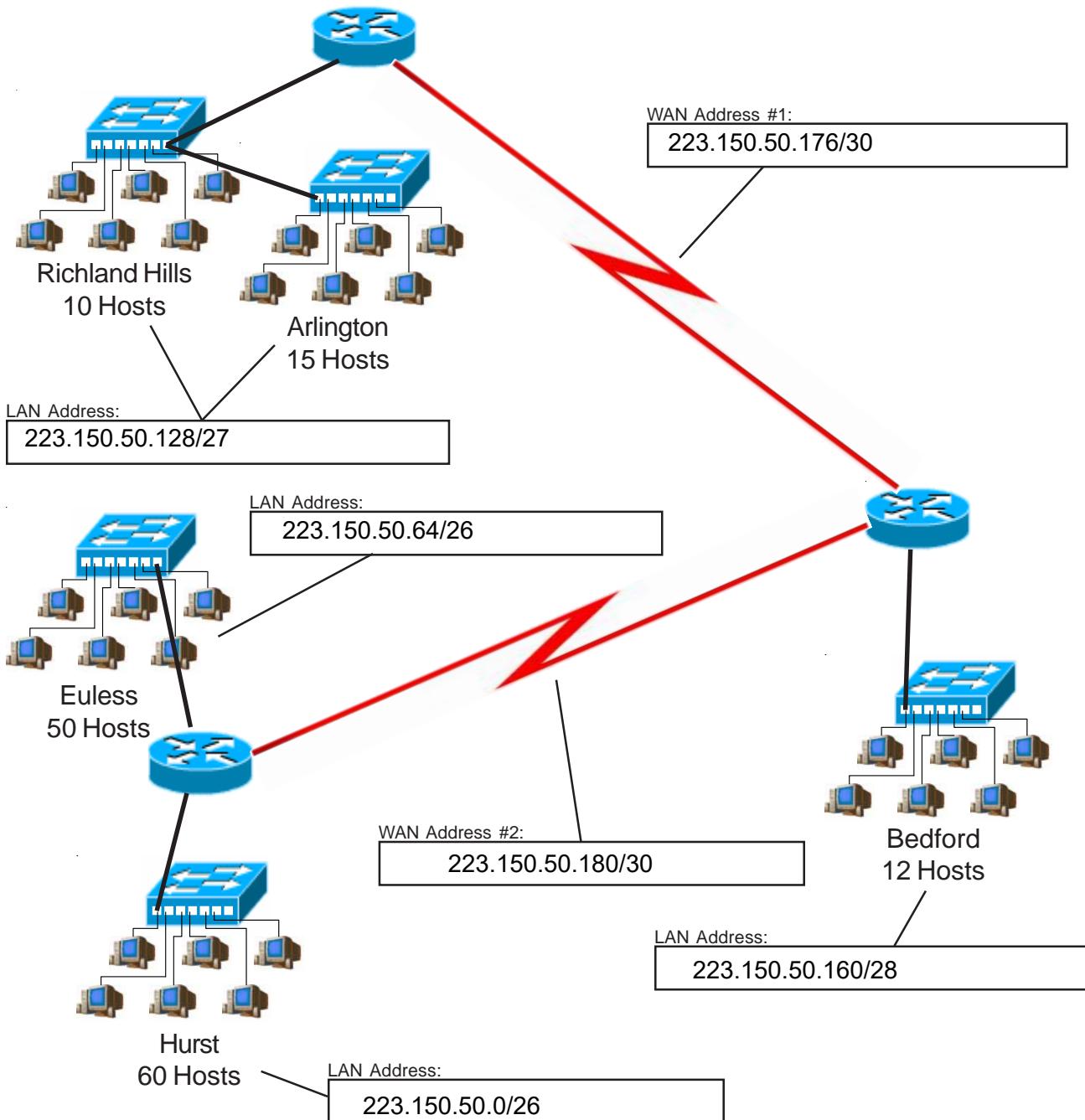
<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255						
0-127						
0-63			0-31	0-15	0-7	0-3 4-7
64-127			32-63	16-31	8-15 16-23	8-11 12-15 16-19 20-23
128-255			64-95	32-47	24-31	24-27 28-31 32-35 36-39
192-255			80-95	40-47	32-39 48-55	40-43 44-47 48-51 52-55 56-59 60-63
192-255			96-127	64-79	64-71 72-79	64-67 68-71 72-75 76-79
192-255			128-191	96-111	80-87 88-95	80-83 84-87 88-91 92-95
192-255			160-191	128-143	96-103 104-111	96-99 100-103 104-107 108-111
192-255			192-223	144-159	112-119 120-127	112-115 116-119 120-123 124-127
192-255			208-223	160-175	128-135 136-143 144-151 152-159	128-131 132-135 136-139 140-143
192-255			224-255	176-191	16-167 168-175 176-183 184-191	160-163 164-167 168-171 172-175 176-179 180-183 184-187 188-191
192-255			224-255	192-207	192-199 200-207	192-195 196-199 200-203 204-207
192-255			224-255	208-223	208-215 216-223	208-211 212-215 216-219 220-223
192-255			224-255	224-239	224-231 232-239	224-227 228-231 232-235 236-239
192-255			224-255	240-255	240-247	240-243 244-247 248-251 252-255

# VLSM Addressing

## VLSM Chart Method

### Problem 20

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This company will be using the class C address 223.150.50.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

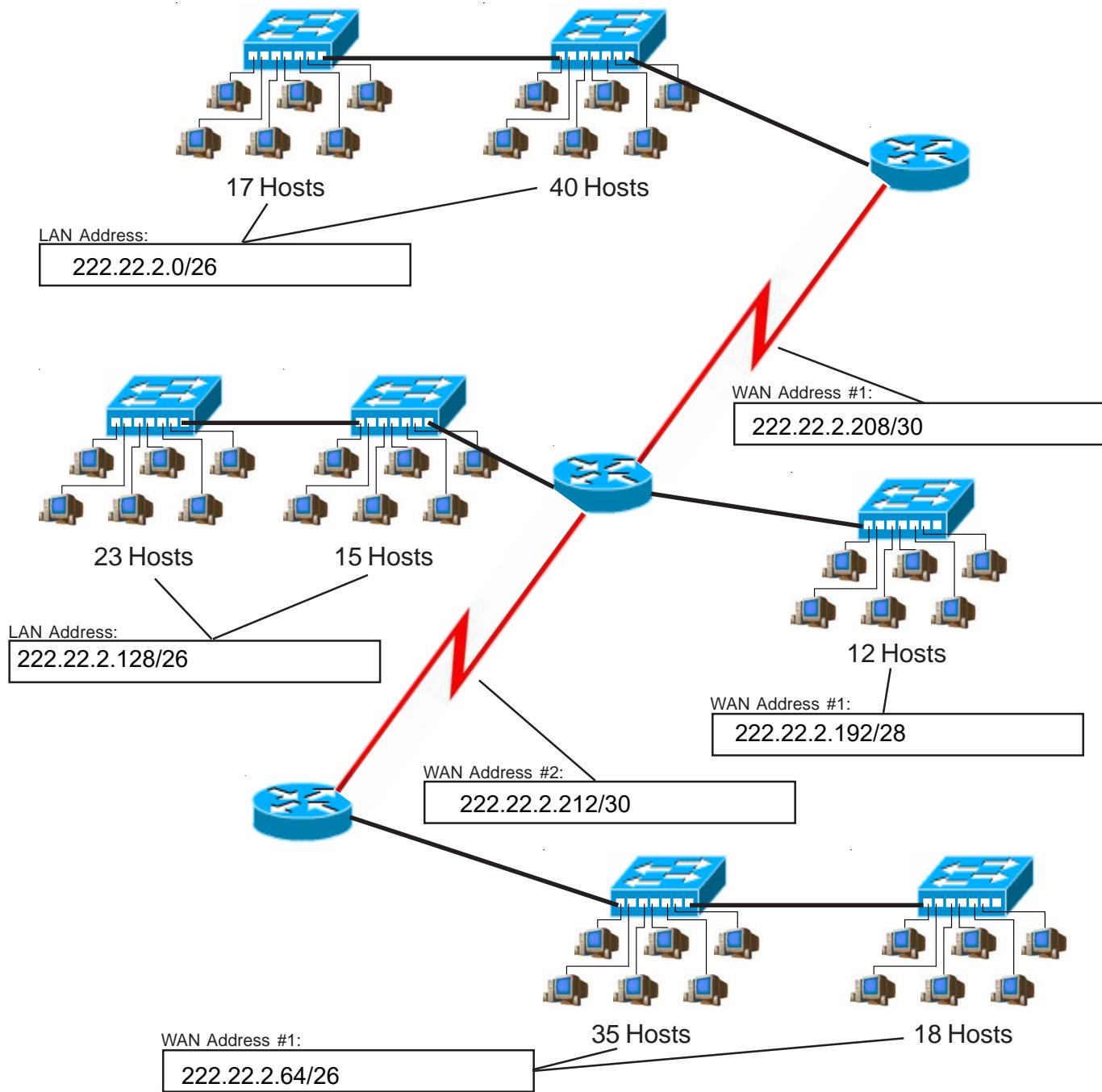
<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255						
0-127						
0-63			0-31	0-15	0-7	0-3
					8-15	4-7
						8-11
						12-15
						16-19
						20-23
						24-27
						28-31
						32-35
						36-39
						40-43
						44-47
						48-51
						52-55
						56-59
						60-63
						64-67
						68-71
						72-75
						76-79
						80-83
						84-87
						88-91
						92-95
						96-99
						100-103
						104-107
						108-111
						112-115
						116-119
						120-123
						124-127
						128-131
						132-135
						136-139
						140-143
						144-147
						148-151
						152-155
						156-159
						160-163
						164-167
						168-171
						172-175
						176-179
						180-183
						184-187
						188-191
						192-195
						196-199
						200-203
						204-207
						208-211
						212-215
						216-219
						220-223
						224-227
						228-231
						232-235
						236-239
						240-243
						244-247
						248-251
						252-255

# VLSM Addressing

## VLSM Chart Method

### Problem 21

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This company will be using the class C address 222.22.2.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

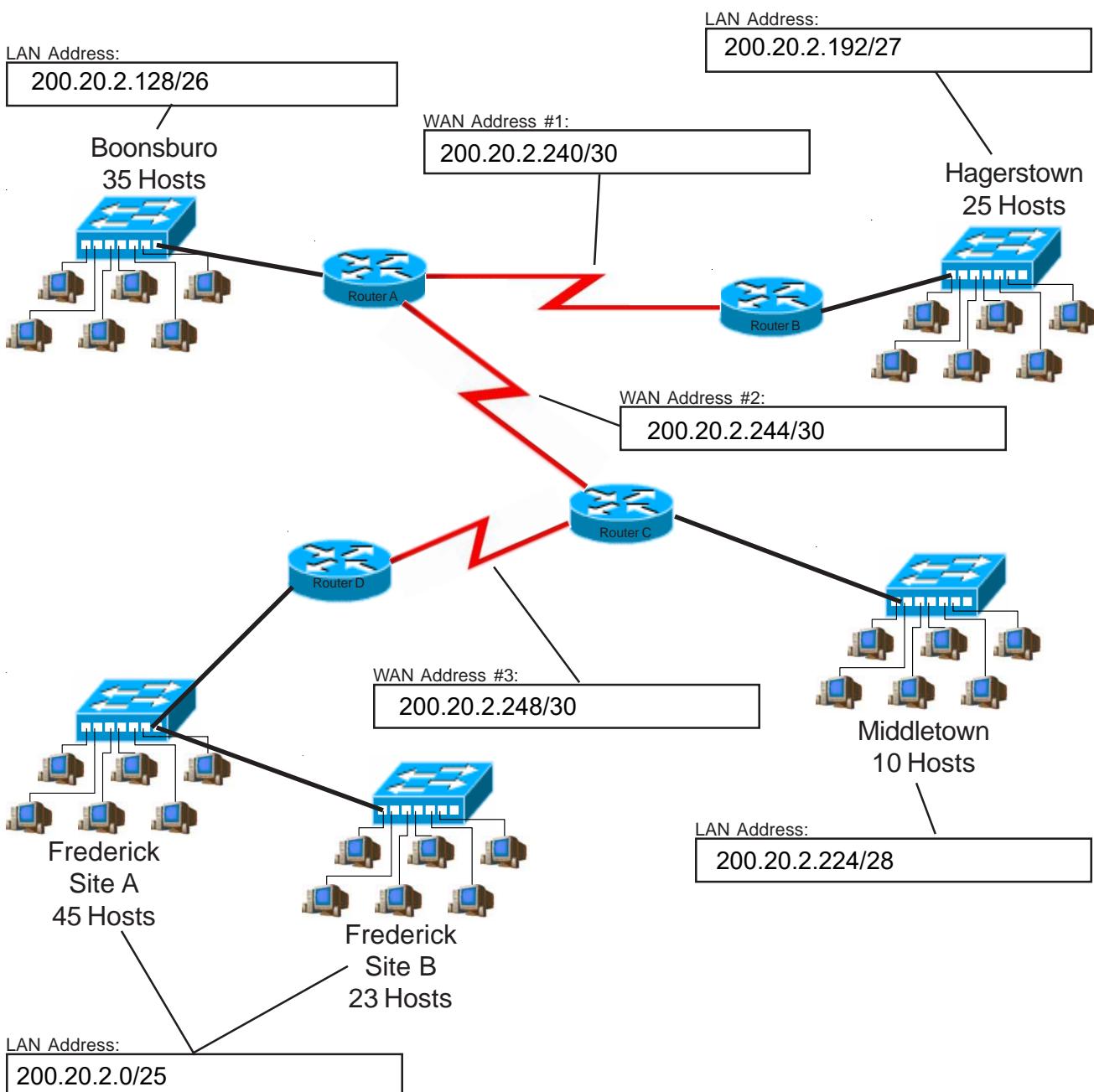
<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255						
0-127						
128-255						
0-63			0-31	0-15	0-7	0-3
64-127			32-63	16-31	8-15	4-7
128-191			32-47	16-23	16-23	8-11
192-255			48-63	24-31	24-31	12-15
128-191			64-95	32-47	32-39	16-19
192-255			80-95	40-47	40-47	20-23
128-191			96-127	48-55	48-55	24-27
192-255			128-159	56-63	56-63	28-31
192-255			160-191	64-79	64-71	32-35
192-255			176-191	72-79	72-79	36-39
192-255			192-207	80-87	80-87	40-43
192-255			208-223	88-95	88-95	44-47
192-255			224-239	96-103	96-103	48-51
192-255			224-255	104-111	104-111	52-55
192-255			240-255	112-119	112-119	56-59
192-255			240-255	120-127	120-127	60-63
192-255			224-239	128-135	128-135	64-67
192-255			224-239	136-143	136-143	68-71
192-255			224-239	144-151	144-151	72-75
192-255			224-239	152-159	152-159	76-79
192-255			224-239	160-167	160-167	80-83
192-255			224-239	168-175	168-175	84-87
192-255			224-239	176-183	176-183	88-91
192-255			224-239	184-191	184-191	92-95
192-255			224-239	192-199	192-199	96-99
192-255			224-239	200-207	200-207	100-103
192-255			224-239	208-215	208-215	104-107
192-255			224-239	216-223	216-223	108-111
192-255			224-239	224-231	224-231	112-115
192-255			224-239	232-239	232-239	116-119
192-255			224-239	240-247	240-247	120-123
192-255			224-239	248-255	248-255	124-127
192-255			224-239	252-255	252-255	128-131
192-255			224-239			132-135
192-255			224-239			136-139
192-255			224-239			140-143
192-255			224-239			144-147
192-255			224-239			148-151
192-255			224-239			152-155
192-255			224-239			156-159
192-255			224-239			160-163
192-255			224-239			164-167
192-255			224-239			168-171
192-255			224-239			172-175
192-255			224-239			176-179
192-255			224-239			180-183
192-255			224-239			184-187
192-255			224-239			188-191
192-255			224-239			192-195
192-255			224-239			196-199
192-255			224-239			200-203
192-255			224-239			204-207
192-255			224-239			208-211
192-255			224-239			212-215
192-255			224-239			216-219
192-255			224-239			220-223
192-255			224-239			224-227
192-255			224-239			228-231
192-255			224-239			232-235
192-255			224-239			236-239
192-255			224-239			240-243
192-255			224-239			244-247
192-255			224-239			248-251
192-255			224-239			252-255

# VLSM Addressing

## VLSM Chart Method

### Problem 22

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This company will be using the class C address 200.20.2.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

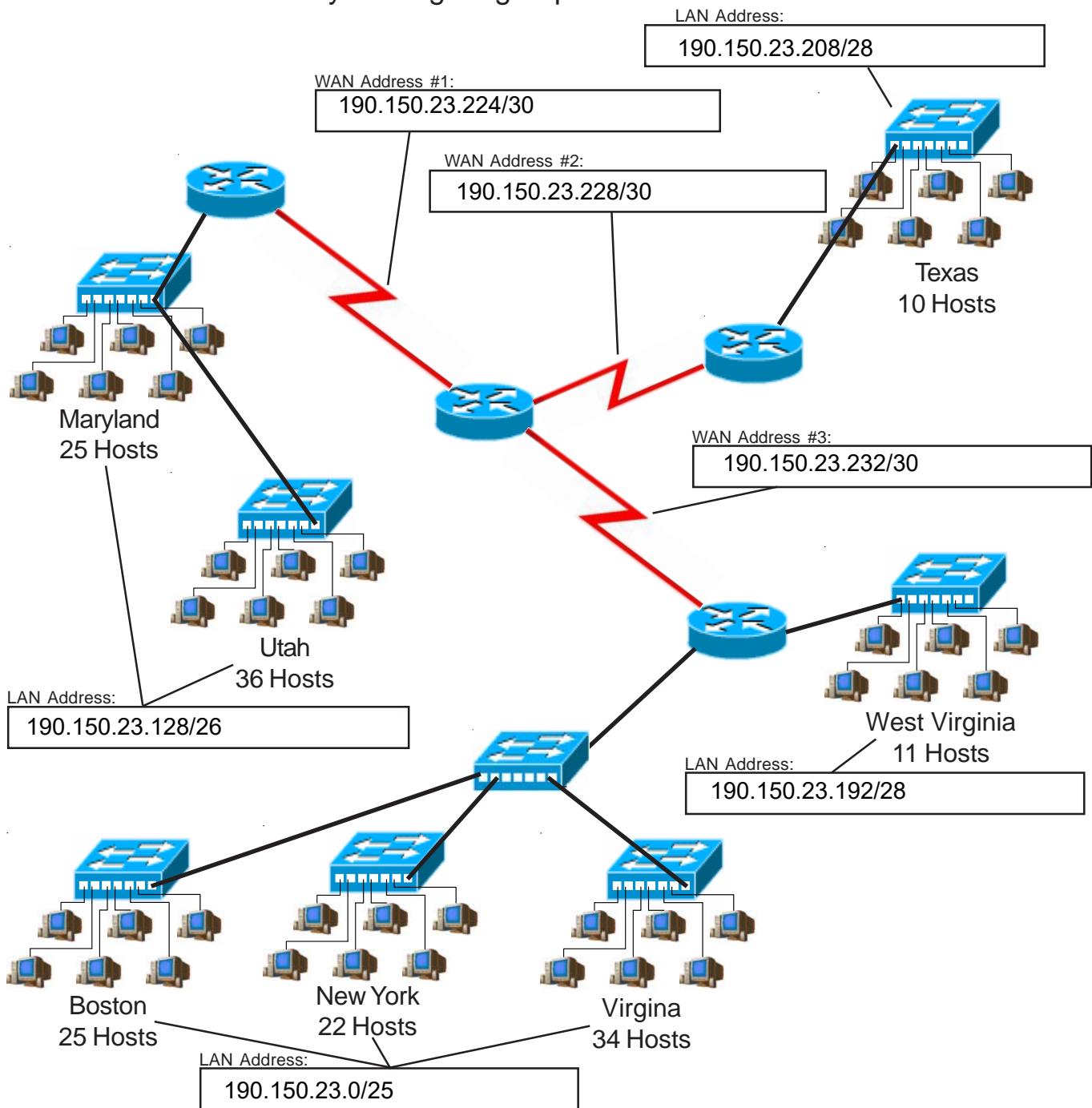
<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255						
0-127						
0-63			0-31	0-15	0-7	0-3
					8-15	4-7
						8-11
						12-15
						16-19
						20-23
						24-27
						28-31
						32-35
						36-39
						40-43
						44-47
						48-51
						52-55
						56-59
						60-63
						64-67
						68-71
						72-75
						76-79
						80-83
						84-87
						88-91
						92-95
						96-99
						100-103
						104-107
						108-111
						112-115
						116-119
						120-123
						124-127
						128-131
						132-135
						136-139
						140-143
						144-147
						148-151
						152-155
						156-159
						160-163
						164-167
						168-171
						172-175
						176-179
						180-183
						184-187
						188-191
						192-195
						196-199
						200-203
						204-207
						208-211
						212-215
						216-219
						220-223
						224-227
						228-231
						232-235
						236-239
						240-243
						244-247
						248-251
						252-255

# VLSM Addressing

## VLSM Chart Method

### Problem 23

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This company will be using the class C address 190.150.23.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

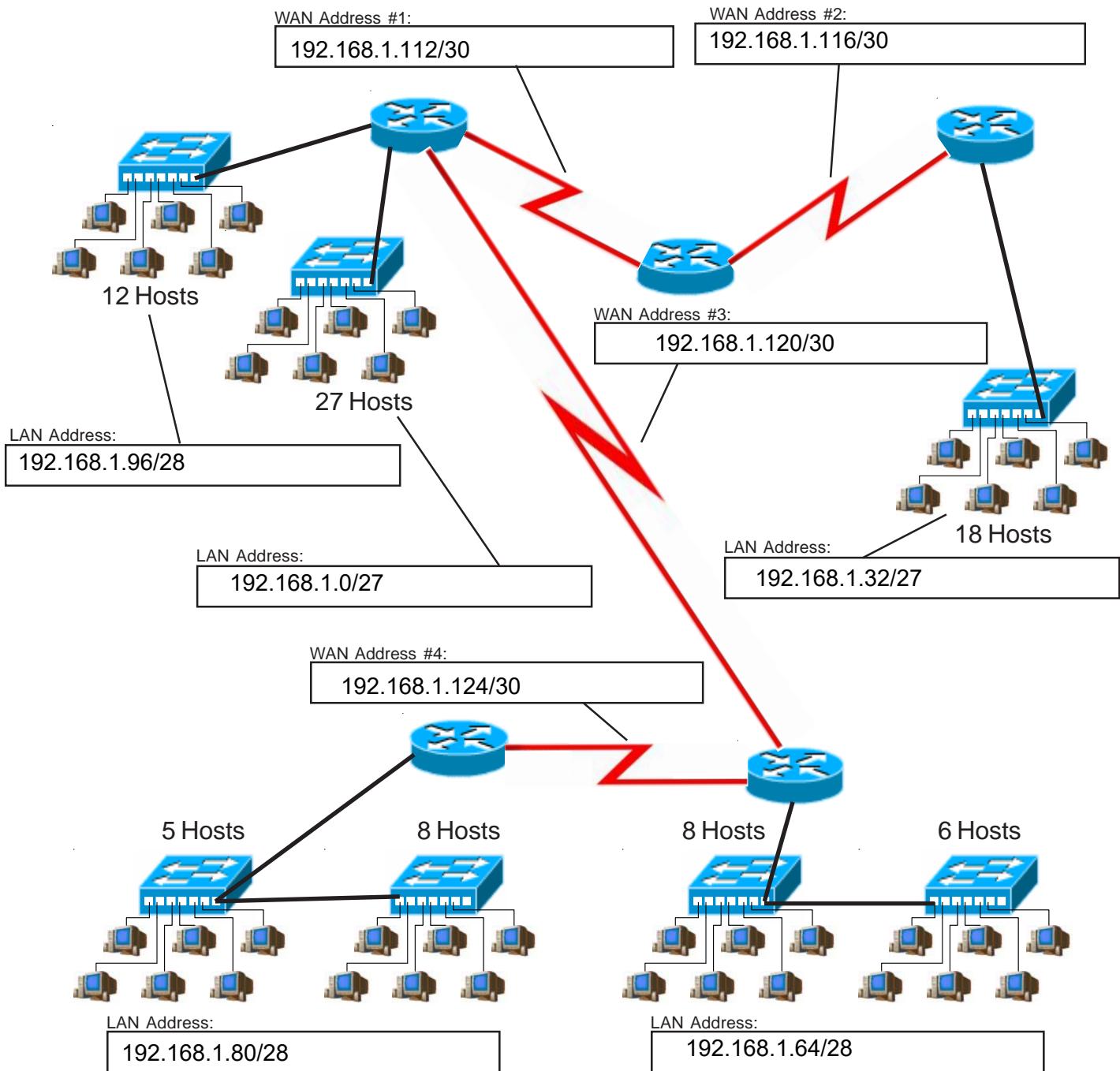
<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255						
0-127						
0-63			0-31	0-15	0-7	0-3 4-7
64-127			32-63	16-31	8-15	8-11 12-15
128-255			64-95	32-47	16-23	16-19 20-23
192-255			80-95	40-47	24-31	24-27 28-31
224-255			96-127	48-63	32-39	32-35 36-39
			128-191	64-79	40-47	40-43 44-47
			160-191	96-111	48-55	48-51 52-55
			192-223	128-143	56-63	56-59 60-63
			208-223	144-159	64-71	64-67 68-71
			224-255	160-175	72-79	72-75 76-79
				176-191	80-87	80-83 84-87
					88-95	88-91 92-95
					96-103	96-99 100-103
					104-111	104-107 108-111
					112-119	112-115 116-119
					120-127	120-123 124-127
					128-135	128-131 132-135
					136-143	136-139 140-143
					144-151	144-147 148-151
					152-159	152-155 156-159
					160-167	160-163 164-167
					168-175	168-171 172-175
					176-183	176-179 180-183
					184-191	184-187 188-191
					192-199	192-195 196-199
					200-207	200-203 204-207
					208-215	208-211 212-215
					216-223	216-219 220-223
					224-231	224-227 228-231
					232-239	232-235 236-239
					240-247	240-243 244-247
					248-255	248-251 252-255

# VLSM Addressing

## VLSM Chart Method

### Problem 24

Using the network diagram and information given create an addressing scheme which utilizes variable-length subnet masks. Show the subnet address and CIDR in the boxes below, color or shade the sub-subnets used in the chart. This company will be using the class C address 192.168.1.0. Remember to start with your largest groups first.



# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

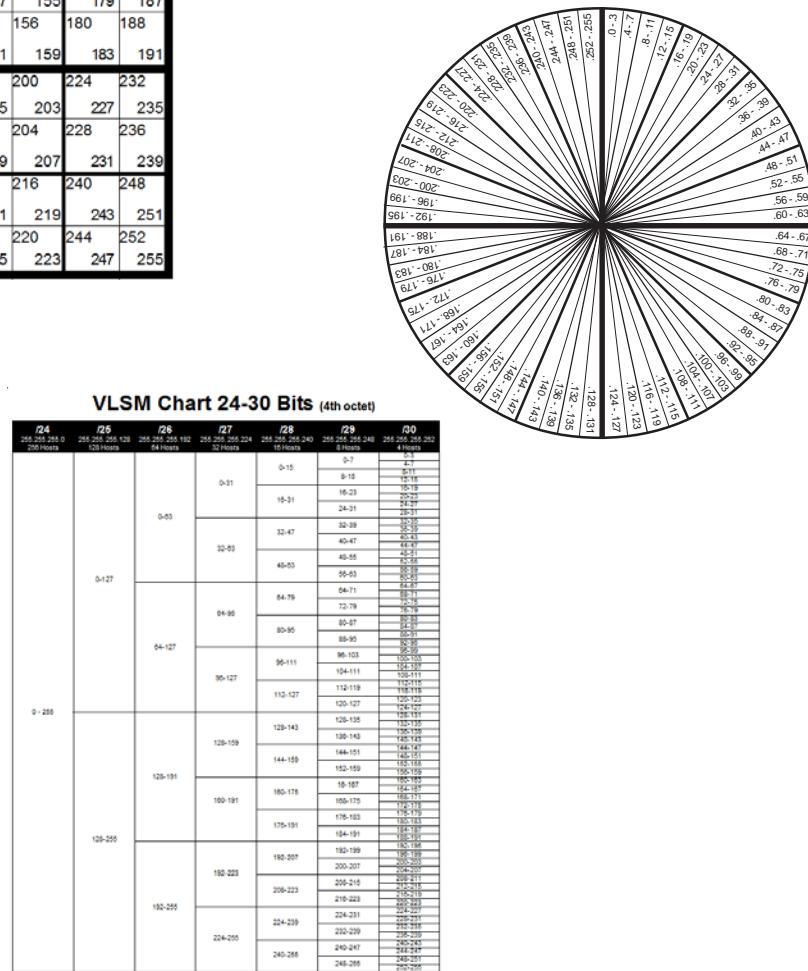
<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
128-255	64-127	32-63	16-31	16-23	8-15	8-11 12-15
192-255	128-191	96-127	48-63	24-31	16-23	16-19 20-23 24-27 28-31
224-255	192-223	160-191	32-47	32-39	32-39	32-35 36-39
240-255	208-223	128-159	64-95	40-47	40-47	40-43 44-47
			64-79	48-55	48-55	48-51 52-55
			80-95	56-63	56-63	56-59 60-63
			96-111	64-71	64-71	64-67 68-71
			112-127	72-79	72-79	72-75 76-79
				80-87	80-87	80-83 84-87
				88-95	88-95	88-91 92-95
				96-103	96-103	96-99 100-103
				104-111	104-111	104-107 108-111
				112-119	112-119	112-115 116-119
				120-127	120-127	120-123 124-127
			128-143	128-135	128-135	128-131 132-135
			144-159	136-143	136-143	136-139 140-143
			160-175	144-151	144-151	144-147 148-151
			176-191	152-159	152-159	152-155 156-159
				16-167	16-167	160-163 164-167
				168-175	168-175	168-171 172-175
				176-183	176-183	176-179 180-183
				184-191	184-191	184-187 188-191
			192-207	192-199	192-199	192-195 196-199
			208-223	200-207	200-207	200-203 204-207
			224-239	208-215	208-215	208-211 212-215
			224-255	216-223	216-223	216-219 220-223
				224-231	224-231	224-227 228-231
				232-239	232-239	232-235 236-239
				240-247	240-247	240-243 244-247
				248-255	248-255	248-251 252-255



# Practical VLSM Problems

Use the VLSM method of your choice to complete the following problems.

0	8	32	40	128	136	160	168
3	11	35	43	131	139	163	171
4	12	36	44	132	140	164	172
7	15	39	47	135	143	167	175
16	24	48	56	144	152	176	184
19	27	51	59	147	155	179	187
20	28	52	60	148	156	180	188
23	31	55	63	151	159	183	191
64	72	96	104	192	200	224	232
67	75	99	107	195	203	227	235
68	76	100	108	196	204	228	236
71	79	103	111	199	207	231	239
80	88	112	120	208	216	240	248
83	91	115	123	211	219	243	251
84	92	116	124	212	220	244	252
87	95	119	127	215	223	247	255



# VLSM Addressing

(Sample)

## Problem 25

You are developing a school network with the class C address 192.168.2.0/24. There will be three computer labs with 30 computers each that need to be on different sub-subnets. Forty eight classrooms with one computer each that will comprise a single sub-subnet. The administrative office and guidance office contain a total of seven computers which will need to be grouped together. Plan for four more mini labs with six computers to each sub-subnetwork. Divide the network using variable length subnet masks. Complete the information required below. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	192.168.2.0	/26	192.168.2.1	192.168.2.62	192.168.2.63
2	192.168.2.64	/27	192.168.2.65	192.168.2.94	192.168.2.95
3	192.168.2.96	/27	192.168.2.97	192.168.2.126	192.168.2.127
4	192.168.2.128	/27	192.168.2.129	192.168.2.158	192.168.2.159
5	192.168.2.160	/28	192.168.2.161	192.168.2.174	192.168.2.175
6	192.168.2.176	/29	192.168.2.177	192.168.2.182	192.168.2.183
7	192.168.2.184	/29	192.168.2.185	192.168.2.190	192.168.2.191
8	192.168.2.192	/29	192.168.2.193	192.168.2.198	192.168.2.199
9	192.168.2.200	/29	192.168.2.201	192.168.2.206	192.168.2.207
10					
11					
12					
13					
14					

## VLSM Addressing (Sample)

### Problem 26

You are setting up a small business network with the class C address 220.55.80.0/24. The marketing division will need 12 computers. Research and development needs 27 computers. The reception area will need two computers. Management requires 19 computers. Divide the network using variable length subnet masks. Complete the information required below. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	220.55.80.0	/27	220.55.80.1	220.55.80.30	220.55.80.31
2	220.55.80.32	/27	220.55.80.	220.55.80.62	220.55.80.63
3	220.55.80.64	/28	220.55.80.65	220.55.80.78	220.55.80.79
4	220.55.80.80	/30	220.55.80.81	220.55.80.82	220.55.80.83
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VLSM Addressing

## Problem 27

You are setting up a medium sized network with the class C address 222.37.34.0/24. Marketing needs 29 computers. Research and development needs 110 computers. Bookkeeping will use 12 computers. The reception area will need three computers. Management requires 60 computers. Divide the network using variable length subnet masks. Complete the information required below. Remember to work from largest to smallest.

## VLSM Addressing

### Problem 28

A shipping company needs to set up its network across several locations computers. The Waco office needs 22 computers. The Fargo office will need links between all three locations need to be included in the solution. Using the divide the network using VLSM. Complete the information required below. Re to smallest.

Ver office needs six  
utters. The WAN  
s 192.168.10.0/24  
ork from largest

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	192.168.10.0	/27	192.168.10.1	192.168.10.30	192.168.10.31
2	192.168.10.32	/29	192.168.10.33	192.168.10.38	192.168.10.39
3	192.168.10.40	/29	192.168.10.41	192.168.10.46	192.168.10.47
4	192.168.10.48	/30	192.168.10.49	192.168.10.50	192.168.10.51
5	192.168.10.52	/30	192.168.10.53	192.168.10.54	192.168.10.55
Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	
1					
2					
3					
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## VLSM Addressing

### Problem 29

A new school is being built in the local school district. It will have three classrooms each. There will be 58 classrooms with 2 computers each that need to be connected. The office staff and administrators will need 7 computers. The guidance and a few other faculty members will need 5 computers. The school has been given the address 223.145.75.0/24. Complete the table below. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	223.145.75.0	/25	223.145.75.1	223.145.75.126	223.145.75.127
2	223.145.75.128	/27	223.145.75.129	223.145.75.158	223.145.75.159
3	223.145.75.160	/27	223.145.75.161	223.145.75.190	223.145.75.191
4	223.145.75.192	/27	223.145.75.193	223.145.75.222	223.145.75.223
5	223.145.75.224	/28	223.145.75.225	223.145.75.238	223.145.75.239
6	223.145.75.240	/29	223.145.75.241	223.145.75.246	223.145.75.247
7	223.145.75.248	/29	223.145.75.249	223.145.75.254	223.145.75.255

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host
1				
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## VLSM Addressing

### Problem 30

A local college is setting up a campus wide network. The office wing will include 1 each, 2 labs of 30 computers each and one lab of 35 computers. Remember to work from largest to smallest.

wing will be on its own network  
There are 2 labs of 20 computers  
to the information required below.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	192.168.250.0	/26	92.168.250.1	92.168.250.62	92.168.250.63
2	92.168.250.64	/27	92.168.250.65	92.168.250.94	92.168.250.95
3	92.168.250.96	/27	92.168.250.97	92.168.250.126	92.168.250.127
4	92.168.250.128	/27	92.168.250.129	92.168.250.158	92.168.250.159
5	92.168.250.160	/27	92.168.250.161	92.168.250.190	92.168.250.191
6	92.168.250.192	/27	92.168.250.193	92.168.250.222	92.168.250.223

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Broadcast Address
1				
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## VLSM Addressing

### Problem 31

You are setting up a network for a company in four locations. Location A has 128 computers. Location B has 55 computers. Location C has 4 computers. Location D has 122 computers. Location E has 55 computers. You have one WAN connection between all four locations. Complete the information required below for each location. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	192.168.10.0	/25	192.168.10.1	192.168.10.126	192.168.10.127
2	192.168.10.128	/26	192.168.10.129	192.168.10.190	192.168.10.191
3	192.168.10.192	/28	192.168.10.193	192.168.10.206	192.168.10.207
4	192.168.10.208	/29	192.168.10.209	192.168.10.214	192.168.10.215
5	192.168.10.216	/30	192.168.10.217	192.168.10.218	192.168.10.219
6	192.168.10.220	/30	192.168.10.221	192.168.10.222	192.168.10.223
7	192.168.10.224	/30	192.168.10.225	192.168.10.226	192.168.10.227

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host
1				
2				
3				
4				
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7				
8				
9				
10				
11				
12				
13				
14				

vers. Location B  
has 55 computers.  
Location C has 4 computers.  
Location D has 122 computers.  
Location E has 55 computers.  
WAN connection required between all four locations.  
Address required between 192.168.10.0 and 192.168.10.255.

## VLSM Addressing

### Problem 32

A college dormitory is being remolded. A new network is being implemented with two drops each that will be on one sub-subnet. The offices will have three drops. A small study hall will include 30 drops. Using the information required below using VLSM. Work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	192.168.12.0	/25	192.168.12.1	192.168.12.126	192.168.12.127
2	192.168.12.128	/27	192.168.12.129	192.168.12.158	192.168.12.159
3	192.168.12.160	/29	192.168.12.161	192.168.12.166	192.168.12.167
4	192.168.12.168	/29	192.168.12.169	192.168.12.174	192.168.12.175

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
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12					
13					
14					

## VLSM Addressing

### Problem 33

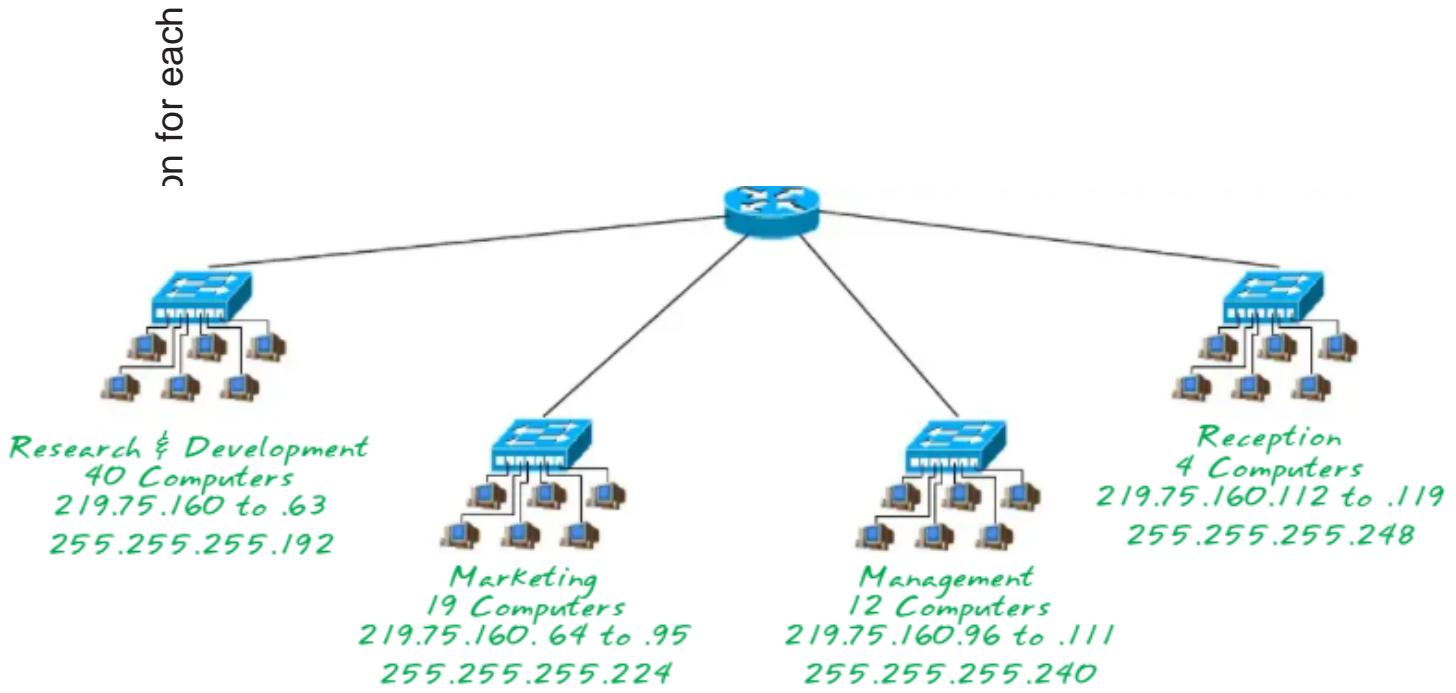
You are setting up a business network with the class C address 219.75. division will need 19 computers. Research and development needs 40 computers. Management requires 12 computers. Divide the network into four subnets. On the opposite page draw a detailed map of this network. Includ information. One router will be used for each branch of the network with the subnet mask. One router v

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	219.75.160.0	/26	219.75.160.1	219.75.160.62	219.75.160.63
2	219.75.160.64	/27	219.75.160.65	219.75.160.94	219.75.160.95
3	219.75.160.96	/28	219.75.160.97	219.75.160.110	219.75.160.111
4	219.75.160.112	/29	219.75.160.113	219.75.160.118	219.75.160.119

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
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### Problem 33 - Detail

Draw a detailed map of this network. Include the name and size of each branch of the network, and the subnet mask.



## VLSM Addressing

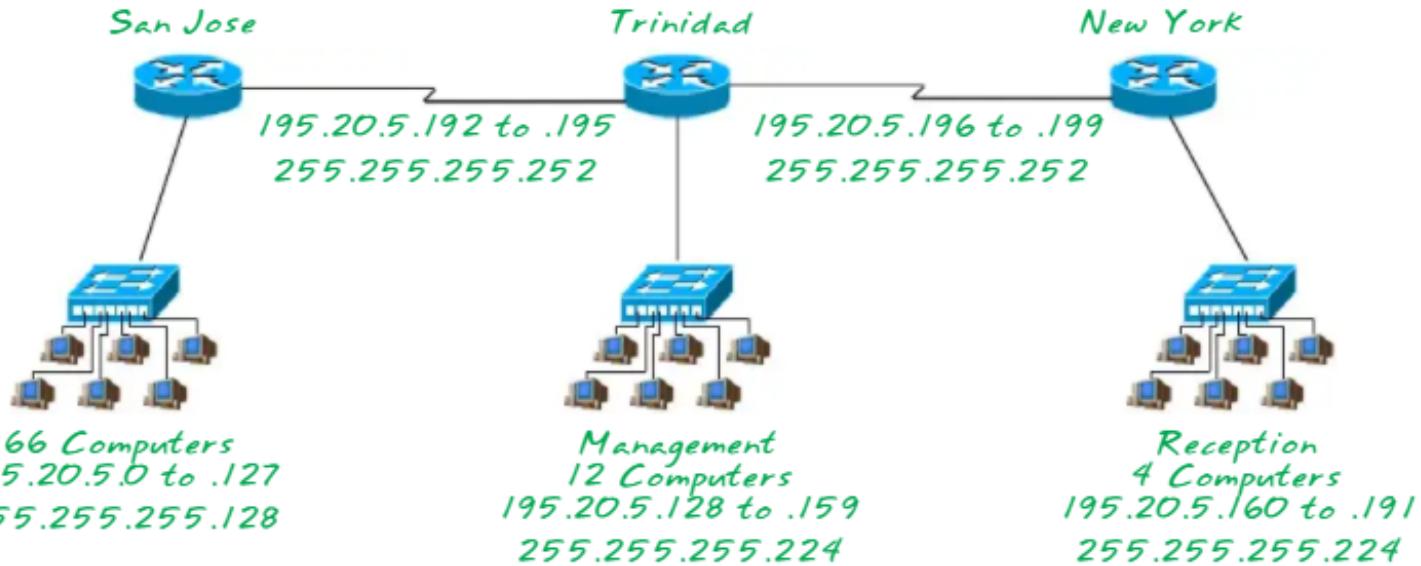
### Problem 34

A small company needs to set up its network across several locations. The Ne  
eds 15 computers. The San Jose office needs 66 computers. The Trinidad office  
computers. You will need two WAN links between the routers. Using the IP address  
network using VLSM. On the opposite page draw a detailed map of this network. Inc  
subnet IP addresses information for each branch of the network. Label the WAN link  
tion. Complete the information required below. Work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	195.20.5.0	/25	195.20.5.1	195.20.5.126	195.20.5.127
2	195.20.5.128	/27	195.20.5.129	195.20.5.158	195.20.5.159
3	195.20.5.160	/27	195.20.5.161	195.20.5.190	195.20.5.191
4	195.20.5.192	/30	195.20.5.193	195.20.5.194	195.20.5.195
5	195.20.5.196	/30	195.20.5.197	195.20.5.198	195.20.5.199
Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	
1					
2					
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9					
10					
11					
12					
13					
14					

### Problem 34 - Data

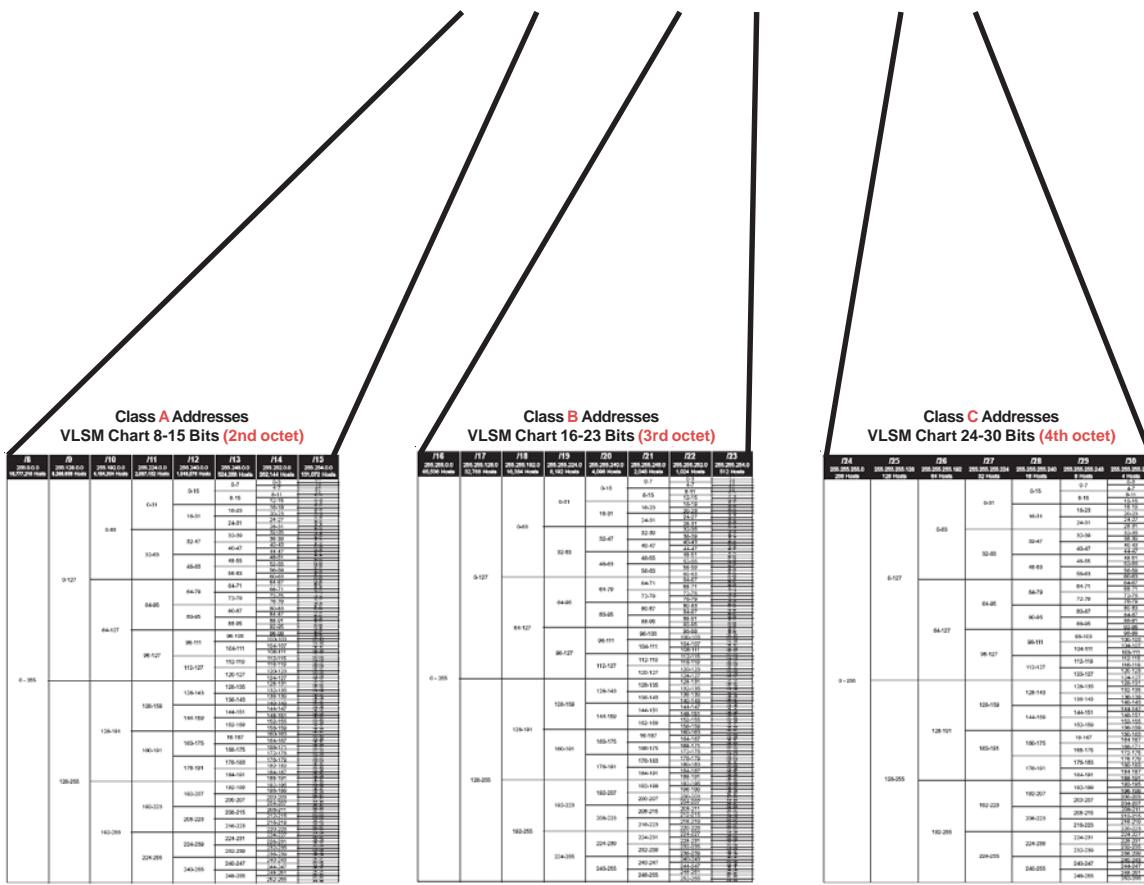
Draw a detailed map of this network. Include the name and size of each branch of the network.





# Class A and B VLSM Problems

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# VLSM

with

## Class A and B Addresses

We've gone over the practical applications of using VLSM on class C addresses. The same approach works with class A and B addresses. For example an ISP may have a class A address which it needs to subnet between its customers. Each customer may need to take their addresses and subnet them again in order to use them more effectively. The real trick to this is to remember which octet of the IP address you are working with.

### Sample Problem 35

#### Part 1 of 3

Use the **Class A** address chart to break down the address for different ISP customers. At this stage of the problem you are creating subnets using the second octet of the IP address.

#### ISP Addresses 15.0.0.0

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Customer #1	8 million	15.0.0.0 to 15.127.255.255	/9
Customer #2	2 million	15.128.0.0 to 15.159.255.255	/11
Customer #3	2,000,000	15.160.0.0 to 15.191.255.255	/11
Customer #4	1,000,000	15.192.0.0 to 15.207.255.255	/12
Customer #5	500,000	15.208.0.0 to 15.215.255.255	/13
Customer #6	450,000	15.216.0.0 to 15.223.255.255	/13
Customer #7	200,000	15.224.0.0 to 15.227.255.255	/14
Customer #8	130,000	15.228.0.0 to 15.229.255.255	/15
Customer #9	100,000	15.230.0.0 to 15.231.255.255	/15

# Class A Addresses

## VLSM Chart 8-15 Bits (2nd octet)

<b>/8</b>	<b>/9</b>	<b>/10</b>	<b>/11</b>	<b>/12</b>	<b>/13</b>	<b>/14</b>	<b>/15</b>
255.0.0.0 16,777,216 Hosts	255.128.0.0 8,388,608 Hosts	255.192.0.0 4,194,304 Hosts	255.224.0.0 2,097,152 Hosts	255.240.0.0 1,048,576 Hosts	255.248.0.0 524,288 Hosts	255.252.0.0 262,144 Hosts	255.254.0.0 131,072 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1
128-255	128-191	128-159	128-143	16-23	4-7	2-3	4-5
				8-15	8-11	6-7	8-9
				16-31	12-15	10-11	12-13
				32-47	16-19	14-15	14-15
				32-63	20-23	18-19	16-17
				48-63	24-27	22-23	24-25
				48-55	28-31	26-27	26-27
				56-63	32-35	28-29	28-29
					36-39	30-31	30-31
					40-43	34-35	34-35
					44-47	36-37	36-37
					48-51	38-39	38-39
					52-55	40-41	40-41
					56-59	42-43	42-43
					60-63	44-45	44-45
						46-47	46-47
						48-49	48-49
						50-51	50-51
						52-53	52-53
						54-55	54-55
						56-57	56-57
						58-59	58-59
						60-61	60-61
						62-63	62-63
						64-65	64-65
						66-67	66-67
						68-69	68-69
						70-71	70-71
						72-73	72-73
						74-75	74-75
						76-77	76-77
						78-79	78-79
						80-81	80-81
						82-83	82-83
						84-85	84-85
						86-87	86-87
						88-91	88-91
						90-91	90-91
						92-93	92-93
						94-95	94-95
						96-97	96-97
						98-99	98-99
						100-103	100-101
						104-107	102-103
						108-111	104-105
						112-115	106-107
						116-119	112-113
						120-123	114-115
						124-127	116-117
						128-131	118-119
						132-135	112-113
						136-139	134-135
						140-143	136-137
						144-147	138-139
						148-151	140-141
						152-155	142-143
						156-159	144-145
						160-163	146-147
						164-167	148-149
						168-171	150-151
						172-175	152-153
						176-179	154-155
						180-183	156-157
						184-187	158-159
						188-191	160-161
						192-195	162-163
						196-199	164-165
						200-203	166-167
						204-207	168-169
						208-211	170-171
						212-215	174-175
						216-219	176-177
						220-223	178-179
						224-227	180-181
						228-231	182-183
						232-235	184-185
						236-239	186-187
						240-243	188-189
						244-247	190-191
						248-251	192-193
						252-255	194-195

# VLSM

with

## Class A and B Addresses

### Sample Problem 35

#### Part 2 of 3

Customer #5 has a total of 524,288 addresses. Use the **Class B** address chart to break down the sub-subnetwork addresses for their different clients. At this stage of the problem you are creating sub-subnets with the third octet of the IP address.

ISP Addresses 15.208.0.0

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Client #1	7,500	15.208.0.0 to 15.208.31.255	/19
Client #2	5,000	15.208.32.0 to 15.208.63.255	/19
Client #3	4,500	15.208.64.0 to 15.208.95.255	/19
Client #4	2,000	15.208.96.0 to 15.208.103.255	/21
Client #5	1,450	15.208.104.0 to 15.208.111.255	/21
Client #6	1,150	15.208.112.0 to 15.208.119.255	/21
Client #7	900	15.208.120.0 to 15.208.123.255	/22
Client #8	750	15.208.124.0 to 15.208.127.255	/22
Client #9	450	15.208.128.0 to 15.208.129.255	/23

# Class B Addresses

## VLSM Chart 16-23 Bits (3rd octet)

<b>/16</b>	<b>/17</b>	<b>/18</b>	<b>/19</b>	<b>/20</b>	<b>/21</b>	<b>/22</b>	<b>/23</b>
255.255.0.0 65,536 Hosts	255.255.128.0 32,768 Hosts	255.255.192.0 16,384 Hosts	255.255.224.0 8,192 Hosts	255.255.240.0 4,096 Hosts	255.255.248.0 2,048 Hosts	255.255.252.0 1,024 Hosts	255.255.254.0 512 Hosts
0 - 255			0-31	0-7	0-3	0-1	
				8-15	4-7	2-3	
					8-11	4-5	
					12-15	6-7	
					16-19	8-9	
					20-23	10-11	
					24-27	12-13	
					28-31	14-15	
					32-35	16-17	
					36-39	18-19	
					40-43	20-21	
					44-47	22-23	
					48-51	24-25	
					52-55	26-27	
					56-59	28-29	
					60-63	30-31	
					64-67	32-33	
					68-71	34-35	
					72-75	36-37	
					76-79	38-39	
					80-83	40-41	
					84-87	42-43	
					88-91	44-45	
					92-95	46-47	
					96-99	48-49	
					100-103	50-51	
					104-107	52-53	
					108-111	54-55	
					112-115	56-57	
					116-119	58-59	
					120-123	60-61	
					124-127	62-63	
					128-131	64-65	
					132-135	66-67	
					136-139	68-69	
					140-143	70-71	
					144-147	72-73	
					148-151	74-75	
					152-155	76-77	
					156-159	78-79	
					160-163	80-81	
					164-167	82-83	
					168-171	84-85	
					172-175	86-87	
					176-179	88-89	
					180-183	90-91	
					184-187	92-93	
					188-191	94-95	
					192-195	96-97	
					196-199	98-99	
					200-203	100-101	
					204-207	102-103	
					208-211	104-105	
					212-215	106-107	
					216-219	108-109	
					220-223	111-111	
					224-227	112-113	
					228-231	114-115	
					232-235	116-117	
					236-239	118-119	
					240-243	120-121	
					244-247	122-123	
					248-251	124-125	
					252-255	126-127	
						128-131	
						132-135	
						136-139	
						140-143	
						144-147	
						148-151	
						152-155	
						156-159	
						160-163	
						164-167	
						168-171	
						172-175	
						176-179	
						180-183	
						184-187	
						188-191	
						192-195	
						196-199	
						200-203	
						204-207	
						208-211	
						212-215	
						216-219	
						220-223	
						224-227	
						228-231	
						232-235	
						236-239	
						240-243	
						244-247	
						248-251	
						252-255	

# VLSM

with

## Class A and B Addresses

### Sample Problem 35

#### Part 3 of 3

Client #8 has a total of 1,024 addresses. Use the **Class C** address chart to break down the sub-subnetwork addresses for their different branch offices. At this stage of the problem you are creating sub-subnets with the fourth octet of the IP address.

**ISP Addresses 15.208.124.0**

<b>Customer Name</b>	<b>Number of Addresses</b>	<b>Address Range</b> (Include subnet & broadcast addresses)	<b>CIDR</b>
Branch #1	100	<i>15.208.124.0 to 15.208.124.127</i>	/25
Branch #2	55	<i>15.208.124.128 to 15.208.124.191</i>	/26
Branch #3	25	<i>15.208.124.192 to 15.208.124.223</i>	/27
Branch #4	6	<i>15.208.124.224 to 15.208.124.231</i>	/29
Branch #5	4	<i>15.208.124.232 to 15.208.124.239</i>	/29
Branch #6	2	<i>15.208.124.240 to 15.208.124.243</i>	/30
Branch #7	2	<i>15.208.124.244 to 15.208.124.247</i>	/30
Branch #8	2	<i>15.208.124.248 to 15.208.124.251</i>	/30
Branch #9	2	<i>15.208.124.252 to 15.208.124.255</i>	/30

# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-15	0-7	0-3	
			8-15	8-15	4-7	
			16-31	16-23	8-11	
				24-31	12-15	
					16-19	
					20-23	
					24-27	
					28-31	
					32-35	
					36-39	
					40-43	
					44-47	
					48-51	
					52-55	
					56-59	
					60-63	
					64-67	
					68-71	
					72-75	
					76-79	
					80-83	
					84-87	
					88-91	
					92-95	
					96-99	
					100-103	
					104-107	
					108-111	
					112-115	
					116-119	
					120-123	
					124-127	
					128-135	
					132-135	
					136-139	
					140-143	
					144-147	
					148-151	
					152-155	
					156-159	
					160-163	
					164-167	
					168-171	
					172-175	
					176-179	
					180-183	
					184-187	
					188-191	
					192-195	
					196-199	
					200-203	
					204-207	
					208-211	
					212-215	
					216-219	
					220-223	
					224-227	
					228-231	
					232-235	
					236-239	
					240-243	
					244-247	
					248-251	
					252-255	

# VLSM

with

## Class A and B Addresses

### Problem 36

#### Part 1 of 3

The school system you are working for is using the private address of 172.32.0.0 to subnet the entire district. Use the **Class B** address chart to break down the sub-subnetwork addresses for the different schools and offices.

At this stage of the problem you are creating sub-subnets with the third octet of the IP address. Remember which octet of the IP address you are working in.

School System Address 172.32.**0**.0

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
North High	2,400	172.32.0.0 - 172.32.15.255	/20
South High	2,000	172.32.16.0 - 172.32.23.255	/21
North Middle	1,200	172.32.24.0 - 172.32.31.266	/21
South Middle	1,000	172.32.32.0 - 172.32.35.255	/22
Central Elem.	550	172.32.36.0 - 172.32.39.255	/22
Southern Elem.	475	172.32.40.0 - 172.32.41.255	/23
Eastern Elem.	450	172.32.42.0 - 172.32.43.255	/23
Central Office	400	172.32.44.0 - 172.32.45.255	/23
Western Elem.	300	172.32.46.0 - 172.32.47.255	/23

# Class B Addresses

## VLSM Chart 16-23 Bits (3rd octet)

<b>/16</b>	<b>/17</b>	<b>/18</b>	<b>/19</b>	<b>/20</b>	<b>/21</b>	<b>/22</b>	<b>/23</b>
255.255.0.0 65,536 Hosts	255.255.128.0 32,768 Hosts	255.255.192.0 16,384 Hosts	255.255.224.0 8,192 Hosts	255.255.240.0 4,096 Hosts	255.255.248.0 2,048 Hosts	255.255.252.0 1,024 Hosts	255.255.254.0 512 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0 - 1
128-255	128-255	128-191	128-159	128-143	128-135	128-131	128 - 131
					132-135	132 - 133	132 - 135
					136-143	136 - 139	136 - 137
					144-151	144 - 147	146 - 147
					144-159	148 - 151	150 - 151
					160-175	160 - 163	162 - 163
					168-175	164 - 167	164 - 167
					176-183	168 - 171	168 - 171
					176-183	172 - 175	174 - 175
					184-191	176 - 177	178 - 179
					184-191	180 - 183	182 - 183
					192-207	184 - 187	184 - 185
					192-207	188 - 191	186 - 187
					200-207	190 - 191	188 - 189
					208-215	192 - 195	192 - 195
					208-215	196 - 199	196 - 197
					216-223	200 - 203	198 - 199
					216-223	204 - 207	200 - 201
					224-231	208 - 211	204 - 205
					224-231	212 - 215	208 - 209
					228-231	214 - 215	212 - 213
					232-235	218 - 219	214 - 217
					236-239	220 - 223	218 - 219
					240-247	224 - 227	220 - 221
					240-247	228 - 229	224 - 225
					244-247	230 - 231	228 - 229
					248-251	232 - 233	230 - 231
					248-255	234 - 235	232 - 233
						252-255	240 - 241
						252-255	242 - 243
						252-255	244 - 245
						254-255	246 - 247

# VLSM

with

## Class A and B Addresses

### Problem 36

#### Part 2 of 3

Eastern Elementary has been given 512 hosts, with the address range of 172.32.42.0 / 21 (255.255.248.0).

Based on the information below supply the required address ranges and subnet masks for each school area. Use the **Class C** address chart to break down the sub-subnetworks.

#### **Hint:**

Another way to look at this problem is to see that with the third octet range of 42 to 43 you have access to 2 groups of 255 addresses (172.32.42.0 and 172.32.43.0). Think in terms of having two Class C VLSM charts.

### Eastern Elementary School Address Range 172.32.42.0 to 172.32.43.255

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Students	250	172.32.42.0 - 172.32.42.255	/24
Printers	45	172.32.43.0 - 172.32.43.63	/26
Staff	40	172.32.43.64 - 172.32.43.127	/26
Network Devices	25	172.32.43.128 - 172.32.43.159	/27
Administrative	12	172.32.43.160 - 172.32.43.175	/28

## Class C Addresses

### VLSM Chart 24-30 Bits (4th octet)

<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	128-255	128-191	0-63	0-15	0-7	0-3 4-7 8-11 12-15
			0-31	16-31	16-23	16-19 20-23
				32-47	24-31	24-27 28-31
				32-63	32-39	32-35 36-39
					40-47	40-43 44-47
					48-55	48-51 52-55
					56-63	56-59 60-63
				64-79	64-71	64-67 68-71
					72-79	72-75 76-79
				80-95	80-87	80-83 84-87
					88-95	88-91 92-95
				96-111	96-103	96-99 100-103
					104-111	104-107 108-111
				112-127	112-119	112-115 116-119
					120-127	120-123 124-127
				128-143	128-135	128-131 132-135
					136-143	136-139 140-143
				144-159	144-151	144-147 148-151
					152-159	152-155 156-159
				160-175	160-167	160-163 164-167
					168-175	168-171 172-175
				176-191	176-183	176-179 180-183
					184-191	184-187 188-191
				192-207	192-199	192-195 196-199
					200-207	200-203 204-207
				208-223	208-215	208-211 212-215
					216-223	216-219 220-223
				224-239	224-231	224-227 228-231
					232-239	232-235 236-239
				240-255	240-247	240-243 244-247
					248-255	248-251 252-255

# VLSM

with

## Class A and B Addresses

### Problem 36

#### Part 3 of 3

South High in part 1 of this problem has been given 2,048 hosts, with the address range of 172.32.16.0 / 21 (255.255.248.0).

Based on the information below supply the required address ranges and subnet masks for each school area. Use both the **Class B** and **Class C** address charts to break down the sub-subnetwork addresses for the different areas of the network.

#### **Hint:**

With this problem you are creating sub-subnets with both the third and fourth octets of the IP address. You may need to use the Class B VLSM chart for the *Students* addressing information. All the other addresses will be using the Class C VLSM chart. Another way to look at this problem is to see that with the third octet range of 16 to 23 you have access to 8 groups of 255 addresses or eight Class C VLSM charts.

**South High School**  
**Address Range 172.32.16.0 to 172.32.23.255**

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Students	1,000	172.32.16.0 - 172.32.19.255	/22
Network Devices	250	172.32.20.0 - 172.32.20.255	/24
Printers	200	172.32.21.0 - 172.32.21.255	/24
Staff	150	172.32.22.0 - 172.32.22.255	/24
Administrative	50	172.32.23.0 - 172.32.23.63	/26

# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
128-255	64-127	32-63	16-31	8-15	8-11	4-7
192-255	128-191	96-127	48-63	16-23	12-15	8-11
224-255	192-223	160-191	32-47	24-31	20-23	16-19
240-255	192-207	128-159	40-47	24-31	24-27	28-31
			48-55	32-39	32-35	36-39
			56-63	40-47	40-43	44-47
			64-79	64-71	48-51	52-55
			80-95	72-79	56-59	60-63
			96-111	80-87	64-67	68-71
			112-127	88-95	72-75	76-79
				96-103	80-83	84-87
				104-111	88-91	92-95
				112-119	96-99	100-103
				120-127	104-107	108-111
					112-115	116-119
					120-123	124-127
					128-131	132-135
					136-143	136-139
					144-151	140-143
					152-159	144-147
					160-167	148-151
					168-175	152-155
					176-183	156-159
					184-191	160-163
					192-199	164-167
					200-207	168-171
					208-215	172-175
					216-223	176-179
					224-231	180-183
					232-239	184-187
					240-247	188-191
					248-255	192-195
						196-199
						200-203
						204-207
						208-211
						212-215
						216-219
						220-223
						224-227
						228-231
						232-235
						236-239
						240-243
						244-247
						248-251
						252-255

# VLSM

with

## Class A and B Addresses

### Problem 37

#### Part 1 of 3

The company you are working for is using the IP address 110.0.0.0 sub-subneted for multiple offices around the world. Use the **Class A** address chart to break down the sub-subnetwork addresses for the different offices.

At this stage of the problem you are creating sub-subnets with the third octet of the IP address. Remember which octet of the IP address you are working in.

Company Address 110.**0**.0.0

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Moskva	3,050,000	110.0.0.0 - 110.63.255.255	/10
New York	1,540,000	100.64.0.0 - 100.95.255.255	/11
St. Petersburg	1,075,000	110.96.0.0 - 110.127.255.255	/11
London	975,000	110.128.0.0 - 110.143.255.255	/12
Ekaterinburg	525,000	110.144.0.0 - 110.159.255.255	/12
Munchen	450,000	110.160.0.0 - 110.167.255.255	/13
Napoli	150,000	110.168.0.0 - 110.171.255.255	/14
Birmingham	130,000	110.172.0.0 - 110.173.255.255	/15
Rotterdam	95,000	110.174.0.0 - 110.175.255.255	/15

# Class A Addresses

## VLSM Chart 8-15 Bits (2nd octet)

<b>/8</b>	<b>/9</b>	<b>/10</b>	<b>/11</b>	<b>/12</b>	<b>/13</b>	<b>/14</b>	<b>/15</b>
255.0.0.0 16,777,216 Hosts	255.128.0.0 8,388,608 Hosts	255.192.0.0 4,194,304 Hosts	255.224.0.0 2,097,152 Hosts	255.240.0.0 1,048,576 Hosts	255.248.0.0 524,288 Hosts	255.252.0.0 262,144 Hosts	255.254.0.0 131,072 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0 - 1
128-255	128-255	128-191	128-159	128-143	128-135	128-131	128 - 131
					132-135	132 - 133	132 - 135
					136-143	136 - 139	136 - 137
					144-151	144 - 147	146 - 147
					144-159	148 - 151	150 - 151
					160-175	160 - 163	162 - 163
					168-175	164 - 167	164 - 167
					176-183	168 - 171	168 - 169
					176-183	172 - 175	172 - 173
					184-191	176 - 177	178 - 179
					184-191	180 - 183	182 - 183
					192-207	184 - 187	184 - 185
					192-207	188 - 191	186 - 187
					208-223	190 - 191	188 - 189
					208-223	192 - 195	192 - 193
					216-223	196 - 199	196 - 197
					224-231	200 - 203	198 - 199
					224-231	204 - 207	200 - 201
					224-239	208 - 211	204 - 205
					224-239	212 - 215	208 - 209
					232-239	216 - 219	214 - 215
					232-239	220 - 223	212 - 213
					240-247	224 - 227	210 - 211
					240-247	228 - 231	212 - 213
					248-255	232 - 235	214 - 215
					248-255	236 - 239	216 - 217
					248-255	240 - 243	218 - 219
					248-255	244 - 247	220 - 221
					248-255	248 - 251	222 - 223
					248-255	252 - 253	224 - 225
					248-255	254 - 255	226 - 227

# VLSM

with

## Class A and B Addresses

### Problem 37

#### Part 2 of 3

London in part 1 of this problem has been given 1,048,576 hosts, with the address range of 110.128.0.0 to 110.143.255.255 /12 (255.240.0.0).

Based on the information below supply the required address ranges and subnet masks for each office. Use the **Class B** address chart to break down the sub-subnetwork addresses for the different areas of the network.

**London**  
Address Range 110.**128.0**.0 to 110.**143.255**.255

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Office #1	6,450	110.128.0.0 - 110.128.31.255	/19
Office #2	3,780	110.128.32.0 - 110.128.47.255	/19
Office #3	2,750	110.128.48.0 - 110.128.63.255	/19
Office #4	2,000	110.128.64.0 - 110.128.71.255	/21
Office #5	1,000	110.128.72.0 - 110.128.75.255	/21
Office #6	845	110.128.76.0 - 110.128.79.255	/21
Office #7	500	110.128.80.0 - 110.128.81.255	/22
Office #8	450	110.128.82.0 - 110.128.83.255	/22
Office #9	300	110.128.84.0 - 110.128.85.255	/23

## Class B Addresses

### VLSM Chart 16-23 Bits (3rd octet)

<b>/16</b>	<b>/17</b>	<b>/18</b>	<b>/19</b>	<b>/20</b>	<b>/21</b>	<b>/22</b>	<b>/23</b>
255.255.0.0 65,536 Hosts	255.255.128.0 32,768 Hosts	255.255.192.0 16,384 Hosts	255.255.224.0 8,192 Hosts	255.255.240.0 4,096 Hosts	255.255.248.0 2,048 Hosts	255.255.252.0 1,024 Hosts	255.255.254.0 512 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-3	0-1	0-1
128-255	128-255	128-191	128-159	32-47	4-7	2-3	2-3
				8-15	8-11	4-5	4-5
				16-31	12-15	6-7	6-7
				32-63	16-19	8-9	8-9
				48-63	20-23	10-11	10-11
				64-95	24-27	12-13	12-13
				64-127	28-31	14-15	14-15
				96-111	32-35	16-17	16-17
				96-127	36-39	18-19	18-19
				112-127	40-43	20-21	20-21
				128-143	44-47	22-23	22-23
				128-191	48-55	24-25	24-25
				160-191	52-55	26-27	26-27
				192-207	56-59	28-29	28-29
				192-223	60-63	30-31	30-31
				208-223	64-67	32-33	32-33
				224-239	68-71	34-35	34-35
				224-255	72-75	36-37	36-37
				240-255	76-79	38-39	38-39
				240-255	80-83	40-41	40-41
				240-255	84-87	42-43	42-43
				240-255	88-95	44-45	44-45
				240-255	92-95	46-47	46-47
				240-255	96-99	48-49	48-49
				240-255	100-103	50-51	50-51
				240-255	104-111	52-53	52-53
				240-255	108-111	54-55	54-55
				240-255	112-115	56-57	56-57
				240-255	116-119	58-59	58-59
				240-255	120-123	60-61	60-61
				240-255	124-127	62-63	62-63
				240-255	128-131	64-65	64-65
				240-255	132-135	66-67	66-67
				240-255	136-139	68-69	68-69
				240-255	140-143	70-71	70-71
				240-255	144-147	72-73	72-73
				240-255	148-151	74-75	74-75
				240-255	152-155	76-77	76-77
				240-255	156-159	78-79	78-79
				240-255	160-163	80-81	80-81
				240-255	164-167	82-83	82-83
				240-255	168-171	84-85	84-85
				240-255	172-175	86-87	86-87
				240-255	176-179	88-89	88-89
				240-255	180-183	90-91	90-91
				240-255	184-187	92-93	92-93
				240-255	188-191	94-95	94-95
				240-255	192-195	96-97	96-97
				240-255	196-199	98-99	98-99
				240-255	200-203	100-101	100-101
				240-255	204-207	102-103	102-103
				240-255	208-211	104-105	104-105
				240-255	212-215	106-107	106-107
				240-255	216-219	108-109	108-109
				240-255	220-223	110-111	110-111
				240-255	224-227	112-113	112-113
				240-255	228-231	114-115	114-115
				240-255	232-235	116-117	116-117
				240-255	236-239	118-119	118-119
				240-255	240-243	120-121	120-121
				240-255	244-247	122-123	122-123
				240-255	248-251	124-125	124-125
				240-255	252-255	126-127	126-127

# VLSM

with

## Class A and B Addresses

### Problem 37

#### Part 3 of 3

Office #7 in part 2 of this problem has been given 512 hosts, with the address range of 110.128.80.0 / 23 (255.255.254.0).

Based on the information below supply the required address ranges and subnet masks for each school area. Use the **Class C** address chart to break down the sub-subnetwork addresses for the different areas of the network. **Hint:** Another way to look at this problem is to see that with the third octet range of 80 to 81 you have access to 2 groups of 255 addresses or two Class C VLSM charts.

#### Office #7

#### Address Range 110.128.80.0 to 110.128.81.255

Customer Name	Number of Addresses	Address Range	CIDR
1st Floor	125	110.128.80.0 - 110.128.80.127	/25
2nd Floor	75	110.128.80.128 - 110.128.80.255	/25
5th Floor	50	110.128.81.0 - 110.128.81.61	/26
8th Floor	45	110.128.81.64 - 110.128.81.127	/26
4th Floor	30	110.128.81.128 - 110.128.81.175	/27
Basement	14	110.128.81.160 - 110.128.81.175	/28
7th Floor	12	110.128.81.160 - 110.128.81.191	/28
3rd Floor	6	110.128.81.192 - 110.128.81.199	/29
6th Floor	4	110.128.81.200 - 110.128.81.207	/29

# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255						
0-127						
128-255						
0-63			0-31	0-15	0-7	0-3
64-127			32-63	16-31	8-15	4-7
128-191			32-47	16-23	16-23	8-11
192-255			48-63	24-31	24-27	12-15
128-191			64-95	32-47	32-39	16-19
192-255			80-95	40-47	40-47	20-23
128-191			96-127	48-55	48-51	24-27
192-255			128-159	56-63	52-55	28-31
192-255			144-159	64-79	56-59	32-35
192-255			160-191	72-79	60-63	36-39
192-255			176-191	80-87	64-67	40-43
192-255			192-207	88-95	68-71	44-47
192-255			208-223	96-103	72-75	48-51
192-255			224-239	104-111	76-79	52-55
192-255			224-255	112-119	80-83	56-59
192-255			240-255	120-127	84-87	60-63
192-255			240-255	128-135	88-91	92-95
192-255			240-255	136-143	96-99	96-99
192-255			240-255	144-151	100-103	100-103
192-255			240-255	152-159	104-107	104-107
192-255			240-255	160-167	108-111	108-111
192-255			240-255	168-175	112-115	112-115
192-255			240-255	176-183	116-119	116-119
192-255			240-255	184-191	120-123	120-123
192-255			240-255	192-199	124-127	124-127
192-255			240-255	200-207	128-131	128-131
192-255			240-255	208-215	132-135	132-135
192-255			240-255	216-223	136-139	136-139
192-255			240-255	224-231	140-143	140-143
192-255			240-255	232-239	144-147	144-147
192-255			240-255	240-247	148-151	148-151
192-255			240-255	248-255	152-155	152-155
192-255			240-255	252-255	156-159	156-159
192-255			240-255	240-255	160-163	160-163
192-255			240-255	240-255	164-167	164-167
192-255			240-255	240-255	168-171	168-171
192-255			240-255	240-255	172-175	172-175
192-255			240-255	240-255	176-179	176-179
192-255			240-255	240-255	180-183	180-183
192-255			240-255	240-255	184-187	184-187
192-255			240-255	240-255	188-191	188-191
192-255			240-255	240-255	192-195	192-195
192-255			240-255	240-255	196-199	196-199
192-255			240-255	240-255	200-203	200-203
192-255			240-255	240-255	204-207	204-207
192-255			240-255	240-255	208-211	208-211
192-255			240-255	240-255	212-215	212-215
192-255			240-255	240-255	216-219	216-219
192-255			240-255	240-255	220-223	220-223
192-255			240-255	240-255	224-227	224-227
192-255			240-255	240-255	228-231	228-231
192-255			240-255	240-255	232-235	232-235
192-255			240-255	240-255	236-239	236-239
192-255			240-255	240-255	240-243	240-243
192-255			240-255	240-255	244-247	244-247
192-255			240-255	240-255	248-251	248-251
192-255			240-255	240-255	252-255	252-255

# VLSM

with

## Class A and B Addresses

### Problem 38

#### Part 1 of 4

Use the **Class A** address chart to break down the address for different business customers by country. At this stage of this problem you are creating subnets in the second octet of the IP address.

Addresses 75.**0**.0.0

Customer Name	Number of Addresses	Address Range	CIDR
United States	6.5 million	75.0.0.0 - 75.127.255.255	/9
China	4 million	75.128.0.0 - 75.191.255.255	/10
Japan	1 million	75.192.0.0 - 75.207.255.255	/12
Germany	500,000	75.208.0.0 - 75.215.255.255	/13
Russia	455,000	75.216.0.0 - 75.223.255.255	/13
Australia	450,000	75.224.0.0 - 75.231.255.255	/13
Brazil	125,000	75.232.0.0 - 75.233.255.255	/15
Canada	90,000	75.234.0.0 - 75.235.255.255	/15
Denmark	88,000	75.236.0.0 - 75.237.255.255	/15

# Class A Addresses

## VLSM Chart 8-15 Bits (2nd octet)

<b>/8</b>	<b>/9</b>	<b>/10</b>	<b>/11</b>	<b>/12</b>	<b>/13</b>	<b>/14</b>	<b>/15</b>
255.0.0.0 16,777,216 Hosts	255.128.0.0 8,388,608 Hosts	255.192.0.0 4,194,304 Hosts	255.224.0.0 2,097,152 Hosts	255.240.0.0 1,048,576 Hosts	255.248.0.0 524,288 Hosts	255.252.0.0 262,144 Hosts	255.254.0.0 131,072 Hosts
0 - 255							
0-127							
0-63			0-31	0-15	0-7	0-3	0-1
					8-15	4-7	2-3
						8-11	4-5
						12-15	6-7
						16-19	8-9
						20-23	10-11
						24-27	12-13
						28-31	14-15
							16-17
							18-19
							20-21
							22-23
							24-25
							26-27
							28-29
							30-31
							32-33
							34-35
							36-39
							40-41
							42-43
							44-45
							46-47
							48-49
							50-51
							52-53
							54-55
							56-57
							58-59
							60-61
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							64-65
							66-67
							68-69
							70-71
							72-73
							74-75
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							82-83
							84-85
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							88-89
							90-91
							92-93
							94-95
							96-97
							98-99
							100-101
							102-103
							104-105
							106-107
							108-109
							110-111
							112-113
							114-115
							116-117
							118-119
							120-121
							122-123
							124-125
							126-127
							128-129
							130-131
							132-133
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							184-185
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							192-193
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							202-203
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							218-219
							220-221
							222-223
							224-225
							226-227
							228-229
							230-231
							232-233
							234-235
							236-237
							238-239
							240-241
							242-243
							244-245
							246-247
							248-249
							250-251
							252-253
							254-255

# VLSM

with

## Class A and B Addresses

### Sample Problem 38

#### Part 2 of 4

The United States customers have a total of 8,388,608 addresses. Use the **Class A** address chart to break down the sub-subnetwork addresses for their different areas. At this stage of this problem you are creating sub-subnets in the second octet of the IP address.

Addresses Range: 75.0.0.0 to 75.127.255.255

Customer Name	Number of Addresses	Address Range	CIDR
Client #1	1,950,000	75.0.0.0 - 75.31.255.255	/11
Client #2	1,000,000	75.32.0.0 - 75.47.255.255	/12
Client #3	950,000	75.48.0.0 - 75.63.255.255	/12
Client #4	700,000	75.64.0.0 - 75.79.255.255	/12
Client #5	550,000	75.80.0.0 - 75.95.255.255	/12
Client #6	500,000	75.96.0.0 - 75.103.255.255	/13
Client #7	450,000	75.104.0.0 - 75.111.255.255	/13

# Class A Addresses

## VLSM Chart 8-15 Bits (2nd octet)

<b>/8</b>	<b>/9</b>	<b>/10</b>	<b>/11</b>	<b>/12</b>	<b>/13</b>	<b>/14</b>	<b>/15</b>
255.0.0.0 16,777,216 Hosts	255.128.0.0 8,388,608 Hosts	255.192.0.0 4,194,304 Hosts	255.224.0.0 2,097,152 Hosts	255.240.0.0 1,048,576 Hosts	255.248.0.0 524,288 Hosts	255.252.0.0 262,144 Hosts	255.254.0.0 131,072 Hosts
0 - 255							
0-127							
0-63			0-31	0-15	0-7	0-3	0-1
						4-7	2-3
						8-11	4-5
						12-15	6-7
						16-19	8-9
						20-23	10-11
						24-27	12-13
						28-31	14-15
							16-17
							18-19
							20-21
							22-23
							24-25
							26-27
							28-29
							30-31
							32-33
							34-35
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							110-111
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							114-115
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							120-121
							122-123
							124-125
							126-127
							128-129
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							232-233
							234-235
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							238-239
							240-241
							242-243
							244-245
							246-247
							248-249
							250-251
							252-253
							254-255

# VLSM

with

## Class A and B Addresses

### Sample Problem 38

#### Part 3 of 4

Client #7 has a total of 524,288 addresses. Use the **Class B** address chart to break down the sub-subnetwork addresses for their different clients. At this stage of this problem you are creating sub-subnets in the third or forth octet of the IP address.

**Hint:** Another way to look at this problem is to see that with the second octet range of 104 to 111 you have access to 8 groups of 65,536 addresses or 8 Class B VLSM charts.

ISP Addresses 75.104.0.0 to 75.111.255.255

Customer Name	Number of Addresses	Address Range	CIDR
Office #1	60,000	75.104.0.0 - 75.104.255.255	/16
Office #2	45,000	75.105.0.0 - 75.105.255.255	/16
Office #3	30,000	75.106.0.0 - 75.106.127.255	/17
Office #4	24,000	75.106.128.0 - 75.106.255.255	/17
Office #5	15,000	75.107.0.0 - 75.107.63.255	/18
Office #6	10,000	75.107.64.0 - 75.107.127.255	/18
Office #7	8,000	75.107.128.0 - 75.107.159.255	/19
Office #8	2,000	75.107.128.0 - 75.107.167.255	/21
Office #9	1,000	75.107.168.0 - 75.107.171.255	/22

# Class B Addresses

## VLSM Chart 16-23 Bits (3rd octet)

<b>/16</b>	<b>/17</b>	<b>/18</b>	<b>/19</b>	<b>/20</b>	<b>/21</b>	<b>/22</b>	<b>/23</b>
255.255.0.0 65,536 Hosts	255.255.128.0 32,768 Hosts	255.255.192.0 16,384 Hosts	255.255.224.0 8,192 Hosts	255.255.240.0 4,096 Hosts	255.255.248.0 2,048 Hosts	255.255.252.0 1,024 Hosts	255.255.254.0 512 Hosts
0 - 255	128 - 255	0-127	0-63	0-15	0-7	0-3	0 - 1
					8-15	4-7	2 - 3
						8-11	4 - 5
						12-15	6 - 7
						16-19	8 - 9
						20-23	10 - 11
						24-27	12 - 13
						28-31	14 - 15
							16 - 17
							18 - 19
							20 - 21
							22 - 23
							24 - 25
							26 - 27
							28 - 29
							30 - 31
							32 - 33
							34 - 35
							36 - 37
							38 - 39
							40 - 41
							42 - 43
							44 - 45
							46 - 47
							48 - 49
							50 - 51
							52 - 53
							54 - 55
							56 - 57
							58 - 59
							60 - 61
							62 - 63
							64 - 65
							66 - 67
							68 - 69
							70 - 71
							72 - 73
							74 - 75
							76 - 77
							78 - 79
							80 - 81
							82 - 83
							84 - 85
							86 - 87
							88 - 89
							90 - 91
							92 - 93
							94 - 95
							96 - 97
							98 - 99
							100 - 101
							102 - 103
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							112 - 113
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							122 - 123
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							220 - 221
							222 - 223
							224 - 225
							226 - 227
							228 - 229
							230 - 231
							232 - 233
							234 - 235
							236 - 237
							238 - 239
							240 - 241
							242 - 243
							244 - 245
							246 - 247
							248 - 249
							250 - 251
							252 - 253
							254 - 255

# VLSM

with

## Class A and B Addresses

### Sample Problem 38

#### Part 4 of 4

Office #7 from part 3 of 4 has a total of 8,192 addresses. Use the **Class B** address chart to break down the sub-subnetwork addresses for the different branch offices. At this stage of this problem you are creating sub-subnets in the third octet of the IP address.

**Hint:** Remember that the range of this problem is between 128 and 159 in the third octet. Your subnetting will start in the middle of the chart not at the top for this range.

ISP Addresses 75.107.128.0 to 75.107.159.255

Customer Name	Number of Addresses	Address Range	CIDR
Branch #1	4,000	75.107.128.0 - 75.107.143.255	/20
Branch #2	2,000	75.107.144.0 - 75.107.151.255	/21
Branch #3	1,000	75.107.152.0 - 75.107.155.255	/22
Branch #4	500	75.107.156.0 - 75.107.159.255	/23
Branch #5	450	75.107.160.0 - 75.107.161.255	/23

## Class B Addresses

### VLSM Chart 16-23 Bits (3rd octet)

<b>/16</b>	<b>/17</b>	<b>/18</b>	<b>/19</b>	<b>/20</b>	<b>/21</b>	<b>/22</b>	<b>/23</b>
255.255.0.0 65,536 Hosts	255.255.128.0 32,768 Hosts	255.255.192.0 16,384 Hosts	255.255.224.0 8,192 Hosts	255.255.240.0 4,096 Hosts	255.255.248.0 2,048 Hosts	255.255.252.0 1,024 Hosts	255.255.254.0 512 Hosts
0 - 255	128 - 255	128 - 191	0-63	0-15	0-3	0-1	0-1
					4-7	2-3	2-3
					8-15	4-5	6-7
					12-15	8-9	10-11
					16-19	12-13	12-13
					20-23	14-15	14-15
				16-31	24-27	16-17	16-17
					28-31	18-19	18-19
					32-35	20-21	20-21
					36-39	22-23	22-23
		64-127	64-95	32-47	40-43	24-25	24-25
					44-47	44-45	44-45
					48-51	46-47	46-47
					52-55	48-49	48-49
				48-63	56-59	50-51	50-51
					60-63	52-53	52-53
					64-67	54-55	54-55
					68-71	56-57	56-57
		128 - 191	128 - 191	64-79	72-75	58-59	58-59
					76-79	60-61	60-61
					80-83	62-63	62-63
					84-87	64-65	64-65
				80-95	88-91	66-67	66-67
					92-95	68-69	68-69
					96-99	70-71	70-71
					100-103	72-73	72-73
		192 - 255	192 - 255	96-111	104-107	74-75	74-75
					108-111	76-77	76-77
					112-119	78-79	78-79
					116-119	80-81	80-81
				112-127	120-123	82-83	82-83
					124-127	84-85	84-85
					128-131	86-87	86-87
					132-135	88-89	88-89
		0 - 127	0 - 127	128-143	136-143	90-91	90-91
					140-143	92-93	92-93
					144-147	94-95	94-95
					148-151	96-97	96-97
				144-159	152-159	98-99	98-99
					156-159	100-101	100-101
					160-167	102-103	102-103
					164-167	104-105	104-105
		0 - 63	0 - 63	160-175	168-175	106-107	106-107
					172-175	108-109	108-109
					176-179	111-111	111-111
					180-183	112-113	112-113
				176-191	184-187	114-115	114-115
					188-191	116-117	116-117
					192-195	118-119	118-119
					196-199	120-121	120-121
		128 - 191	128 - 191	192-207	200-203	122-123	122-123
					204-207	124-125	124-125
					208-211	126-127	126-127
					212-215	128-131	128-131
				208-223	216-219	132-135	132-135
					220-223	136-137	136-137
					224-227	138-139	138-139
					228-231	140-141	140-141
		192 - 255	192 - 255	224-239	232-235	142-143	142-143
					236-239	144-145	144-145
					240-243	146-147	146-147
					244-247	148-149	148-149
				240-255	248-251	150-151	150-151
					252-255	152-153	152-153
					256-259	154-155	154-155
					260-263	156-157	156-157



# Reference Charts and Support Materials

## Class A Addresses VLSM Chart 8-15 Bits (2nd octet)

## Class B Addresses VLSM Chart 16-23 Bits (3rd octet)

## Class C Addresses VLSM Chart 24-30 Bits (4th octet)

# Class A Addresses

## VLSM Chart 8-15 Bits (2nd octet)

<b>/8</b>	<b>/9</b>	<b>/10</b>	<b>/11</b>	<b>/12</b>	<b>/13</b>	<b>/14</b>	<b>/15</b>
255.0.0.0 16,777,216 Hosts	255.128.0.0 8,388,608 Hosts	255.192.0.0 4,194,304 Hosts	255.224.0.0 2,097,152 Hosts	255.240.0.0 1,048,576 Hosts	255.248.0.0 524,288 Hosts	255.252.0.0 262,144 Hosts	255.254.0.0 131,072 Hosts
0 - 255	128 - 255	0-63	0-31	0-15	0-3	0-1	0-1
				8-15	4-7	2-3	
					8-11	4-5	
						6-7	
						8-9	
						10-11	
						12-15	12-13
							14-15
							16-17
							18-19
							20-21
							22-23
							24-25
							26-27
							28-29
							30-31
							32-33
							34-35
							36-37
							38-39
							40-41
							42-43
							44-47
							48-49
							50-51
							52-53
							54-55
							56-57
							58-59
							60-61
							62-63
							64-65
							66-67
							68-69
							70-71
							72-73
							74-75
							76-77
							78-79
							80-81
							82-83
							84-85
							86-87
							88-91
							90-91
							92-93
							94-95
							96-97
							98-99
							100-101
							102-103
							104-105
							106-107
							108-109
							110-111
							112-113
							114-115
							116-117
							118-119
							120-121
							122-123
							124-125
							126-127
							128-129
							130-131
							132-133
							134-135
							136-137
							138-139
							140-141
							142-143
							144-145
							146-147
							148-149
							150-151
							152-153
							154-155
							156-157
							158-159
							160-161
							162-163
							164-165
							166-167
							168-169
							170-171
							172-173
							174-175
							176-177
							178-179
							180-181
							182-183
							184-185
							186-187
							188-189
							190-191
							192-193
							194-195
							196-197
							198-199
							200-201
							202-203
							204-205
							206-207
							208-209
							210-211
							212-213
							214-215
							216-217
							218-219
							220-221
							222-223
							224-225
							226-227
							228-229
							230-231
							232-233
							234-235
							236-237
							238-239
							240-241
							242-243
							244-245
							246-247
							248-249
							250-251
							252-253
							254-255

## Class B Addresses

### VLSM Chart 16-23 Bits (3rd octet)

<b>/16</b>	<b>/17</b>	<b>/18</b>	<b>/19</b>	<b>/20</b>	<b>/21</b>	<b>/22</b>	<b>/23</b>
255.255.0.0 65,536 Hosts	255.255.128.0 32,768 Hosts	255.255.192.0 16,384 Hosts	255.255.224.0 8,192 Hosts	255.255.240.0 4,096 Hosts	255.255.248.0 2,048 Hosts	255.255.252.0 1,024 Hosts	255.255.254.0 512 Hosts
0 - 255							
0-127							
0-63			0-31	0-15	0-7	0-3	0-1
					4-7	2-3	2-3
					8-15	4-5	4-5
					12-15	6-7	6-7
					16-23	8-9	8-9
					24-31	10-11	10-11
					32-39	12-13	12-13
					40-47	14-15	14-15
					48-55	16-17	16-17
					56-63	18-19	18-19
					64-71	20-21	20-21
					72-79	22-23	22-23
					80-87	24-25	24-25
					88-95	26-27	26-27
					96-103	28-29	28-29
					104-111	30-31	30-31
					112-119	32-33	32-33
					120-127	34-35	34-35
					128-135	36-37	36-37
					136-143	38-39	38-39
					144-151	40-41	40-41
					152-159	42-43	42-43
					160-167	44-45	44-45
					168-175	46-47	46-47
					176-183	48-49	48-49
					184-191	50-51	50-51
					192-199	52-53	52-53
					200-207	54-55	54-55
					208-215	56-57	56-57
					216-223	58-59	58-59
					224-231	60-61	60-61
					232-239	62-63	62-63
					240-247	64-65	64-65
					248-255	66-67	66-67
						68-69	68-69
						70-71	70-71
						72-73	72-73
						74-75	74-75
						76-77	76-77
						78-79	78-79
						80-81	80-81
						82-83	82-83
						84-85	84-85
						86-87	86-87
						88-91	88-91
						90-91	90-91
						92-93	92-93
						94-95	94-95
						96-97	96-97
						98-99	98-99
						100-103	100-101
						104-107	102-103
						108-111	104-105
						112-115	106-107
						114-115	108-109
						116-119	112-113
						118-119	114-115
						120-123	116-117
						122-123	118-119
						124-127	120-121
						126-127	122-123
						128-131	124-125
						130-131	126-127
						132-133	128-129
						134-135	130-131
						136-137	132-133
						138-139	134-135
						140-143	136-137
						142-143	138-139
						144-145	140-141
						146-147	142-143
						148-151	144-145
						150-153	146-147
						152-155	150-151
						154-155	152-153
						156-157	154-155
						158-159	156-157
						160-161	158-159
						162-163	160-161
						164-165	162-163
						166-167	164-165
						168-169	166-167
						170-171	168-169
						172-173	170-171
						174-175	172-173
						176-177	174-175
						178-179	176-177
						180-181	178-179
						182-183	180-181
						184-185	182-183
						186-187	184-185
						188-189	186-187
						190-191	188-189
						192-193	190-191
						194-195	192-193
						196-197	194-195
						198-199	196-197
						200-201	198-199
						202-203	200-201
						204-205	202-203
						206-207	204-205
						208-209	206-207
						210-211	208-209
						212-213	210-211
						214-215	212-213
						216-217	214-215
						218-219	216-217
						220-223	218-219
						222-221	220-223
						224-225	222-223
						226-227	224-225
						228-229	226-227
						230-231	228-229
						232-233	230-231
						234-235	232-233
						236-237	234-235
						238-239	236-237
						240-241	238-239
						242-243	240-241
						244-245	242-243
						246-247	244-245
						248-249	246-247
						250-251	248-249
						252-253	250-251
						254-255	252-253

# Class C Addresses

## VLSM Chart 24-30 Bits (4th octet)

<b>/24</b>	<b>/25</b>	<b>/26</b>	<b>/27</b>	<b>/28</b>	<b>/29</b>	<b>/30</b>
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	128 - 255	192 - 255	224 - 255	240 - 255	248 - 255	252 - 255
						0-3
						4-7
						8-11
						12-15
						16-19
						20-23
						24-27
						28-31
						32-35
						36-39
						40-43
						44-47
						48-51
						52-55
						56-59
						60-63
						64-67
						68-71
						72-75
						76-79
						80-83
						84-87
						88-91
						92-95
						96-99
						100-103
						104-107
						108-111
						112-115
						116-119
						120-123
						124-127
						128-131
						132-135
						136-139
						140-143
						144-147
						148-151
						152-155
						156-159
						160-163
						164-167
						168-171
						172-175
						176-179
						180-183
						184-187
						188-191
						192-195
						196-199
						200-203
						204-207
						208-211
						212-215
						216-219
						220-223
						224-227
						228-231
						232-235
						236-239
						240-243
						244-247
						248-251
						252-255

### Class A Addressing Guide

<b>CIDR</b>	<b># of Bits Borrowed</b>	<b>Subnet Mask</b>	<b>Total # of Subnets</b>	<b>Total # of Hosts</b>	<b>Usable # of Hosts</b>
/8	0	255.0.0.0	1	16,777,216	16,777,214
/9	1	255.128.0.0	2	8,388,608	8,388,606
/10	2	255.192.0.0	4	4,194,304	4,194,302
/11	3	255.224.0.0	8	2,097,152	2,097,150
/12	4	255.240.0.0	16	1,048,576	1,048,574
/13	5	255.248.0.0	32	524,288	524,286
/14	6	255.252.0.0	64	262,144	262,142
/15	7	255.254.0.0	128	131,072	131,070
/16	8	255.255.0.0	256	65,536	65,534
/17	9	255.255.128.0	512	32,768	32,766
/18	10	255.255.192.0	1,024	16,384	16,382
/19	11	255.255.224.0	2,048	8,192	8,190
/20	12	255.255.240.0	4,096	4,096	4,094
/21	13	255.255.248.0	8,192	2,048	2,046
/22	14	255.255.252.0	16,384	1,024	1,022
/23	15	255.255.254.0	32,768	512	510
/24	16	255.255.255.0	65,536	256	254
/25	17	255.255.255.128	131,072	128	126
/26	18	255.255.255.192	262,144	64	62
/27	19	255.255.255.224	524,288	32	30
/28	20	255.255.255.240	1,048,576	16	14
/29	21	255.255.255.248	2,097,152	8	6
/30	22	255.255.255.252	4,194,304	4	2

### Class B Addressing Guide

<b>CIDR</b>	<b># of Bits Borrowed</b>	<b>Subnet Mask</b>	<b>Total # of Subnets</b>	<b>Total # of Hosts</b>	<b>Usable # of Hosts</b>
/16	0	255.255.0.0	1	65,536	65,534
/17	1	255.255.128.0	2	32,768	32,766
/18	2	255.255.192.0	4	16,384	16,382
/19	3	255.255.224.0	8	8,192	8,190
/20	4	255.255.240.0	16	4,096	4,094
/21	5	255.255.248.0	32	2,048	2,046
/22	6	255.255.252.0	64	1,024	1,022
/23	7	255.255.254.0	128	512	510
/24	8	255.255.255.0	256	256	254
/25	9	255.255.255.128	512	128	126
/26	10	255.255.255.192	1,024	64	62
/27	11	255.255.255.224	2,048	32	30
/28	12	255.255.255.240	4,096	16	14
/29	13	255.255.255.248	8,192	8	6
/30	14	255.255.255.252	16,384	4	2

### Class C Addressing Guide

<b>CIDR</b>	<b># of Bits Borrowed</b>	<b>Subnet Mask</b>	<b>Total # of Subnets</b>	<b>Total # of Hosts</b>	<b>Usable # of Hosts</b>
/24	0	255.255.255.0	1	256	254
/25	1	255.255.255.128	2	128	126
/26	2	255.255.255.192	4	64	62
/27	3	255.255.255.224	8	32	30
/28	4	255.255.255.240	16	16	14
/29	5	255.255.255.248	32	8	6
/30	6	255.255.255.252	64	4	2