

# VLSM

Variable-Length Subnet Mask

Workbook

Version 2.0

Instructor's Edition

192.168

192.168.10.96

192.168.10.126

172.31.15.0

10.250.1.0

## 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,  
and to everyone who has sent in suggestions to improve the series.

### Workbooks included in the series:

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

Instructors (and anyone else for that matter) please do not post the Instructors version on public websites. When you do this you are giving everyone else worldwide the answers. Yes, students look for answers this way. It also discourages others; myself included, from posting high quality materials.

Inside Cover

# **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

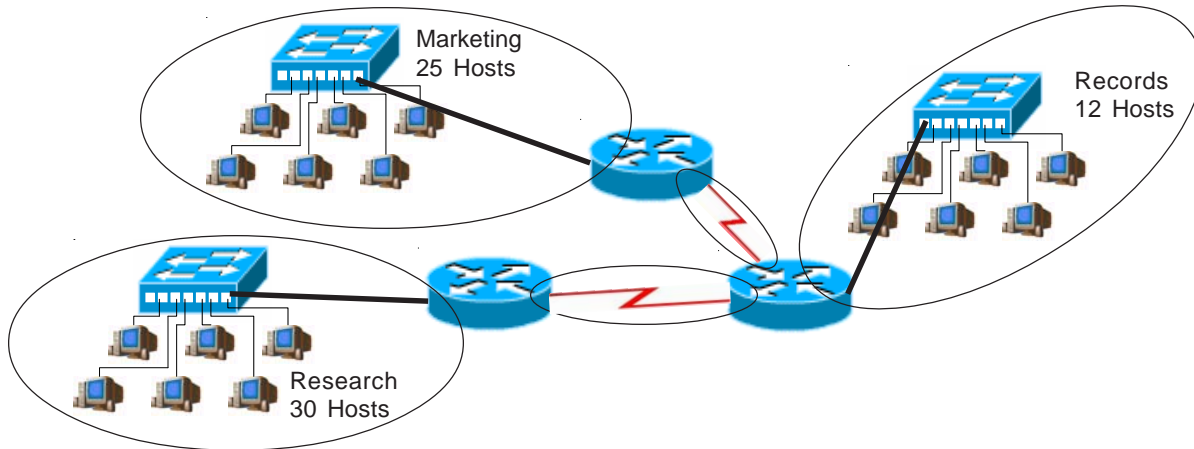
This workbook explores three different methods to figure out sub-subnets: the box method, the circle method, and a VLSM chart.

# 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

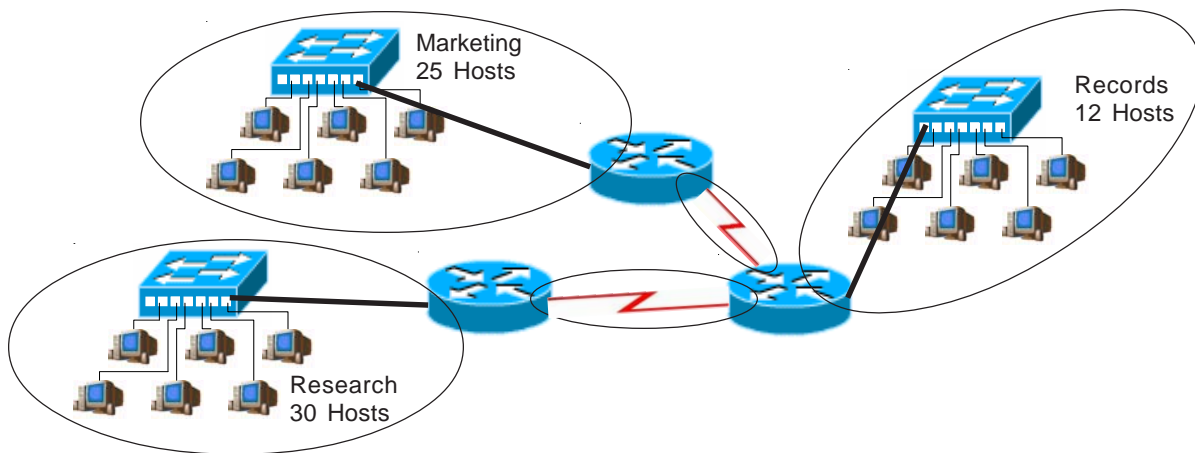
0	32	128	160
31	63	159	191
64	96	192	224
95	127	223	255

## 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 a 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**

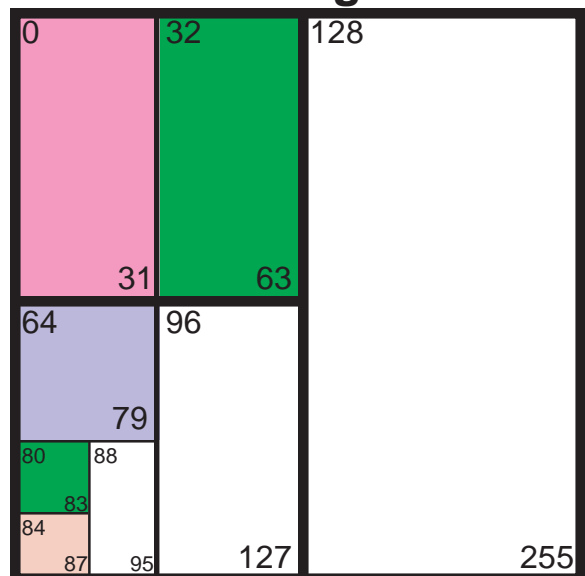


By adjusting the subnet masks you can cut your address usage by almost half in this example. This type of subnetting requires a network protocol which will support it such as: RIP version 2, EIGRP, OSPF, or BGP.

### 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	192.168.1.87	/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

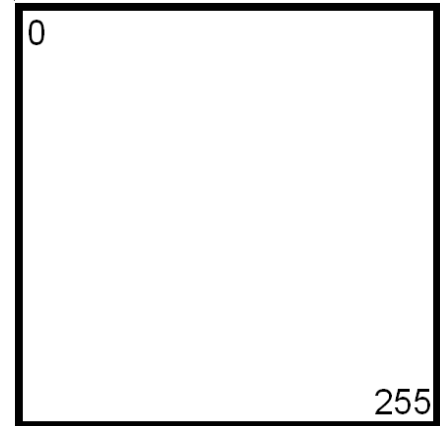


# Visualizing Subnets Using The Box Method

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.

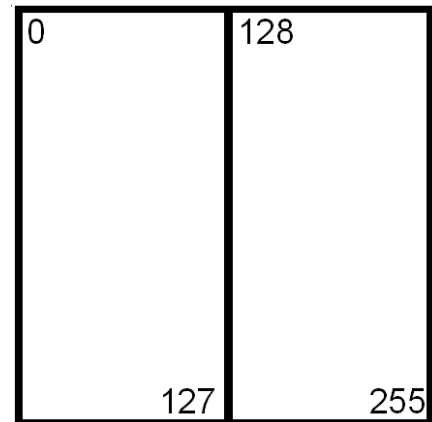
Start with a square. The whole square is a single subnet comprised of 256 addresses.

/24  
255.255.255.0  
256 Hosts  
1 Subnet



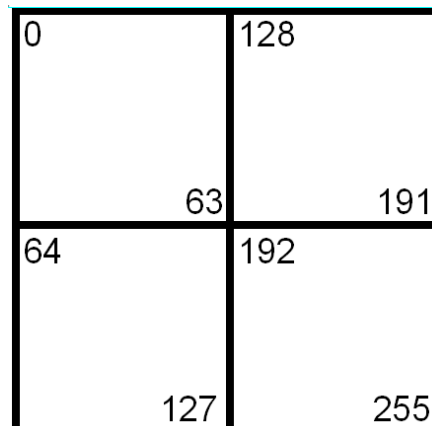
Split the box in half and you get two subnets with 128 addresses.

/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	231	239
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

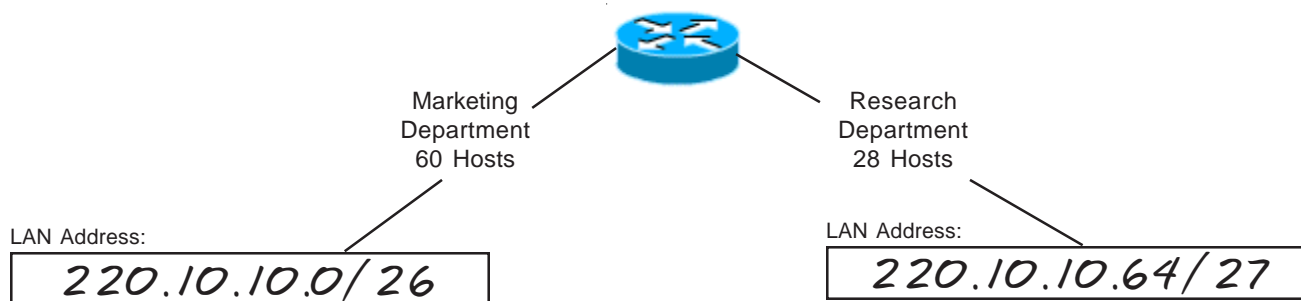
# VLSM Addressing

## Box Method

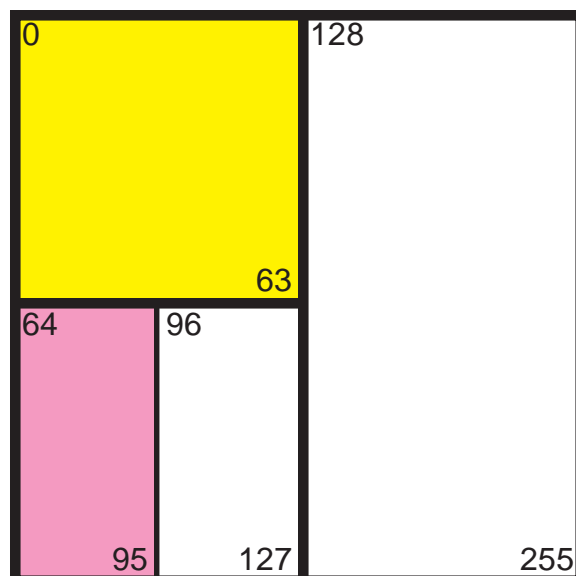
(Sample)

### 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.





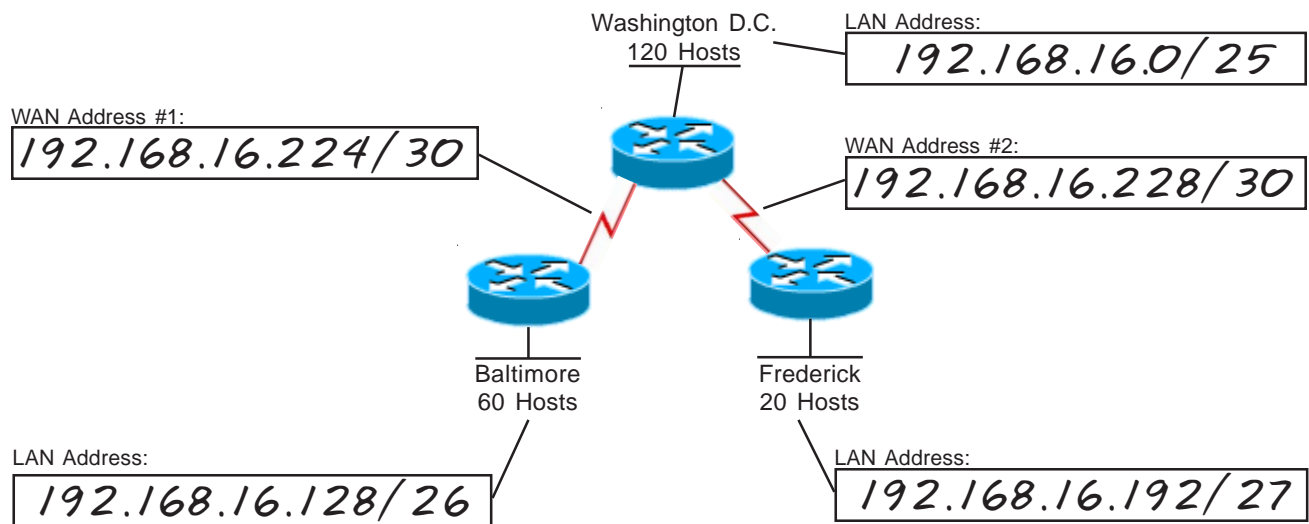
# VLSM Addressing

## Box Method

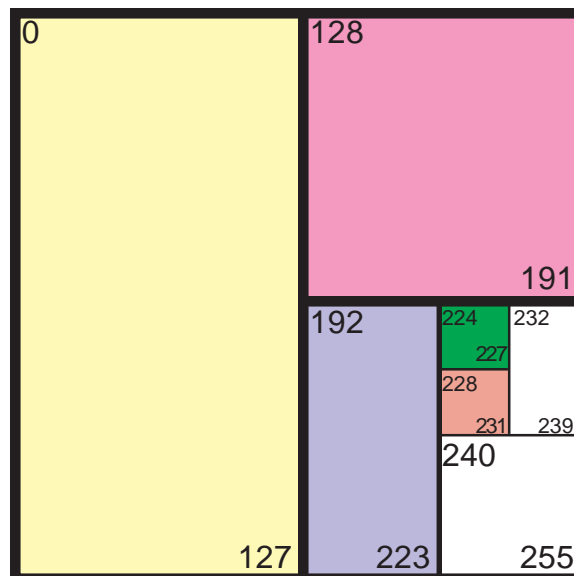
(Sample)

### 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.

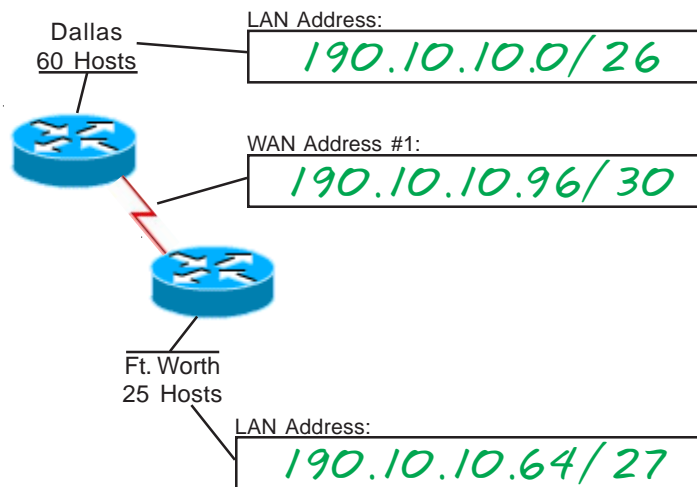


# VLSM Addressing

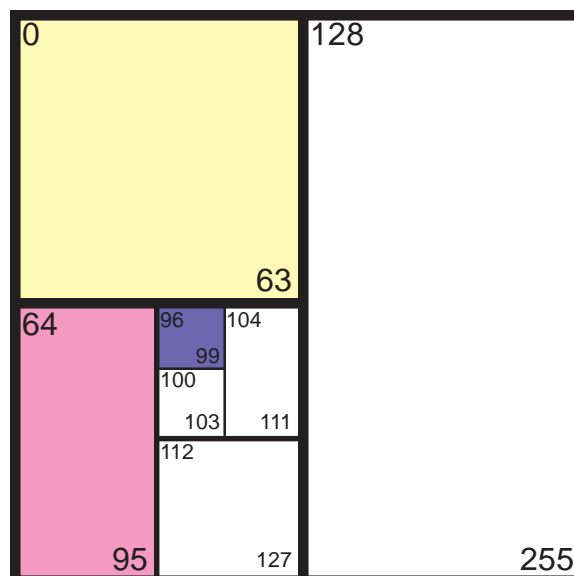
## Box Method

### 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.

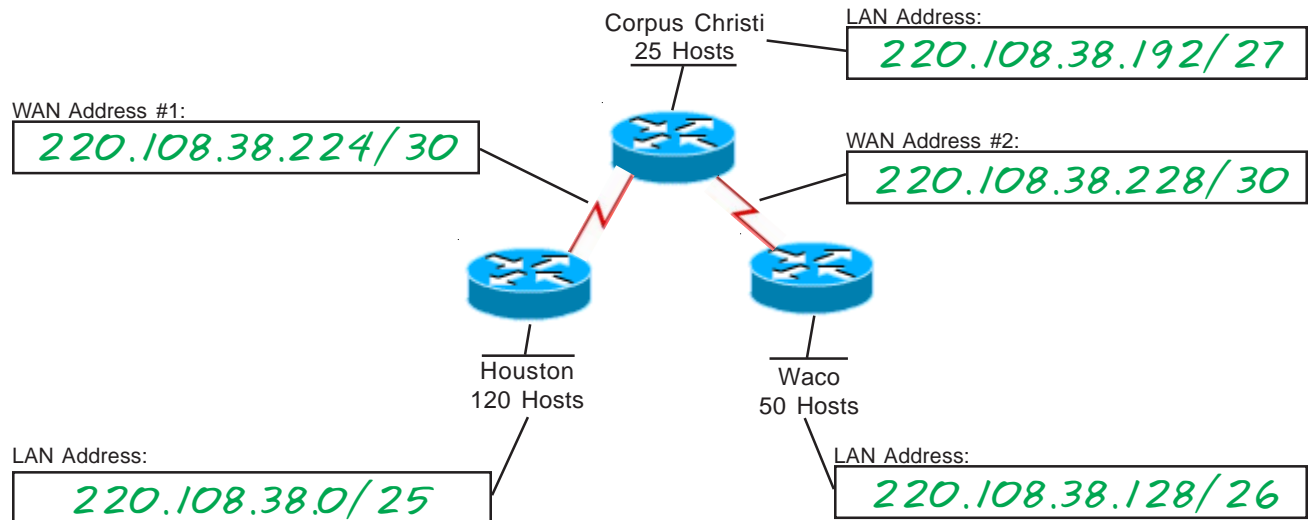


# VLSM Addressing

## 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.

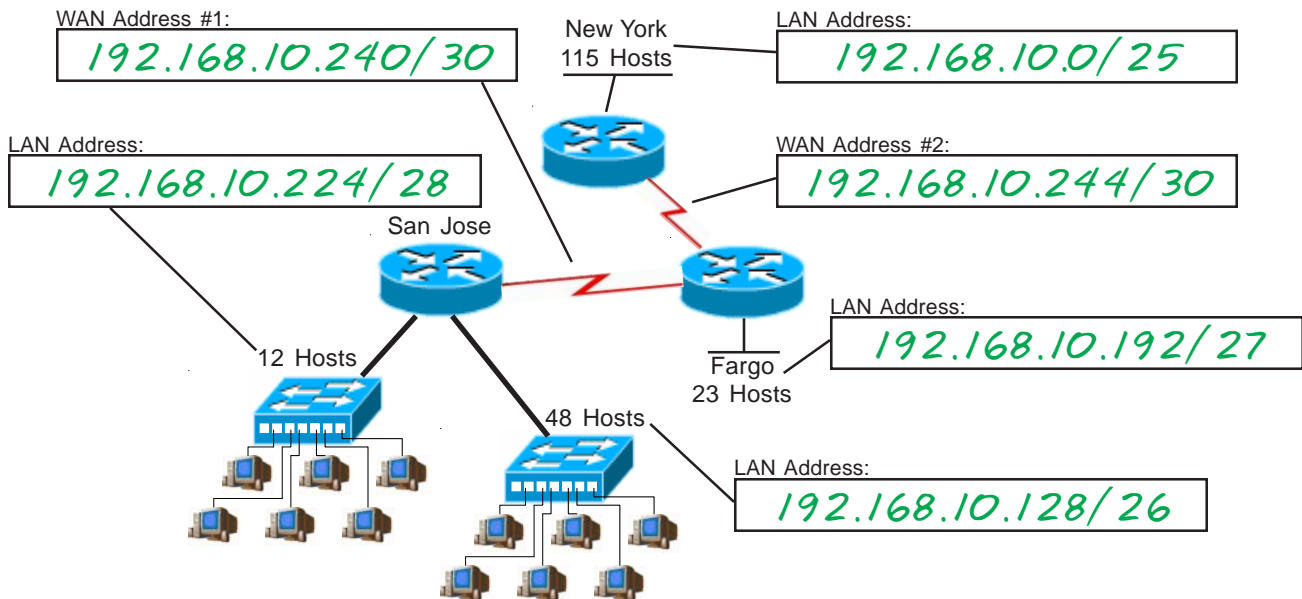
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	163
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	167
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103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

# 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.

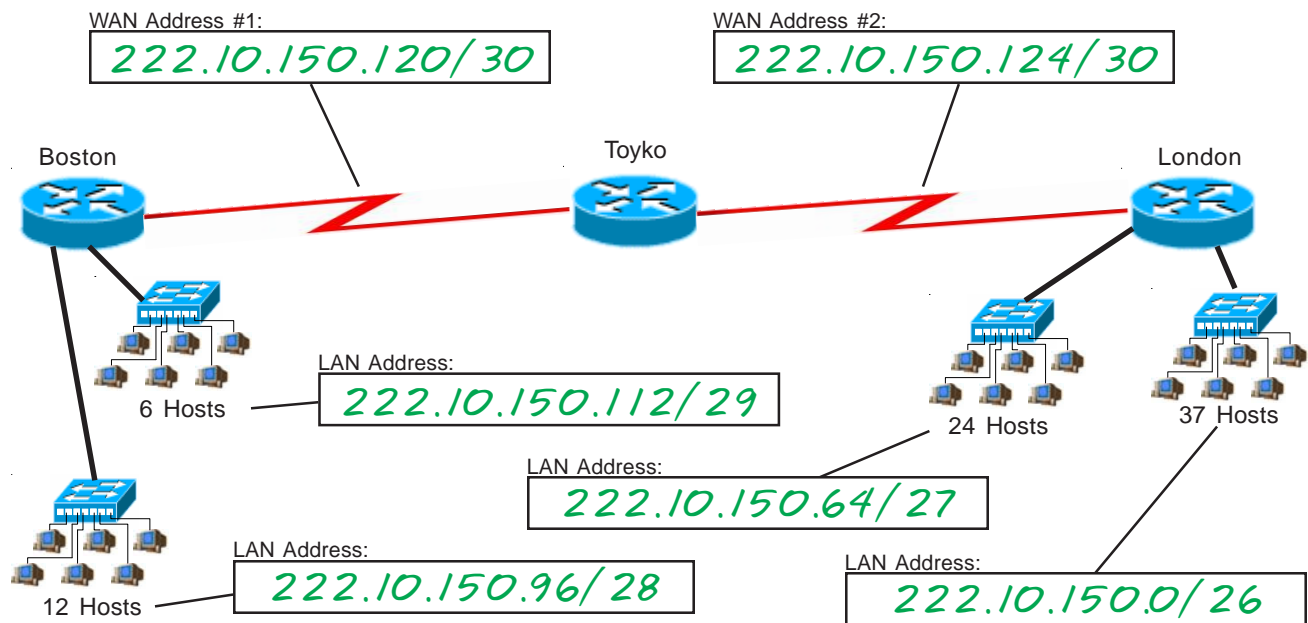
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	163
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	167
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103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

# 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.

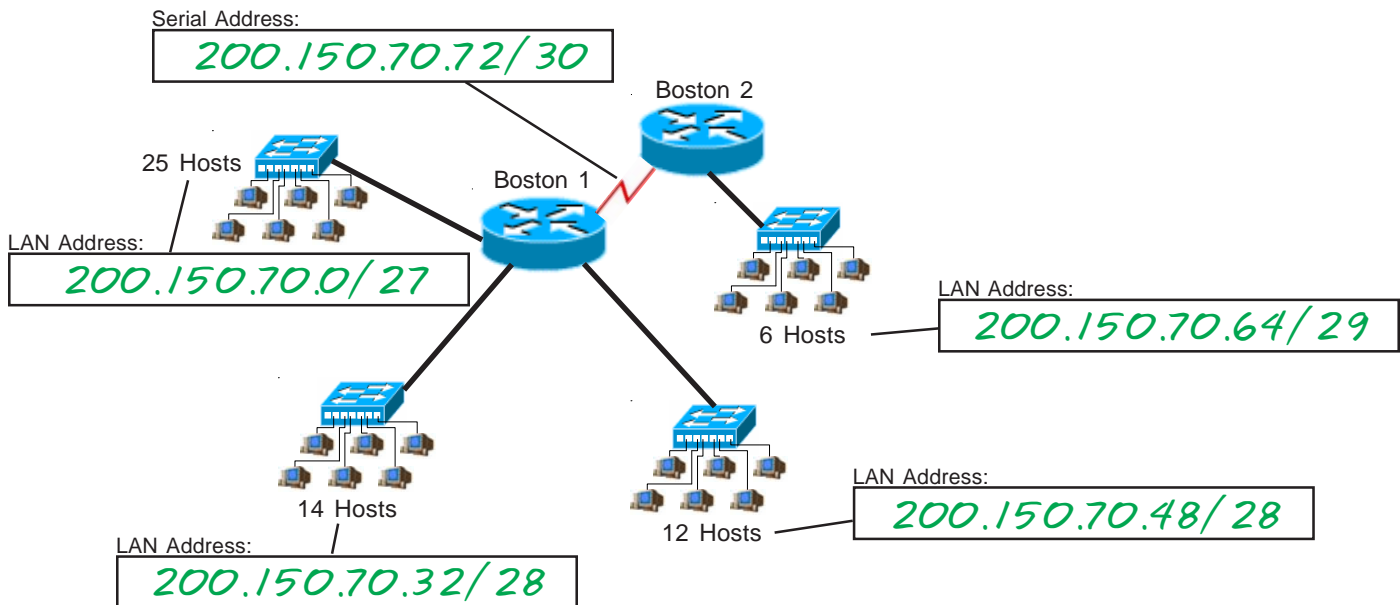
0	32	128	160
31	63	159	191
64	96	192	224
95	111	223	255
112	120		
119	123		
124	127		

# VLSM Addressing

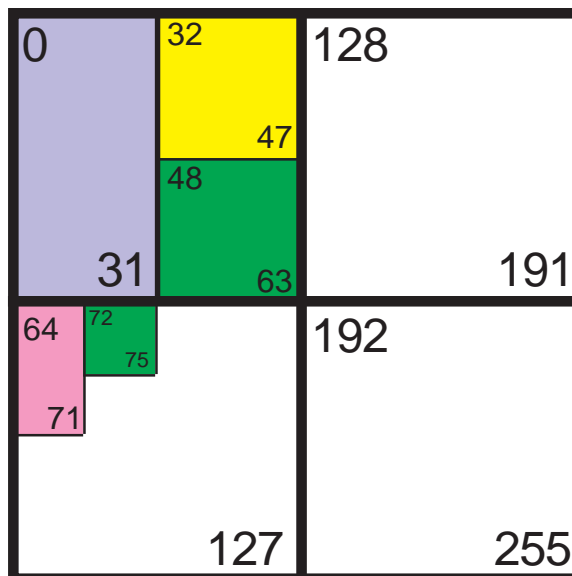
## Box Method

### 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.

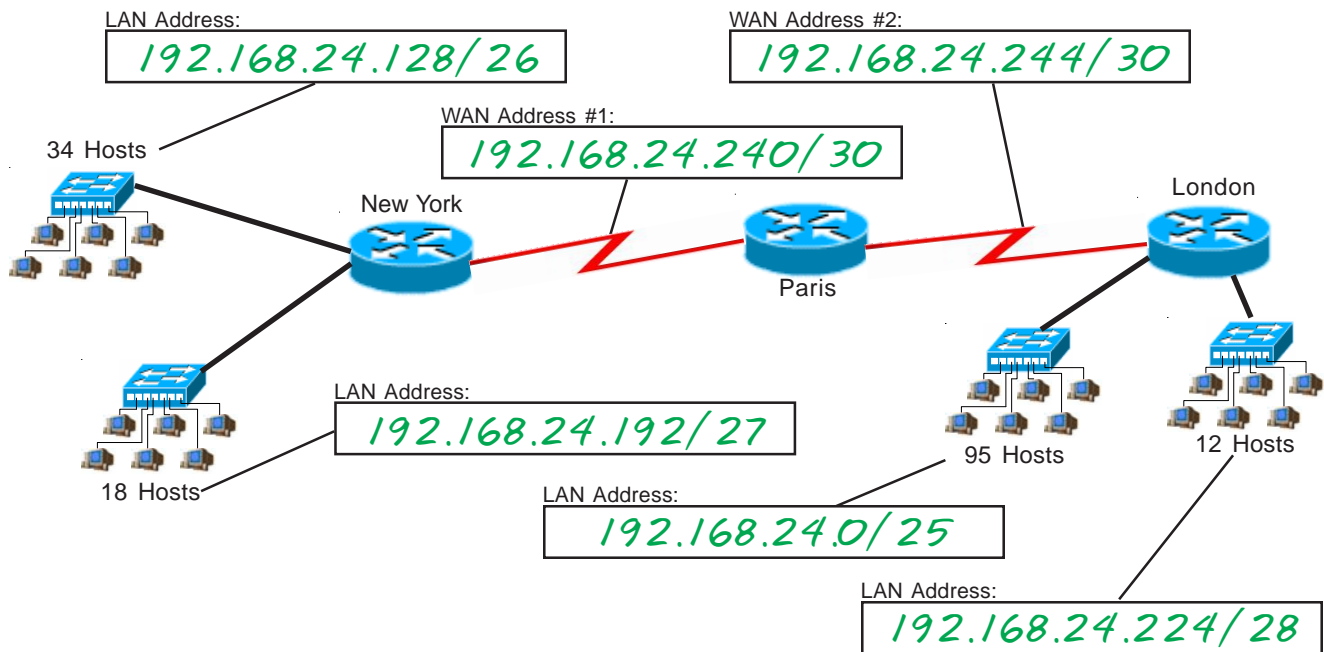


# VLSM Addressing

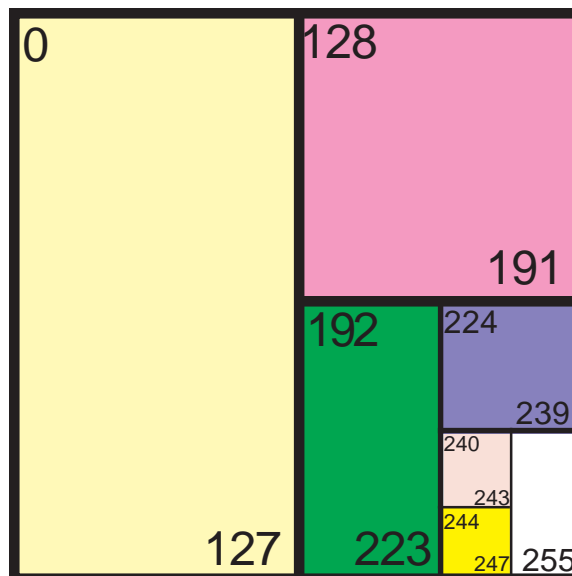
## Box Method

### 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.

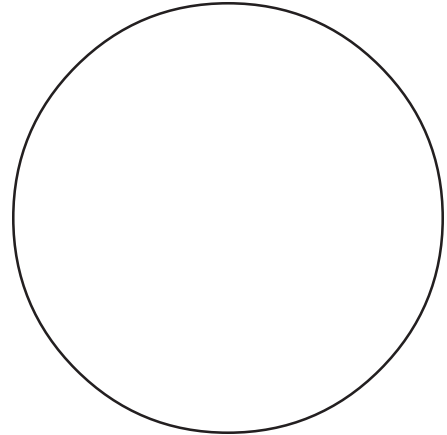


# Visualizing Subnets Using The Circle Method

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.

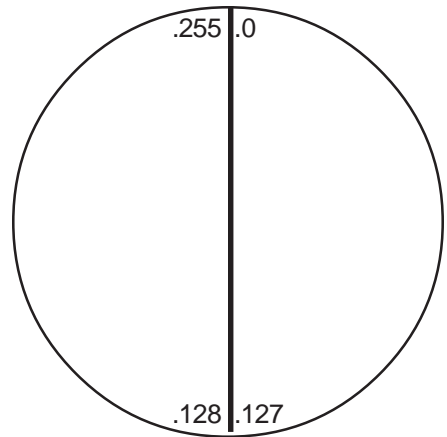
Start with a circle. The whole circle is a single subnet comprised of 256 addresses.

/24  
255.255.255.0  
256 Hosts  
1 Subnet



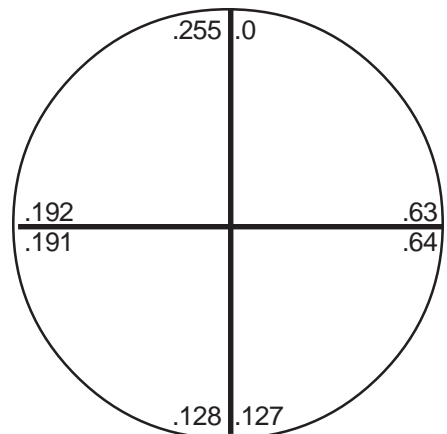
Split the circle in half and you get two subnets with 128 addresses.

/25  
255.255.255.128  
128 Hosts  
2 Subnets



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

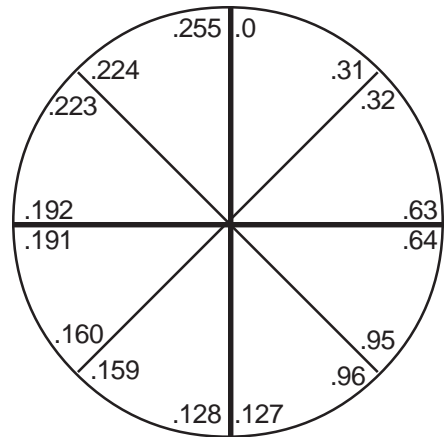
/26  
255.255.255.192  
64 Hosts  
4 Subnets





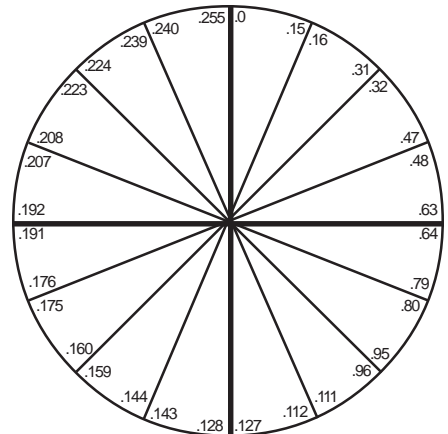
Split each quarter and you get eight subnets with 32 addresses.

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



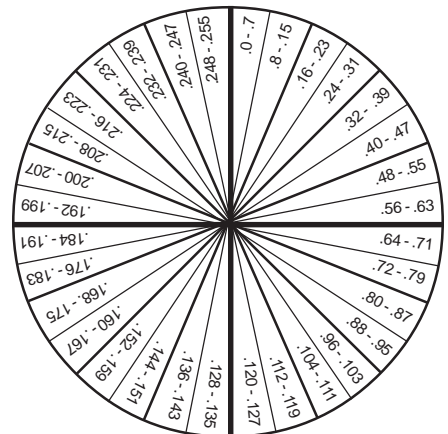
Split the boxes in half again and you get sixteen subnets with sixteen addresses.

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



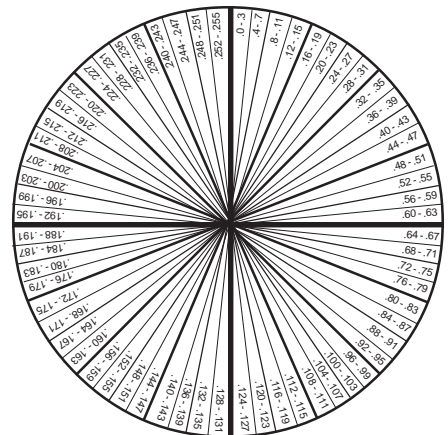
The next split gives you thirty two subnets with eight addresses.

**/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**



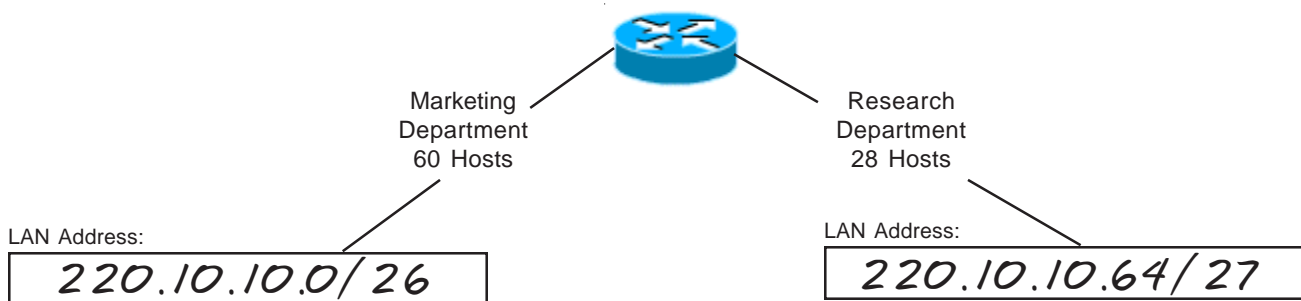
# VLSM Addressing

## Circle Method

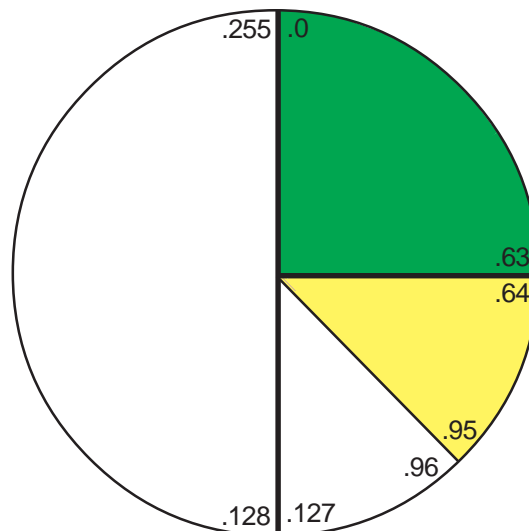
(Sample)

### 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.



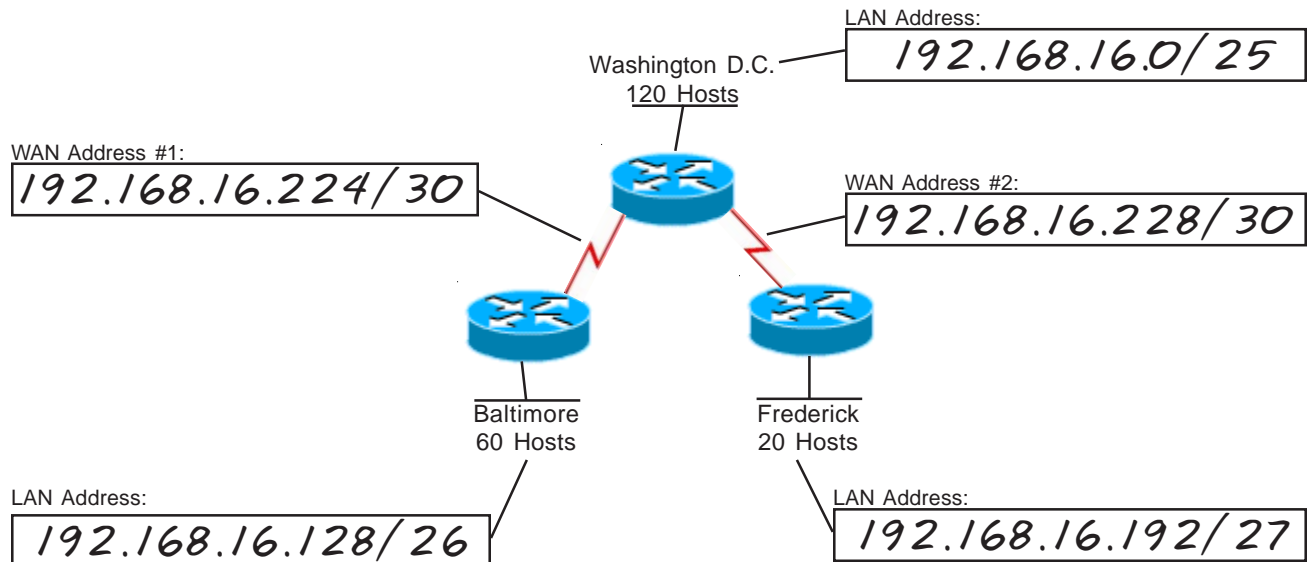
# VLSM Addressing

## Circle Method

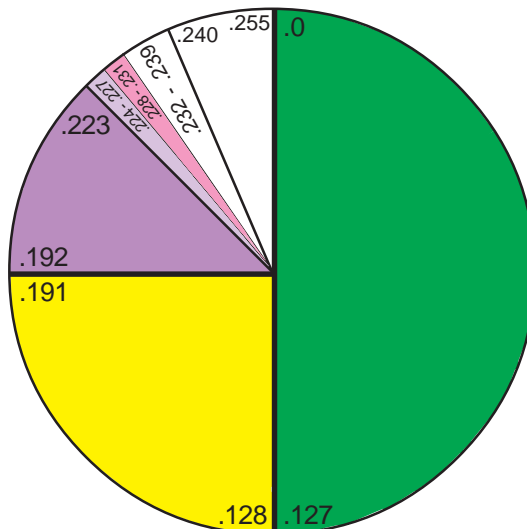
(Sample)

### 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.

LAN Address:

200.20.20.0/25

Marketing  
Department  
100 Hosts

Marketing  
Department  
50 Hosts

Department  
25 Hosts

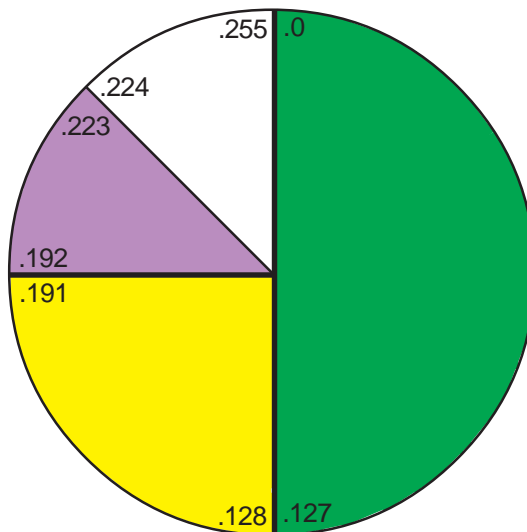
LAN Address:

200.20.20.128/26

LAN Address:

200.20.20.192/27

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

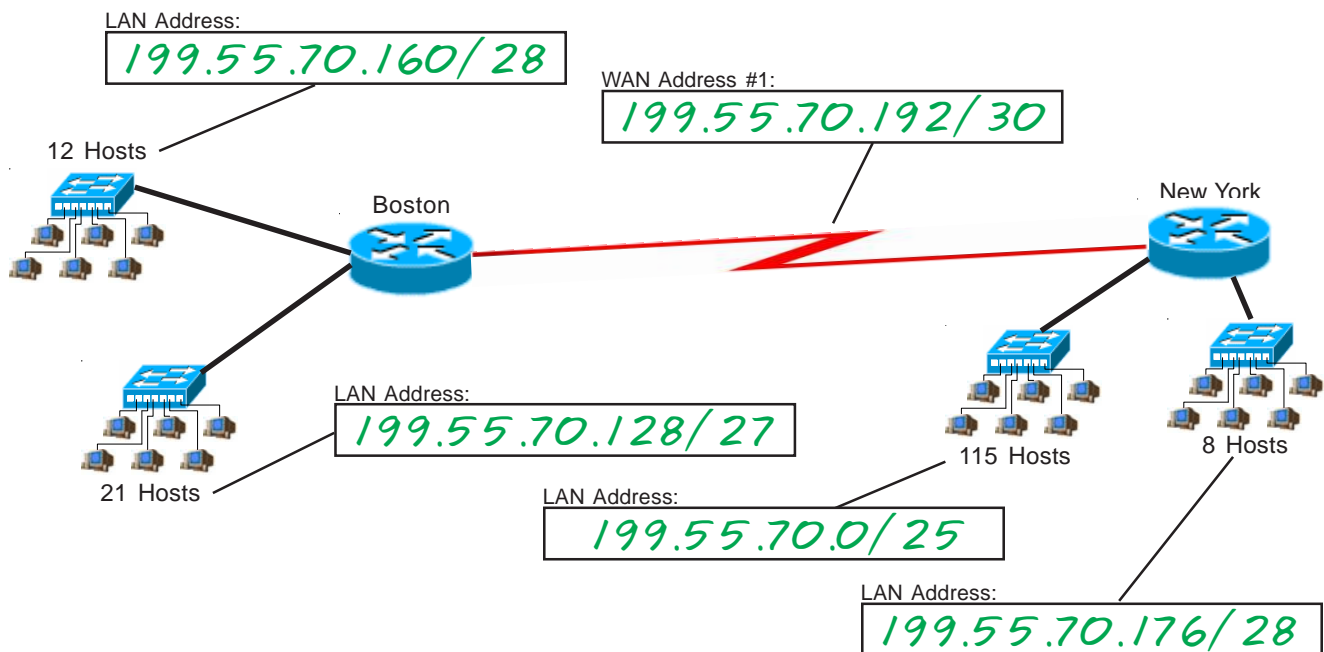


# VLSM Addressing

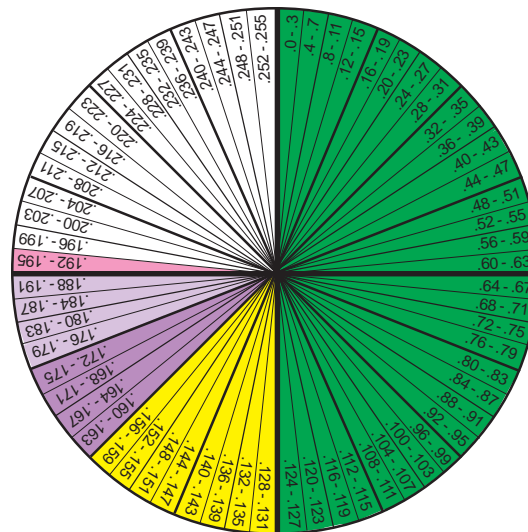
## Circle Method

### 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.

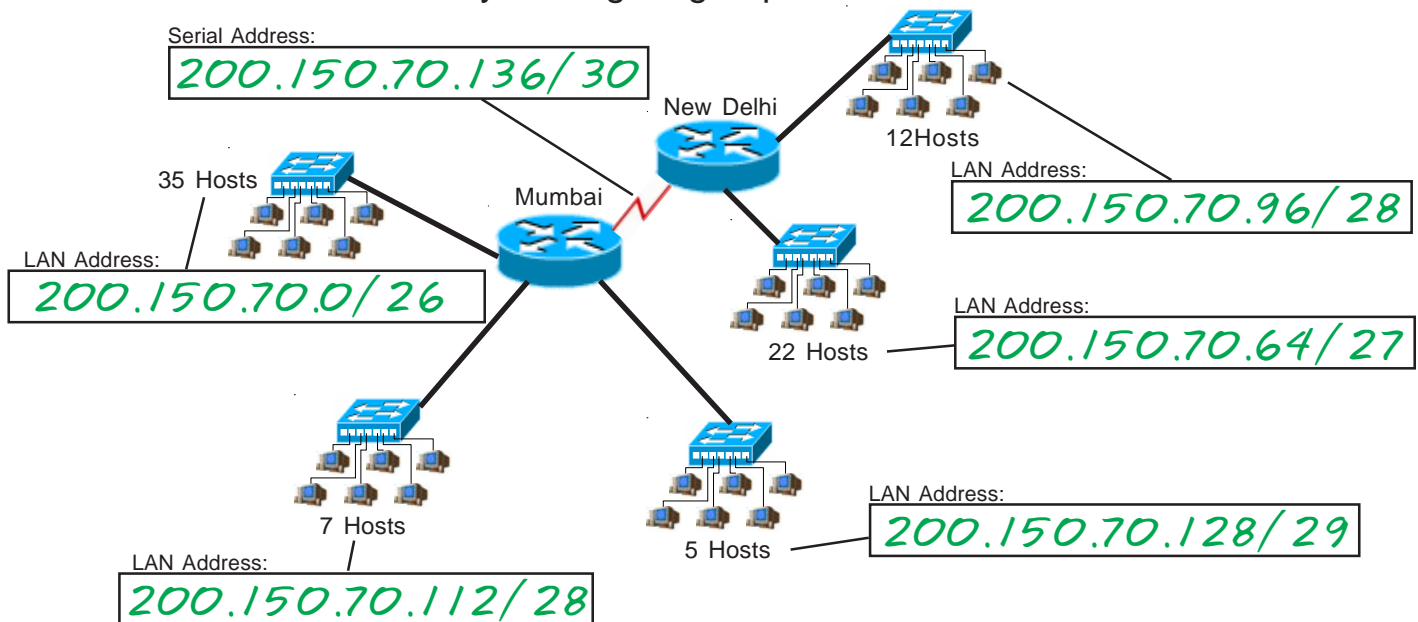


# VLSM Addressing

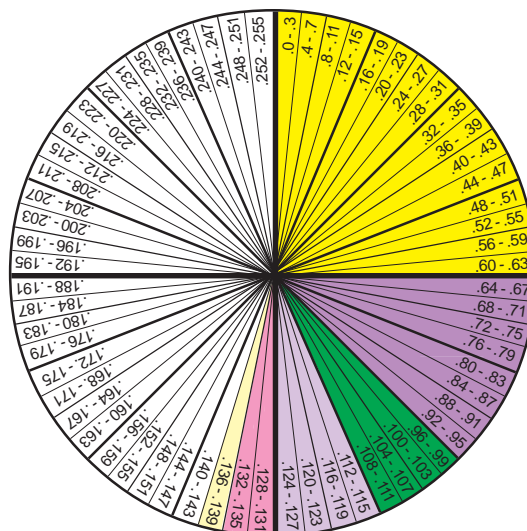
## Circle Method

### 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.

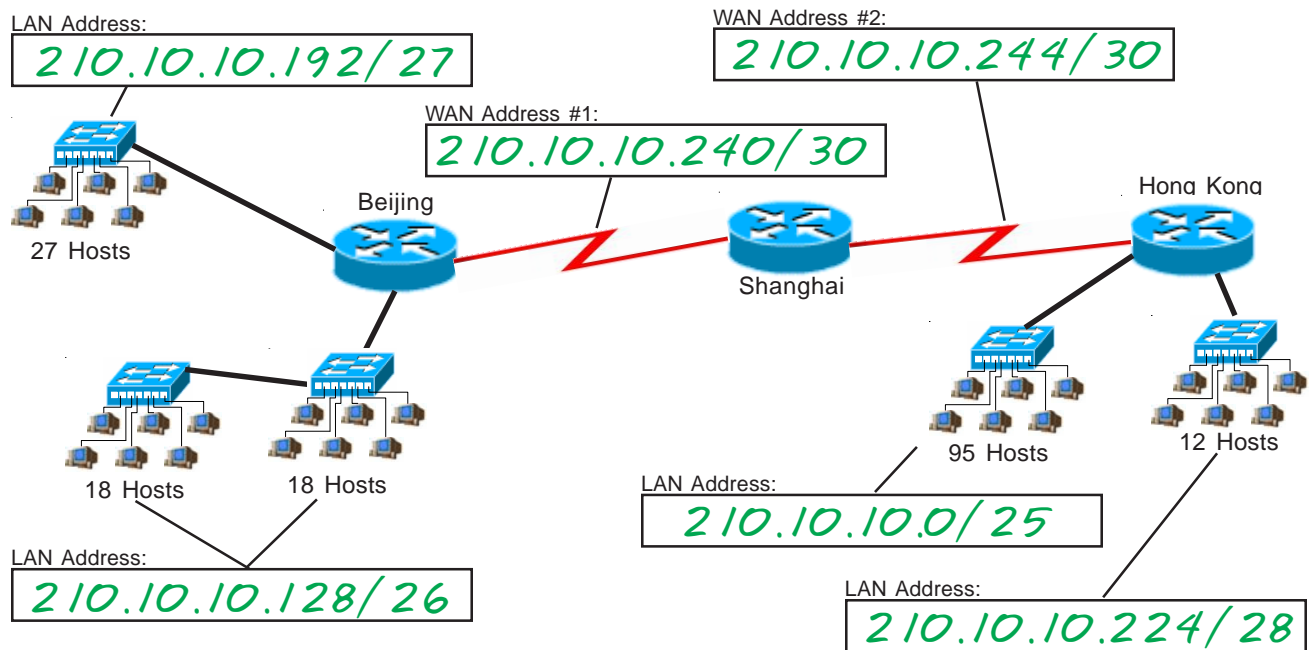


# VLSM Addressing

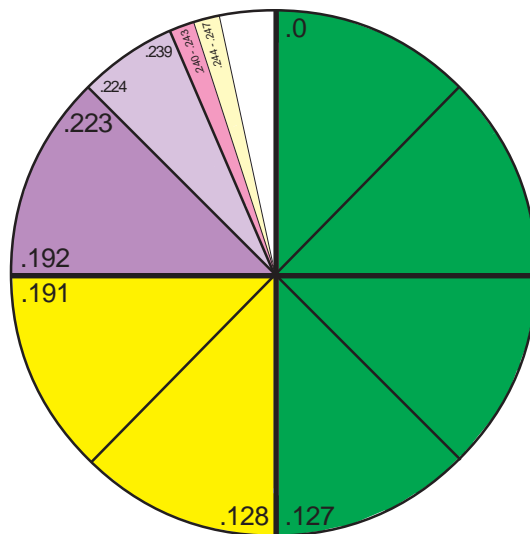
## Circle Method

### 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.

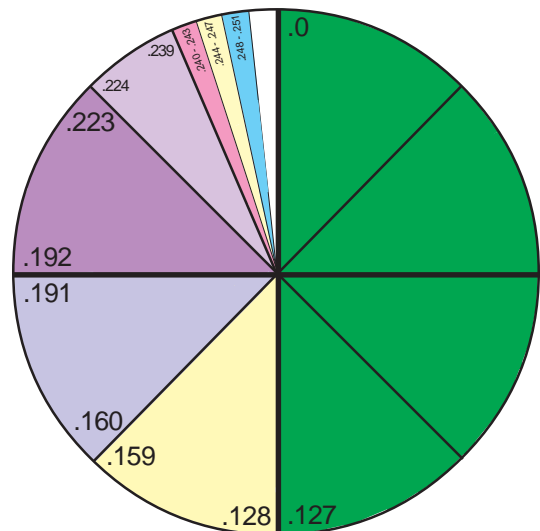
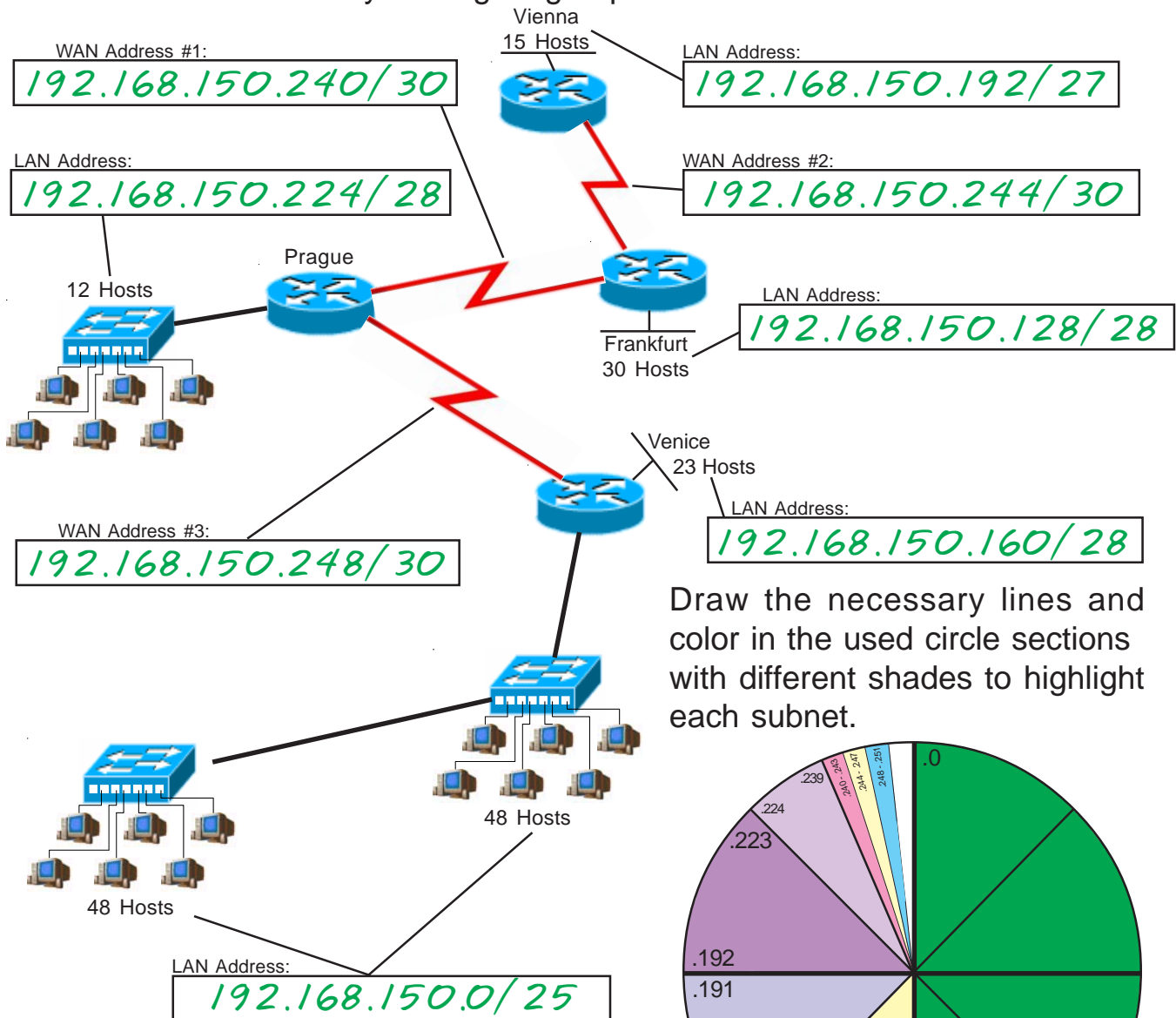


# VLSM Addressing

## 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.



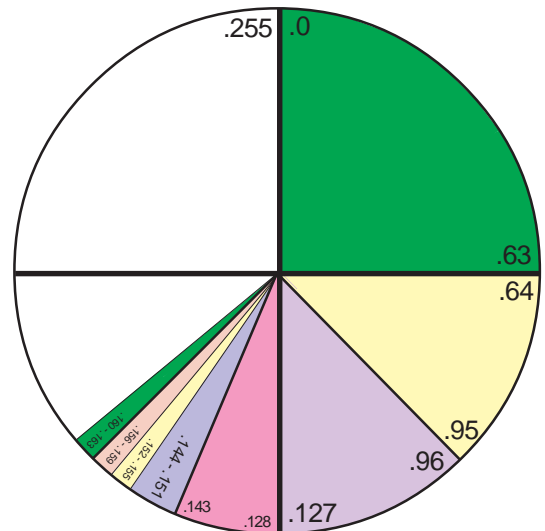
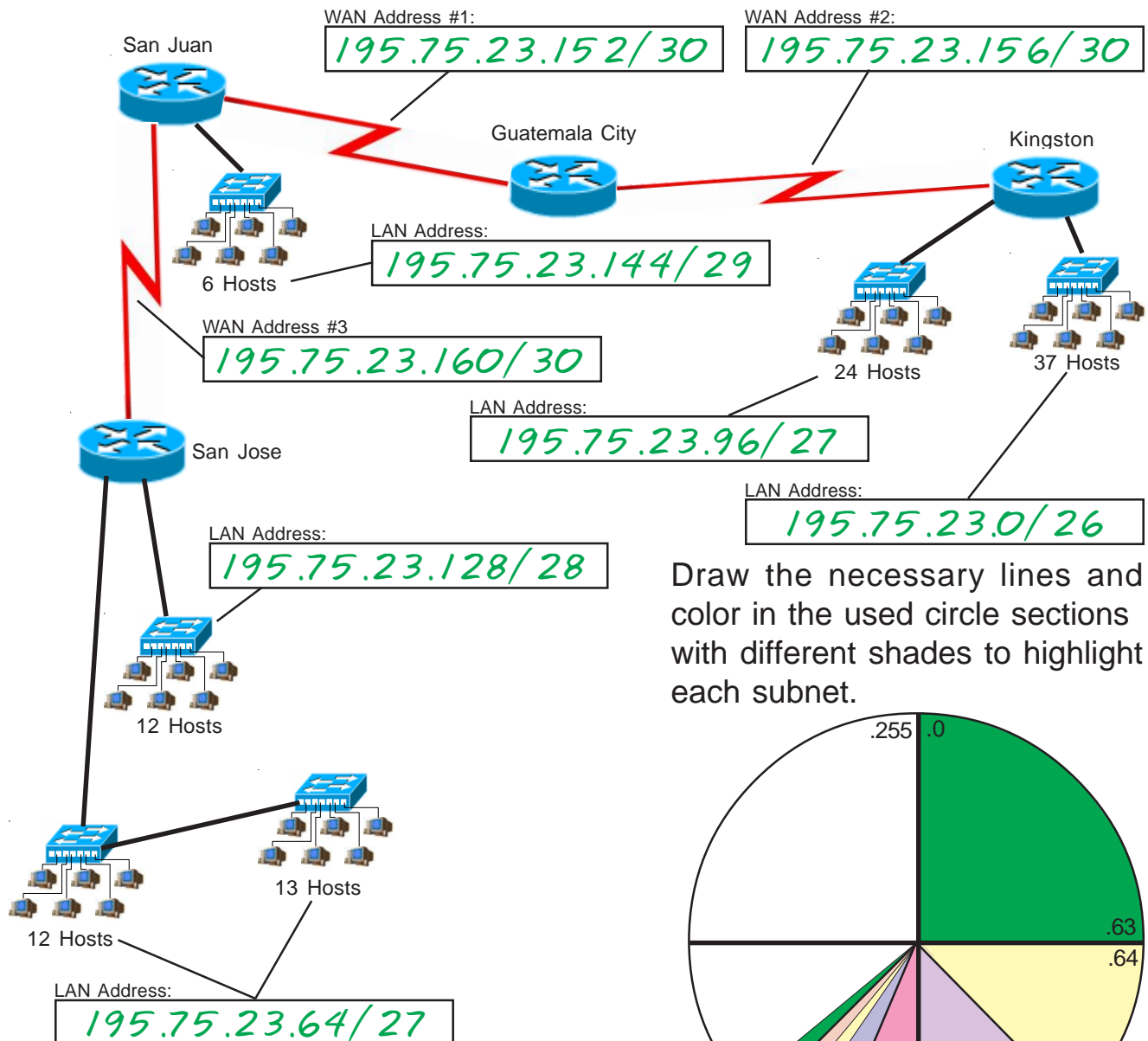


# VLSM Addressing

## 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.

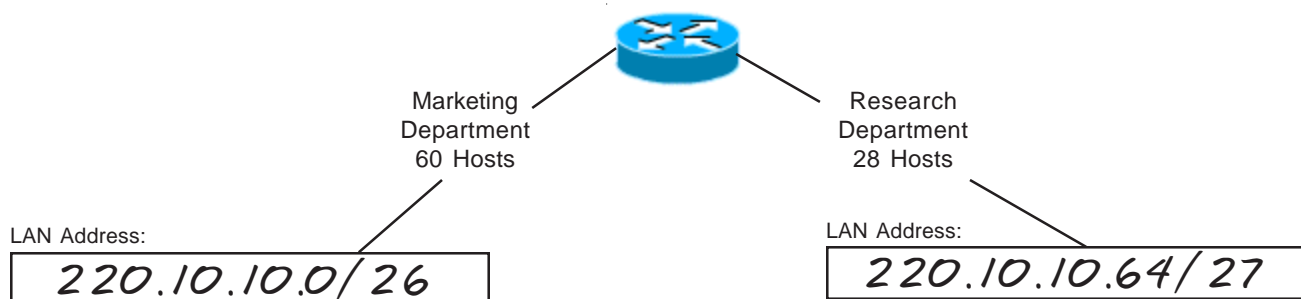
## VLSM Addressing

### 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)

/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31	24-27 28-31
			32-63	32-47	32-39	32-35 36-39
					40-47	40-43 44-47
				48-63	48-55	48-51 52-55
					56-63	56-59 60-63
		64-127	64-95	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
			96-127	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
	128-255	128-191	128-159	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
			160-191	160-175	16-167	160-163 164-167
					168-175	168-171 172-175
				176-191	176-183	176-179 180-183
					184-191	184-187 188-191
		192-255	192-223	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
			224-255	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

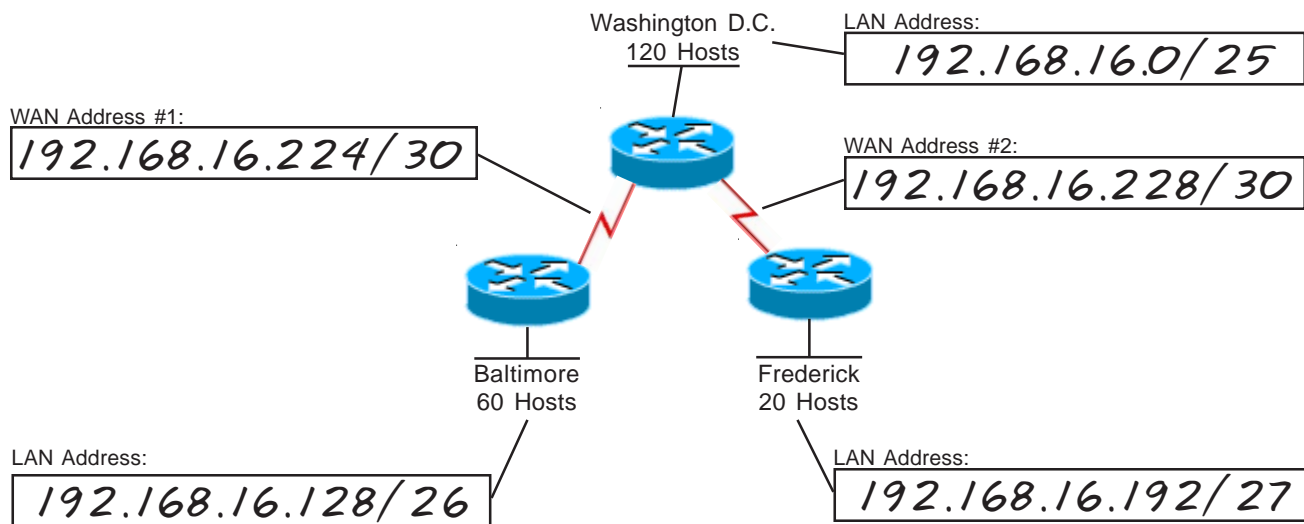
# VLSM Addressing

## 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)

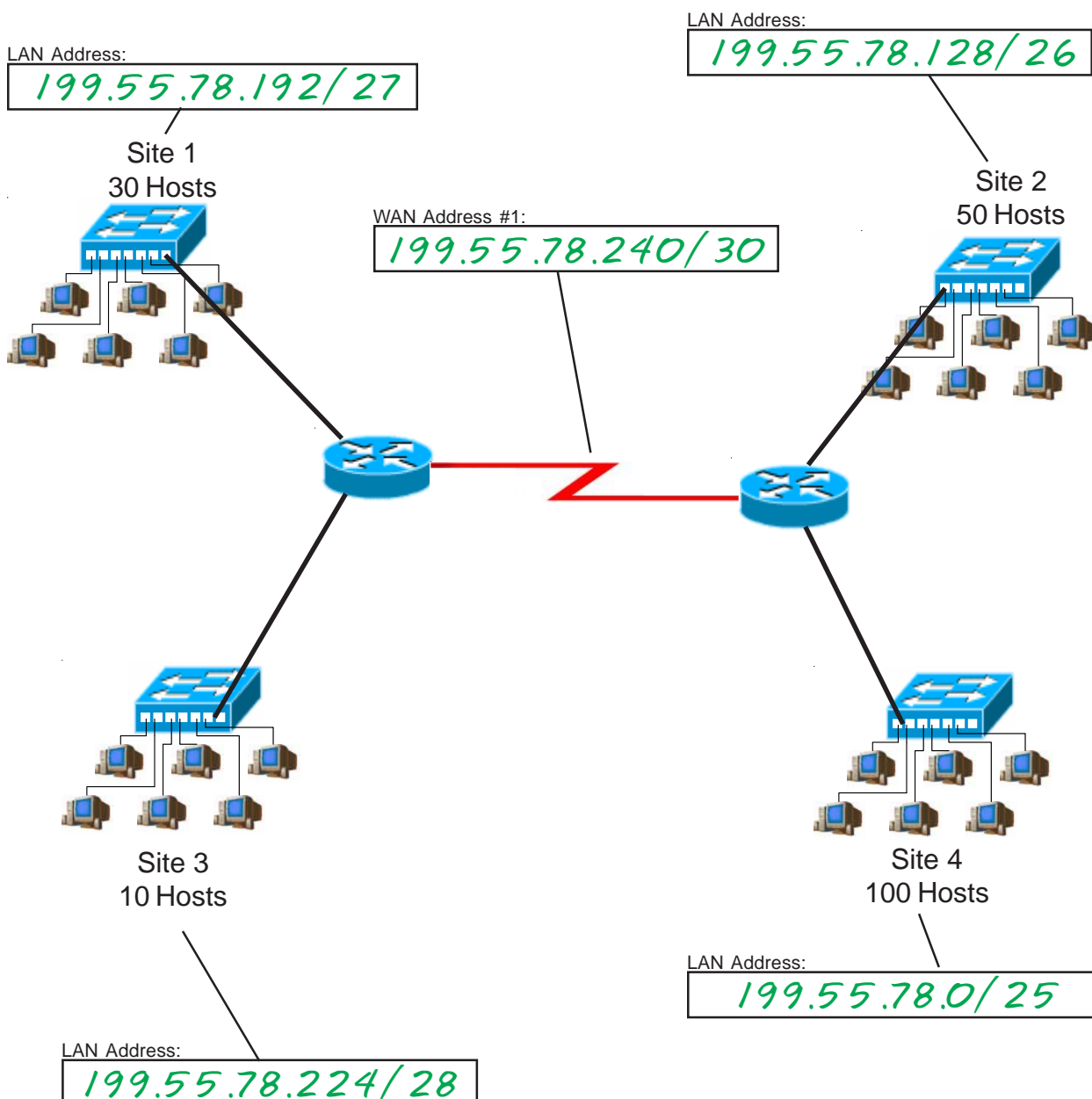
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31	24-27 28-31
		32-63	32-47	32-39	32-39	32-35 36-39
					40-47	40-43 44-47
				48-63	48-55	48-51 52-55
					56-63	56-59 60-63
		64-127	64-95	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
			96-127	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
	128-255	128-191	128-159	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
		160-191	160-175	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
		192-255	192-223	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
			224-255	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 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)

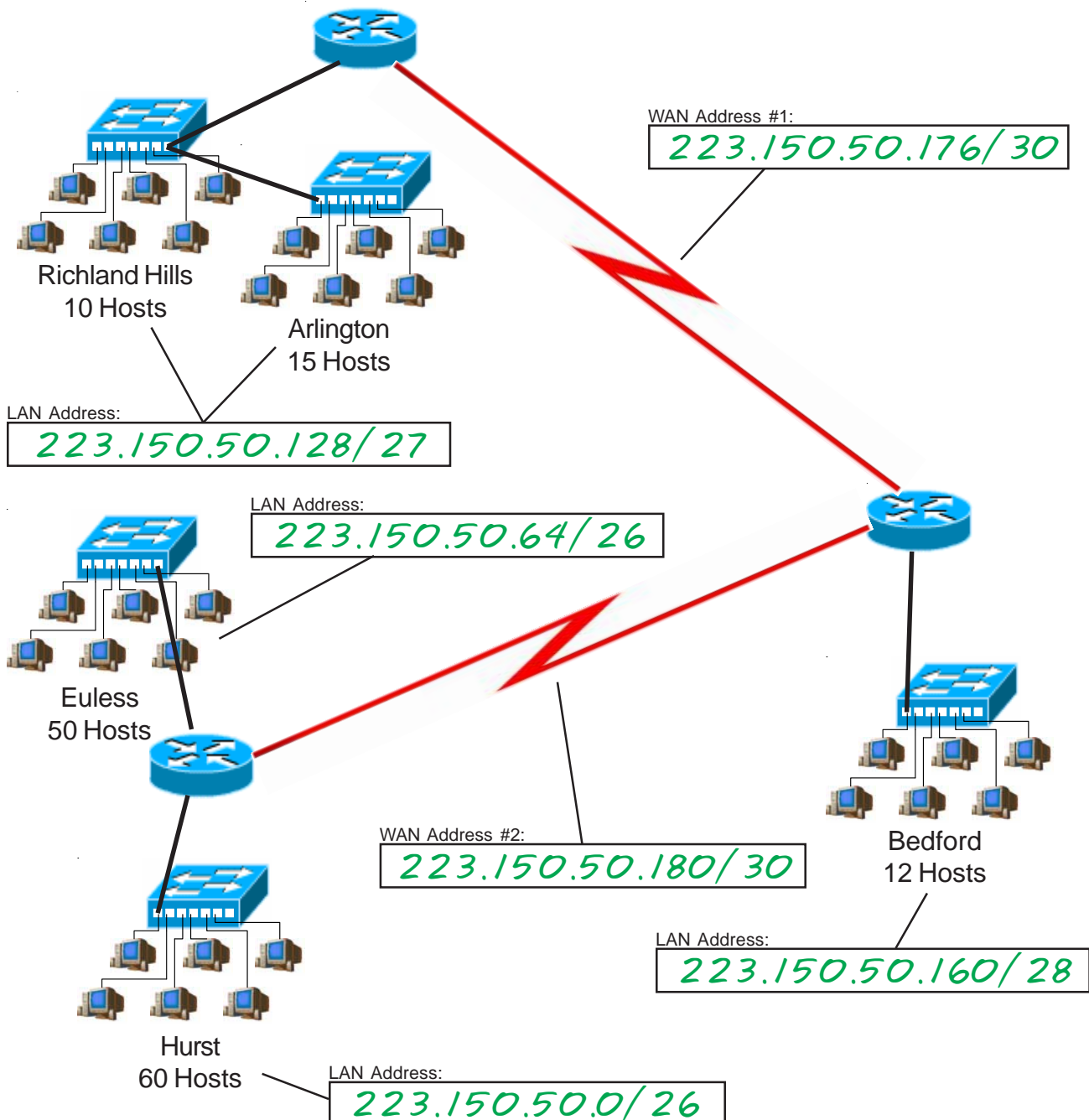
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						36-39
					40-47	40-43
						44-47
				48-63	48-55	48-51
						52-55
					56-63	56-59
						60-63
		64-127	64-95	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
			96-127	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
	128-255	128-191	128-159	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
			160-191	160-175	16-167	160-163
						164-167
					168-175	168-171
						172-175
				176-191	176-183	176-179
						180-183
					184-191	184-187
						188-191
		192-255	192-223	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
			224-255	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 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)

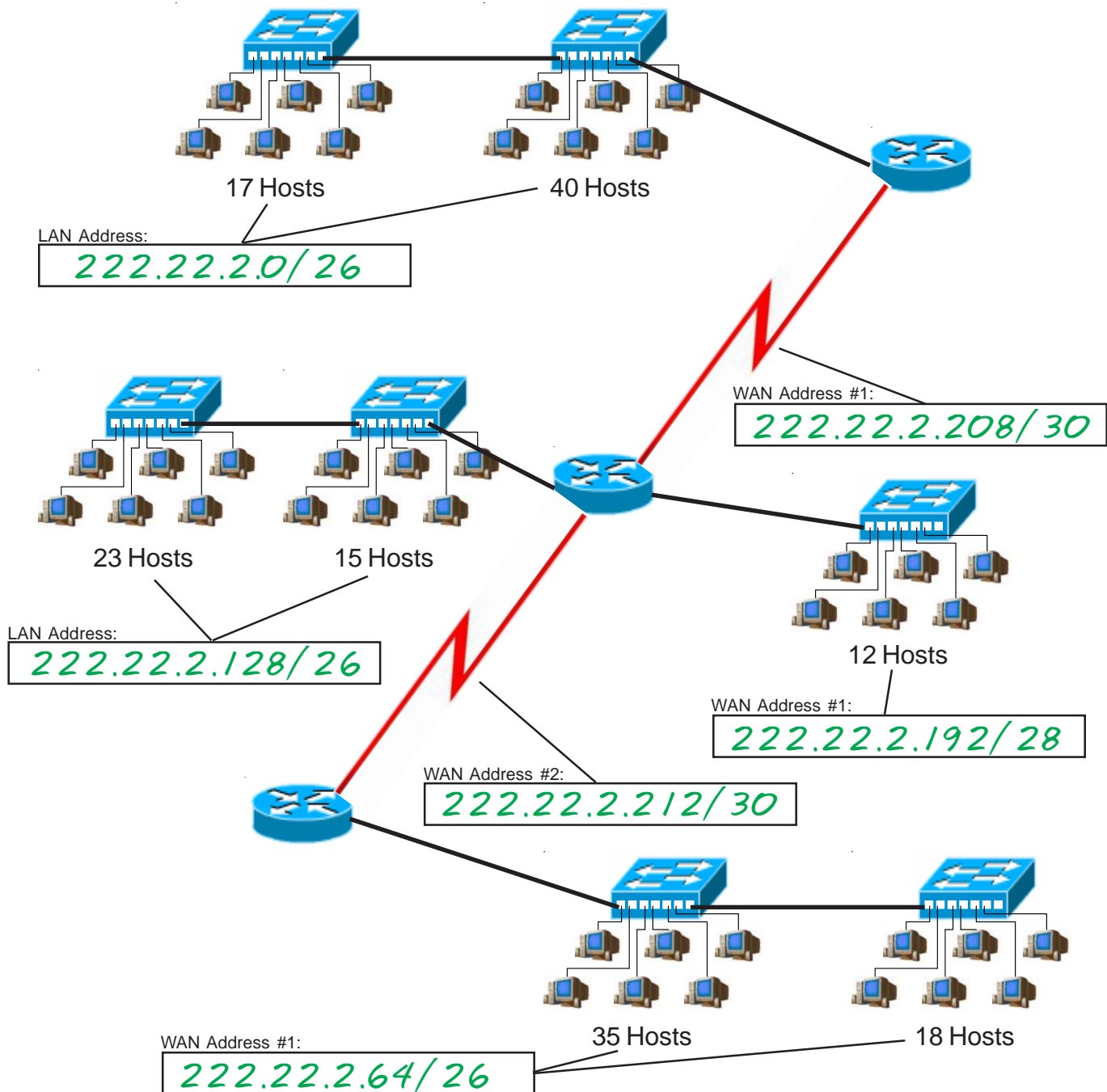
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31	24-27 28-31
			32-63	32-47	32-39	32-35 36-39
					40-47	40-43 44-47
				48-63	48-55	48-51 52-55
					56-63	56-59 60-63
		64-127	64-95	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
			96-127	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
	128-255	128-191	128-159	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
			160-191	160-175	16-167	160-163 164-167
					168-175	168-171 172-175
				176-191	176-183	176-179 180-183
					184-191	184-187 188-191
		192-255	192-223	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
			224-255	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 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)

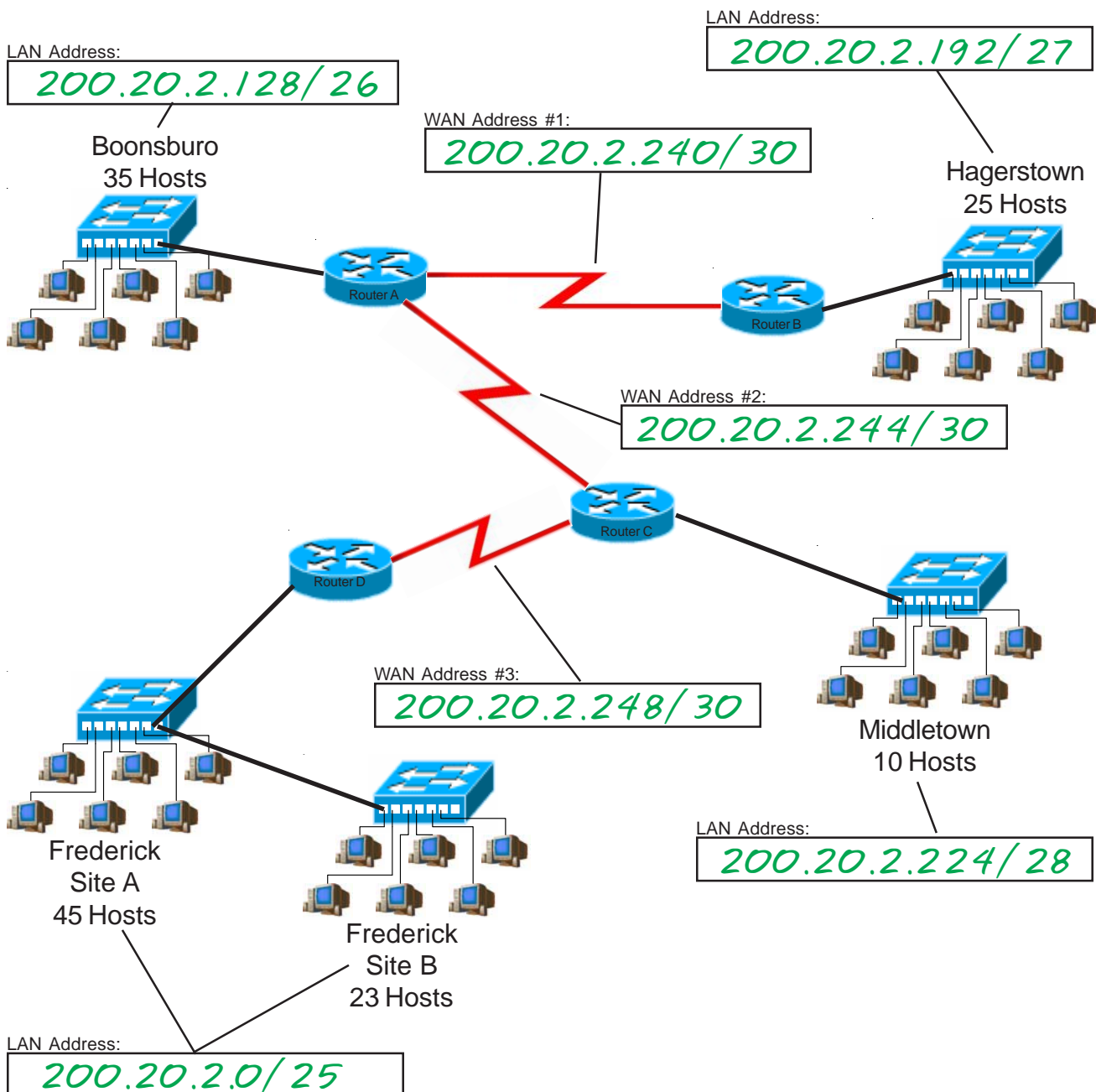
/24	/25	/26	/27	/28	/29	/30		
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts		
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3		
					4-7	4-7		
				16-31	8-15	8-11		
					12-15	12-15		
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

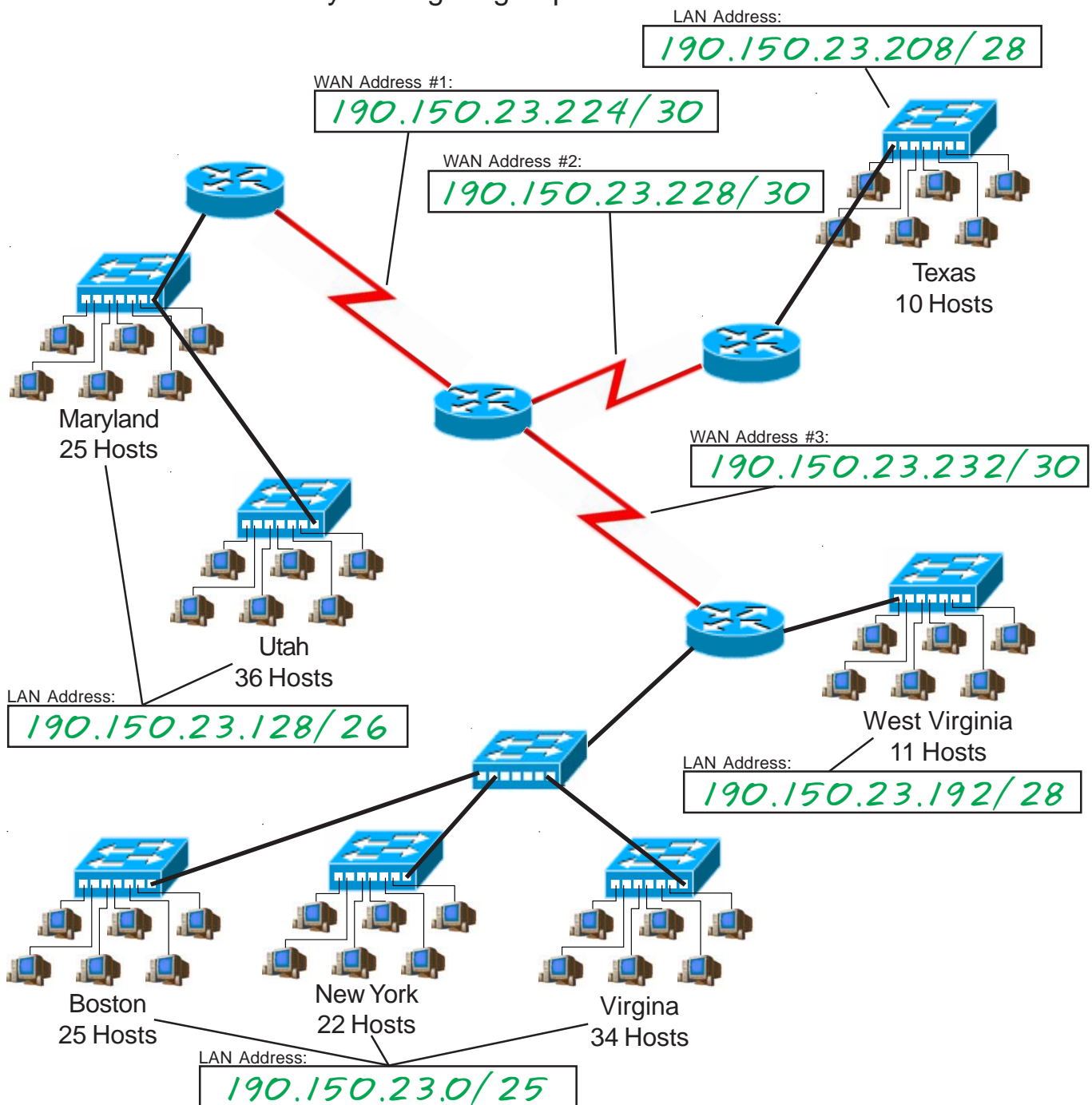
## VLSM Chart 24-30 Bits (4th octet)

/24	/25	/26	/27	/28	/29	/30	
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	4-7	
				16-31	8-15	8-11	
					12-15	12-15	
			32-63	32-47	16-23	16-19	
					20-23	20-23	
				48-63	24-31	24-27	
					28-31	28-31	
		64-127		64-95	64-79	32-39	32-35
						36-39	36-39
				80-95	40-47	40-43	
					44-47	44-47	
		128-191	96-127	96-111	48-55	48-51	
					52-55	52-55	
				104-111	56-63	56-59	
					60-63	60-63	
			128-159	128-143	64-71	64-67	
					68-71	68-71	
				144-159	72-79	72-75	
					76-79	76-79	
	128-255		160-191	160-175	80-87	80-83	
					84-87	84-87	
				176-191	88-95	88-91	
					92-95	92-95	
		192-255	192-207	96-103	96-99		
				100-103	100-103		
			208-223	104-111	104-107		
				108-111	108-111		
		192-223	224-255	224-239	112-119	112-115	
					116-119	116-119	
				240-255	120-127	120-123	
					124-127	124-127	
	224-239		224-231	128-135	128-131		
				132-135	132-135		
			232-239	136-143	136-139		
				140-143	140-143		
	224-243		240-247	240-247	144-147	144-147	
					148-151	148-151	
				248-251	152-159	152-155	
					156-159	156-159	
		252-255	252-255	160-167	160-163		
				164-167	164-167		
			256-259	256-259	168-175	168-171	
					172-175	172-175	
		256-259	256-259	176-183	176-179		
				180-183	180-183		
			260-263	260-263	184-191	184-187	
					188-191	188-191	
	256-259	256-259	256-259	192-199	192-195		
				196-199	196-199		
			260-263	200-207	200-203		
				204-207	204-207		
		260-263	260-263	208-215	208-211		
				212-215	212-215		
			264-267	264-267	216-223	216-219	
					220-223	220-223	
		256-259	256-259	256-259	224-231	224-227	
					228-231	228-231	
				260-263	232-239	232-235	
					236-239	236-239	
	264-267		264-267	240-247	240-243		
				244-247	244-247		
			268-271	268-271	248-251	248-251	
					252-255	252-255	

## 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)

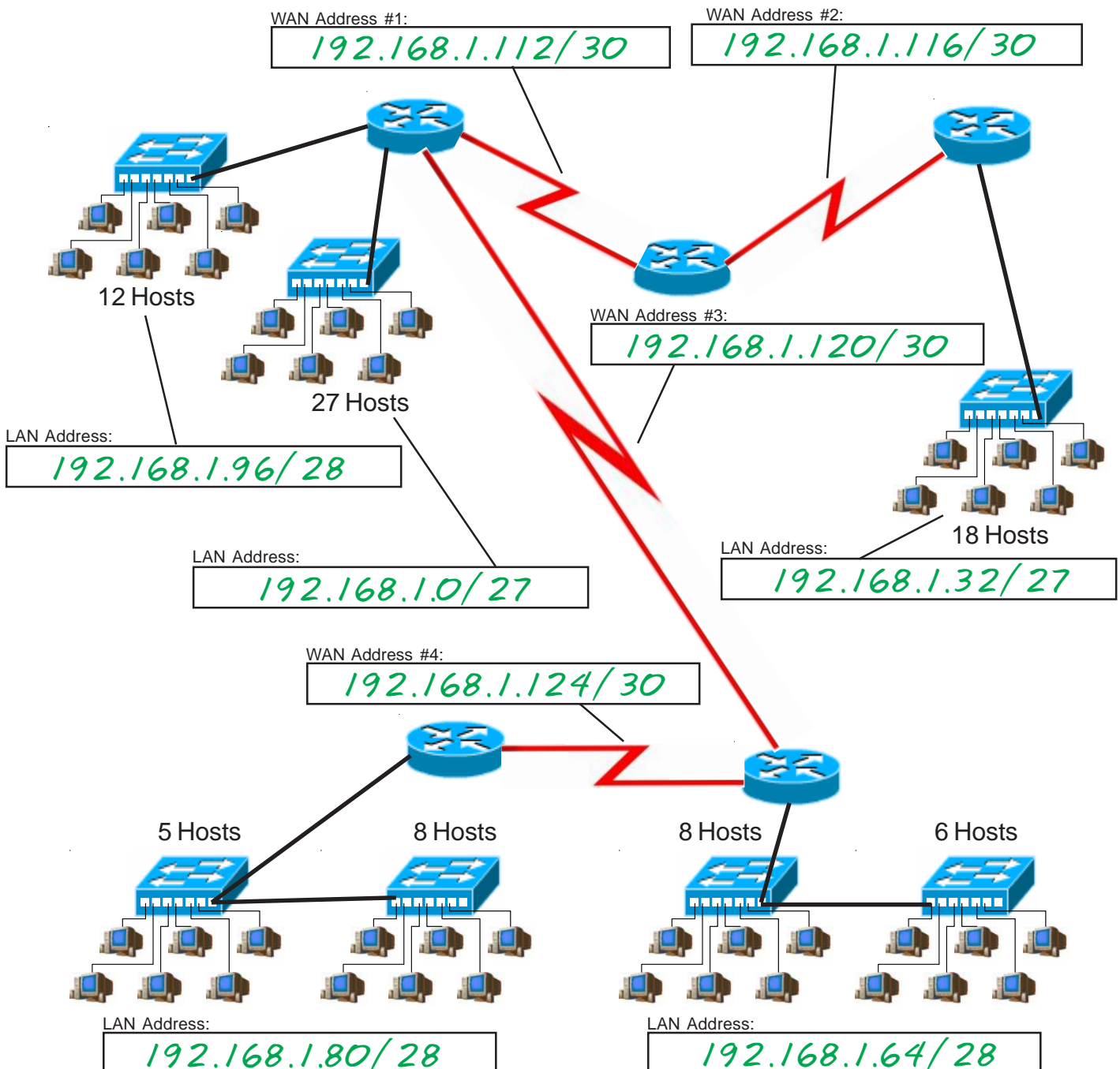
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						36-39
					40-47	40-43
						44-47
				48-63	48-55	48-51
						52-55
					56-63	56-59
						60-63
		64-127	64-95	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
			96-127	96-103	96-99	96-99
						100-103
					104-111	104-107
						108-111
				112-127	112-119	112-115
						116-119
					120-127	120-123
						124-127
	128-255	128-191	128-159	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
			160-191	160-175	16-167	160-163
						164-167
					168-175	168-171
						172-175
				176-191	176-183	176-179
						180-183
					184-191	184-187
						188-191
		192-255	192-223	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
			224-255	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 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)

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

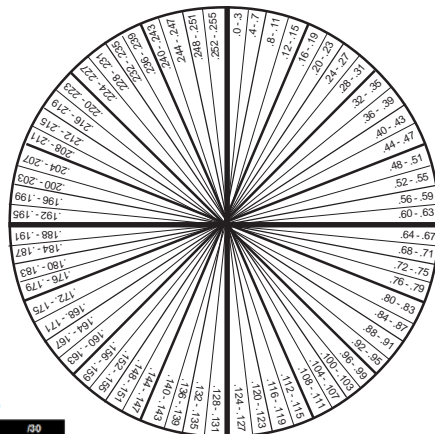


# Practical VLSM

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



VLSM Chart 24-30 Bits (4th octet)

24	25	26	27	28	29	30
256 hosts	128 hosts	64 hosts	32 hosts	16 hosts	8 hosts	4 hosts
0-255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
						8-15
						16-23
						24-31
						32-39
						40-47
						48-55
						56-63
						64-71
						72-79
						80-87
						88-95
						96-103
						104-111
						112-119
						120-127
						128-135
						136-143
						144-151
						152-159
						160-167
						168-175
						176-183
						184-191
						192-199
						200-207
						208-215
						216-223
						224-231
						232-239
						240-247
						248-255

## 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
5					
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14					

## 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.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	222.37.34.0	/25	222.37.34.1	222.37.34.126	222.37.34.127
2	222.37.34.128	/26	222.37.34.129	222.37.34.190	222.37.34.191
3	222.37.34.192	/27	222.37.34.193	222.37.34.222	222.37.34.223
4	222.37.34.224	/28	222.37.34.225	222.37.34.238	222.37.34.239
5	222.37.34.240	/29	222.37.34.241	222.37.34.246	222.37.34.247
6					
7					
8					
9					
10					
11					
12					
13					
14					

## VLSM Addressing

### Problem 28

A shipping company needs to set up its network across several locations. The Denver office needs six computers. The Waco office needs 22 computers. The Fargo office will need five computers. The WAN links between all three locations need to be included in the solution. Using the IP address 192.168.10.0/24 divide the network using VLSM. 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	192.168.10.0	/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
6					
7					
8					
9					
10					
11					
12					
13					
14					

## VLSM Addressing

### Problem 29

A new school is being built in the local school district. It will have three computer labs with 28 computers each. There will be 58 classrooms with 2 computers each that need to be on one sub-subnet. The office staff and administrators will need 7 computers. The guidance and attendance office will have 5 computers. The school has been given the address 223.145.75.0/24. 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	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
8					
9					
10					
11					
12					
13					
14					



## VLSM Addressing

### Problem 30

A local college is setting up a campus wide network. The technology wing will be on its own network address of 192.168.250.0/24. The office wing will include 15 computers. There are 2 labs of 20 computers each, 2 labs of 30 computers each and one lab of 35 computers. 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	192.168.250.0	/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
7					
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## VLSM Addressing

### **Problem 31**

You are setting up a network for a company in four locations. Location A has 8 computers. Location B has 122 computers. Location C has 4 computers. Location D has 55 computers. There is a WAN connection between all four locations. Complete the information required below using the class C address 192.168.10.0. 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
8					
9					
10					
11					
12					
13					
14					

## VLSM Addressing

### Problem 32

A college dormitory is being remodeled. A new network is being installed. There are 50 dorm rooms with two drops each that will be on one sub-subnet. The offices will have 5 drops. The reception desk will have three drops. A small study hall will include 30 drops. Using the IP address 192.168.12.0/24 complete 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
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

## VLSM Addressing

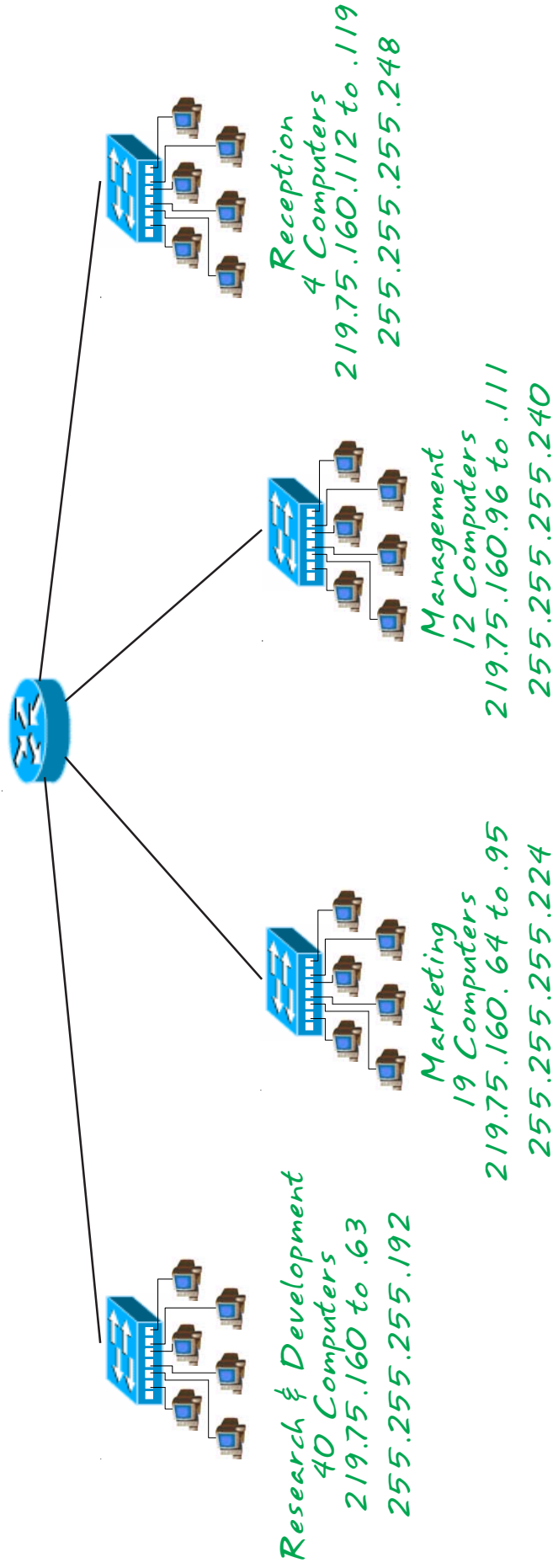
### **Problem 33**

You are setting up a business network with the class C address 219.75.160.0/24. The marketing division will need 19 computers. Research and development needs 40 computers. The reception area will need four computers. Management requires 12 computers. Divide the network using variable length subnet information. On the opposite page draw a detailed map of this network. Include the name and sub-subnet IP addresses for each branch of the network with the subnet mask. One router with four ethernet ports will be used for this network.

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
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

## Problem 33 - Detailed Map

Draw a detailed map of this network. Include the name and sub-subnet IP addresses information for each branch of the network, and the subnet mask.



## VLSM Addressing

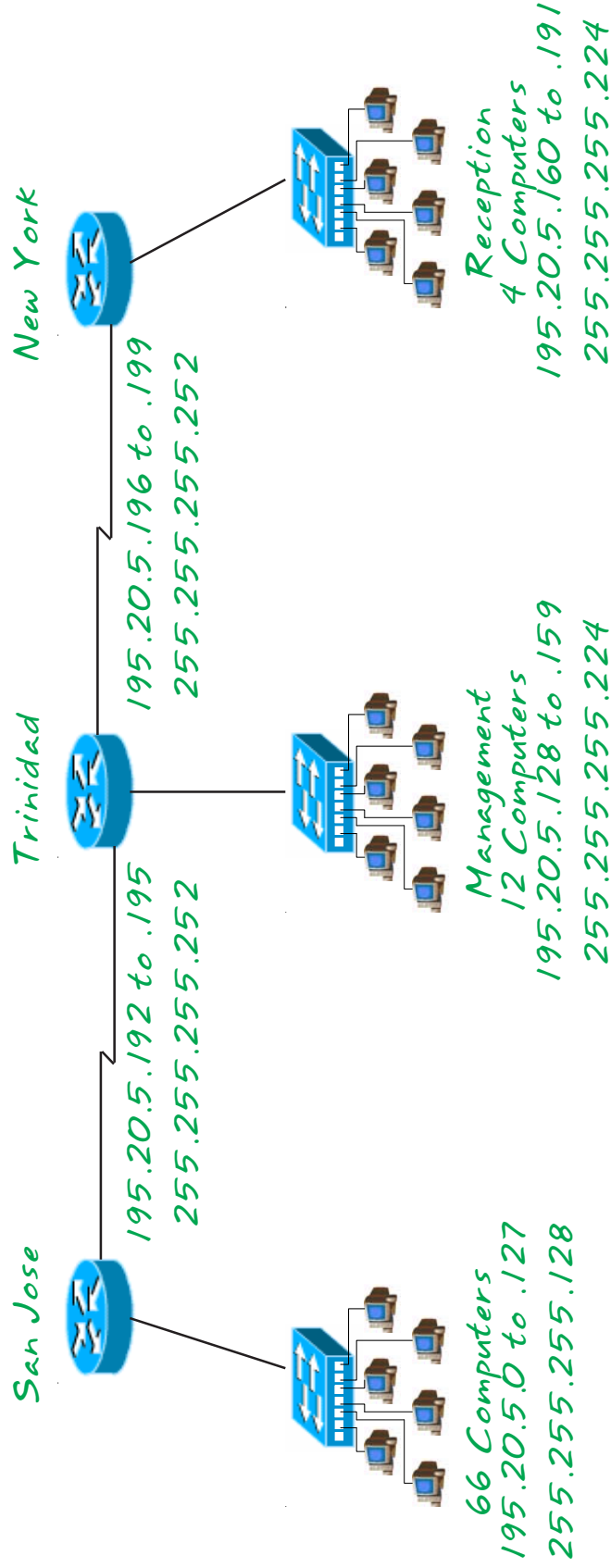
### Problem 34

A small company needs to set up its network across several locations. The New York branch office needs 15 computers. The San Jose office needs 66 computers. The Trinidad office will need 18 computers. You will need two WAN links between the routers. Using the IP address 195.20.5.0/24 divide the network using VLSM. On the opposite page draw a detailed map of this network. Include the name and subnet IP addresses information for each branch of the network. Label the WAN links with the same information. 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
6					
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9					
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12					
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14					

## Problem 34 - Detailed Map

Draw a detailed map of this network. Include the name and sub-subnet IP addresses information for each branch of the network.







10.0.0.0

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

04	05	06	07	08	09	10
200-205	206-210	211-215	216-220	221-225	226-230	231-235
0-01	0-02	0-03	0-04	0-05	0-06	0-07
0-08	0-09	0-10	0-11	0-12	0-13	0-14
0-15	0-16	0-17	0-18	0-19	0-20	0-21
0-22	0-23	0-24	0-25	0-26	0-27	0-28
0-29	0-30	0-31	0-32	0-33	0-34	0-35
0-36	0-37	0-38	0-39	0-40	0-41	0-42
0-43	0-44	0-45	0-46	0-47	0-48	0-49
0-50	0-51	0-52	0-53	0-54	0-55	0-56
0-57	0-58	0-59	0-60	0-61	0-62	0-63
0-64	0-65	0-66	0-67	0-68	0-69	0-70
0-71	0-72	0-73	0-74	0-75	0-76	0-77
0-78	0-79	0-80	0-81	0-82	0-83	0-84
0-85	0-86	0-87	0-88	0-89	0-90	0-91
0-92	0-93	0-94	0-95	0-96	0-97	0-98
0-99	0-100	0-101	0-102	0-103	0-104	0-105
0-106	0-107	0-108	0-109	0-110	0-111	0-112
0-113	0-114	0-115	0-116	0-117	0-118	0-119
0-120	0-121	0-122	0-123	0-124	0-125	0-126
0-127	0-128	0-129	0-130	0-131	0-132	0-133
0-134	0-135	0-136	0-137	0-138	0-139	0-140
0-141	0-142	0-143	0-144	0-145	0-146	0-147
0-148	0-149	0-150	0-151	0-152	0-153	0-154
0-155	0-156	0-157	0-158	0-159	0-160	0-161
0-162	0-163	0-164	0-165	0-166	0-167	0-168
0-169	0-170	0-171	0-172	0-173	0-174	0-175
0-176	0-177	0-178	0-179	0-180	0-181	0-182
0-183	0-184	0-185	0-186	0-187	0-188	0-189
0-190	0-191	0-192	0-193	0-194	0-195	0-196
0-197	0-198	0-199	0-200	0-201	0-202	0-203
0-204	0-205	0-206	0-207	0-208	0-209	0-210
0-211	0-212	0-213	0-214	0-215	0-216	0-217
0-218	0-219	0-220	0-221	0-222	0-223	0-224
0-225	0-226	0-227	0-228	0-229	0-230	0-231
0-232	0-233	0-234	0-235	0-236	0-237	0-238
0-239	0-240	0-241	0-242	0-243	0-244	0-245
0-246	0-247	0-248	0-249	0-250	0-251	0-252
0-253	0-254	0-255	0-256	0-257	0-258	0-259
0-260	0-261	0-262	0-263	0-264	0-265	0-266
0-267	0-268	0-269	0-270	0-271	0-272	0-273
0-274	0-275	0-276	0-277	0-278	0-279	0-280
0-281	0-282	0-283	0-284	0-285	0-286	0-287
0-288	0-289	0-290	0-291	0-292	0-293	0-294
0-295	0-296	0-297	0-298	0-299	0-300	0-301
0-302	0-303	0-304	0-305	0-306	0-307	0-308
0-309	0-310	0-311	0-312	0-313	0-314	0-315
0-316	0-317	0-318	0-319	0-320	0-321	0-322
0-323	0-324	0-325	0-326	0-327	0-328	0-329
0-330	0-331	0-332	0-333	0-334	0-335	0-336
0-337	0-338	0-339	0-340	0-341	0-342	0-343
0-344	0-345	0-346	0-347	0-348	0-349	0-350
0-351	0-352	0-353	0-354	0-355	0-356	0-357
0-358	0-359	0-360	0-361	0-362	0-363	0-364
0-365	0-366	0-367	0-368	0-369	0-370	0-371
0						

# 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	<i>15.0.0.0 to 15.127.255.255</i>	<i>/9</i>
Customer #2	2 million	<i>15.128.0.0 to 15.159.255.255</i>	<i>/11</i>
Customer #3	2,000,000	<i>15.160.0.0 to 15.191.255.255</i>	<i>/11</i>
Customer #4	1,000,000	<i>15.192.0.0 to 15.207.255.255</i>	<i>/12</i>
Customer #5	500,000	<i>15.208.0.0 to 15.215.255.255</i>	<i>/13</i>
Customer #6	450,000	<i>15.216.0.0 to 15.223.255.255</i>	<i>/13</i>
Customer #7	200,000	<i>15.224.0.0 to 15.227.255.255</i>	<i>/14</i>
Customer #8	130,000	<i>15.228.0.0 to 15.229.255.255</i>	<i>/15</i>
Customer #9	100,000	<i>15.230.0.0 to 15.231.255.255</i>	<i>/15</i>

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

57

# 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)

/16 255.255.0.0 65,536 Hosts	/17 255.255.128.0 32,768 Hosts	/18 255.255.192.0 16,384 Hosts	/19 255.255.224.0 8,192 Hosts	/20 255.255.240.0 4,096 Hosts	/21 255.255.248.0 2,048 Hosts	/22 255.255.252.0 1,024 Hosts	/23 255.255.254.0 512 Hosts
0 - 255	0 - 127	0-63	0-31	0-15	0-7	0-3	0-1
					8-15	4-7	2-3
				16-31		8-11	4-5
						12-15	6-7
					16-23	16-19	8-9
					24-31	20-23	10-11
				32-47		24-27	12-13
					32-39	28-31	14-15
					40-47	30-31	16-17
						32-35	18-19
		64-127	32-63	48-63	48-55	36-39	20-21
					56-63	40-43	22-23
				64-79		44-47	24-25
					64-71	48-51	26-27
					72-79	52-55	28-29
						56-59	30-31
				80-95		60-63	32-33
					80-87	64-67	34-35
					88-95	68-71	36-37
						72-75	38-39
		128-191	64-95	96-111	96-103	76-79	40-41
					104-111	80-83	42-43
				112-127		84-87	44-45
					112-119	88-91	46-47
					120-127	92-95	48-49
						96-99	50-51
				128-159	128-135	100-103	52-53
					136-143	104-107	54-55
						108-111	56-57
					144-151	112-115	58-59
		128-255	160-191	160-175	160-167	116-119	60-61
					168-175	120-123	62-63
				176-191		124-127	64-65
					176-183	128-129	66-67
					180-183	132-135	68-69
					184-191	136-139	70-71
				192-207	192-199	140-143	72-73
					196-199	144-147	74-75
					200-207	148-151	76-77
					204-207	152-155	78-79
		192-255	224-255	208-223	208-215	156-159	80-81
					216-223	160-163	82-83
				224-239		164-167	84-85
					224-231	168-171	86-87
					232-239	172-175	88-89
					240-247	176-179	90-91
				240-255		180-183	92-93
					244-247	184-187	94-95
					248-251	188-191	96-97
					252-255	192-195	98-99

# 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**

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

# Class C Addresses

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

/24	/25	/26	/27	/28	/29	/30
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
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						36-39
					40-47	40-43
						44-47
				48-63	48-55	48-51
						52-55
					56-63	56-59
						60-63
		64-127	64-95	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
			96-127	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
	128-255	128-191	128-159	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
			160-191	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
		192-255	192-223	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
			224-255	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 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	<i>172.32.0.0 to 172.32.15.255</i>	<i>/20</i>
South High	2,000	<i>172.32.16.0 to 172.32.23.255</i>	<i>/21</i>
North Middle	1,200	<i>172.32.24.0 to 172.32.31.255</i>	<i>/21</i>
South Middle	1,000	<i>172.32.32.0 to 172.32.35.255</i>	<i>/22</i>
Central Elem.	550	<i>172.32.36.0 to 172.32.39.255</i>	<i>/22</i>
Southern Elem.	475	<i>172.32.40.0 to 172.32.41.255</i>	<i>/23</i>
Eastern Elem.	450	<i>172.32.42.0 to 172.32.43.255</i>	<i>/23</i>
Central Office	400	<i>172.32.44.0 to 172.32.45.255</i>	<i>/23</i>
Western Elem.	300	<i>172.32.46.0 to 172.32.47.255</i>	<i>/23</i>



# Class B Addresses

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

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

# 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	<i>172.32.42.0 to 172.32.42.255</i>	<i>/24</i>
Printers	45	<i>172.32.43.0 to 172.32.43.63</i>	<i>/26</i>
Staff	40	<i>172.32.43.64 to 172.32.43.127</i>	<i>/26</i>
Network Devices	25	<i>172.32.43.128 to 172.32.43.159</i>	<i>/27</i>
Administrative	12	<i>172.32.43.160 to 172.32.43.175</i>	<i>/28</i>

# Class C Addresses

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

/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31	24-27 28-31
			32-63	32-47	32-39	32-35 36-39
					40-47	40-43 44-47
				48-63	48-55	48-51 52-55
					56-63	56-59 60-63
		64-127	64-95	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
			96-127	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
	128-255	128-191	128-159	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
			160-191	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
		192-255	192-223	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
			224-255	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 to 172.32.19.255	/22
Network Devices	250	172.32.20.0 to 172.32.20.255	/24
Printers	200	172.32.21.0 to 172.32.21.255	/24
Staff	150	172.32.22.0 to 172.32.22.255	/24
Administrative	50	172.32.23.0 to 172.32.23.63	/26

# Class C Addresses

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

/24		/25		/26		/27		/28		/29		/30	
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			
						8-15		8-11		12-15			
						16-23		16-19		20-23			
						24-31		24-27		28-31			
					16-31	32-39		32-35		36-39			
						40-47		40-43		44-47			
						48-55		48-51		52-55			
						56-63		56-59		60-63			
				32-63	64-71		64-67		68-71				
					72-79		72-75		76-79				
					64-95	80-87		80-83		84-87			
						88-95		88-91		92-95			
						96-127	96-103		96-99		100-103		
							104-111		104-107		108-111		
					112-119		112-115		116-119				
					120-127		120-123		124-127				
			128-255	128-191	128-159	128-143		128-135		128-131			
						136-143		136-139		140-143			
						144-151		144-147		148-151			
						152-159		152-155		156-159			
						160-191	160-167		160-163		164-167		
							168-175		168-171		172-175		
							176-183		176-179		180-183		
							184-191		184-187		188-191		
					192-255	192-223	192-207		192-199		192-195		
							200-207		200-203		204-207		
							208-215		208-211		212-215		
							216-223		216-219		220-223		
						224-255	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

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	<i>110.0.0.0 to 110.63.255.255</i>	<i>/10</i>
New York	1,540,000	<i>110.64.0.0 to 110.95.255.255</i>	<i>/11</i>
St. Petersburg	1,075,000	<i>110.96.0.0 to 110.127.255.255</i>	<i>/11</i>
London	975,000	<i>110.128.0.0 to 110.143.255.255</i>	<i>/12</i>
Ekaterinoburg	525,000	<i>110.144.0.0 to 110.159.255.255</i>	<i>/12</i>
Munchen	450,000	<i>110.160.0.0 to 110.167.255.255</i>	<i>/13</i>
Napoli	150,000	<i>110.168.0.0 to 110.171.255.255</i>	<i>/14</i>
Birmingham	130,000	<i>110.172.0.0 to 110.173.255.255</i>	<i>/15</i>
Rotterdam	95,000	<i>110.174.0.0 to 110.175.255.255</i>	<i>/15</i>

# Class A Addresses

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

/8 255.0.0.0 16,777,216 Hosts	/9 255.128.0.0 8,388,608 Hosts	/10 255.192.0.0 4,194,304 Hosts	/11 255.224.0.0 2,097,152 Hosts	/12 255.240.0.0 1,048,576 Hosts	/13 255.248.0.0 524,288 Hosts	/14 255.252.0.0 262,144 Hosts	/15 255.254.0.0 131,072 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1
					8-15	4-7	2-3
					16-31	8-11	4-5
						12-15	6-7
			32-63	32-47	16-23	16-19	8-9
					20-23	20-23	10-11
				48-63	24-31	24-27	12-13
					32-39	28-31	14-15
				64-79	40-47	32-35	16-17
					48-55	36-39	18-19
			64-95	80-95	56-63	40-43	20-21
					64-71	44-47	22-23
				96-111	68-71	48-51	24-25
					72-79	52-55	26-27
			96-127	128-159	80-87	56-59	28-29
					88-95	60-63	30-31
				160-191	96-103	64-67	32-33
					104-111	68-71	34-35
				176-191	112-119	72-75	36-37
					120-127	76-79	38-39
	128-255	128-191	128-159	128-143	128-135	80-81	40-41
					136-143	82-83	42-43
				144-159	144-151	84-85	44-45
					152-159	86-87	46-47
			160-191	160-175	160-167	88-89	48-49
					168-175	90-91	50-51
				176-191	176-183	92-93	52-53
					184-191	94-95	54-55
			192-223	192-207	192-199	96-97	56-57
					200-207	98-99	58-59
				208-223	208-215	100-101	60-61
					216-223	102-103	62-63
			224-255	224-239	224-231	104-105	64-65
					232-239	106-107	66-67
				240-255	240-247	108-109	68-69
					248-255	110-111	70-71
				240-255	248-251	112-113	72-73
					252-255	114-115	74-75
					252-255	116-117	76-77
					252-255	118-119	78-79
					252-255	120-121	80-81
					252-255	122-123	82-83
					252-255	124-125	84-85
					252-255	126-127	86-87
					252-255	128-129	88-89
					252-255	130-131	90-91
					252-255	132-133	92-93
					252-255	134-135	94-95
					252-255	136-137	96-97
					252-255	138-139	98-99
					252-255	140-141	100-101
					252-255	142-143	102-103
					252-255	144-145	104-105
					252-255	146-147	106-107
					252-255	148-149	108-109
					252-255	150-151	110-111
					252-255	152-153	112-113
					252-255	154-155	114-115
					252-255	156-157	116-117
					252-255	158-159	118-119
					252-255	160-161	120-121
					252-255	162-163	122-123
					252-255	164-165	124-125
					252-255	166-167	126-127
					252-255	168-169	128-129
					252-255	170-171	130-131
					252-255	172-173	132-133
					252-255	174-175	134-135
					252-255	176-177	136-137
					252-255	178-179	138-139
					252-255	180-181	140-141
					252-255	182-183	142-143
					252-255	184-185	144-145
					252-255	186-187	146-147
					252-255	188-189	148-149
					252-255	190-191	150-151
					252-255	192-193	152-153
					252-255	194-195	154-155
					252-255	196-197	156-157
					252-255	198-199	158-159
					252-255	200-201	160-161
					252-255	202-203	162-163
					252-255	204-205	164-165
					252-255	206-207	166-167
					252-255	208-209	168-169
					252-255	210-211	170-171
					252-255	212-213	172-173
					252-255	214-215	174-175
					252-255	216-217	176-177
					252-255	218-219	178-179
					252-255	220-221	180-181
					252-255	222-223	182-183
					252-255	224-225	184-185
					252-255	226-227	186-187
					252-255	228-229	188-189
					252-255	230-231	190-191
					252-255	232-233	192-193
					252-255	234-235	194-195
					252-255	236-237	196-197
					252-255	238-239	198-199
					252-255	240-241	200-201
					252-255	242-243	202-203
					252-255	244-245	204-205
					252-255	246-247	206-207
					252-255	248-249	208-209
					252-255	250-251	210-211
					252-255	252-253	212-213
					252-255	254-255	214-215
					252-255	254-255	216-217
					252-255	254-255	218-219
					252-255	254-255	220-221
					252-255	254-255	222-223
					252-255	254-255	224-225
					252-255	254-255	226-227
					252-255	254-255	228-229
					252-255	254-255	230-231
					252-255	254-255	232-233
					252-255	254-255	234-235
					252-255	254-255	236-237
					252-255	254-255	238-239
					252-255	254-255	240-241
					252-255	254-255	242-243
					252-255	254-255	244-245
					252-255	254-255	246-247
					252-255	254-255	248-249
					252-255	254-255	250-251
					252-255	254-255	252-253
					252-255	254-255	254-255

# 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	<i>110.128.0.0 to 110.128.31.255</i>	<i>/19</i>
Office #2	3,780	<i>110.128.32.0 to 110.128.47.255</i>	<i>/19</i>
Office #3	2,750	<i>110.128.48.0 to 110.128.63.255</i>	<i>/19</i>
Office #4	2,000	<i>110.128.064.0 to 110.128.71.255</i>	<i>/21</i>
Office #5	1,000	<i>110.128.72.0 to 110.128.75.255</i>	<i>/21</i>
Office #6	845	<i>110.128.76.0 to 110.128.79.255</i>	<i>/21</i>
Office #7	500	<i>110.128.80.0 to 110.128.81.255</i>	<i>/22</i>
Office #8	450	<i>110.128.82.0 to 110.128.83.255</i>	<i>/22</i>
Office #9	300	<i>110.128.84.0 to 110.128.85.255</i>	<i>/23</i>



# Class B Addresses

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

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

# 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	<i>110.128.80.0 to 110.128.80.127</i>	<i>/25</i>
2nd Floor	75	<i>110.128.80.128 to 110.128.80.255</i>	<i>/25</i>
5th Floor	50	<i>110.128.81.0 to 110.128.81.63</i>	<i>/26</i>
8th Floor	45	<i>110.128.81.64 to 110.128.81.127</i>	<i>/26</i>
4th Floor	30	<i>110.128.81.128 to 110.128.81.159</i>	<i>/27</i>
Basement	14	<i>110.128.81.160 to 110.128.81.175</i>	<i>/28</i>
7th Floor	12	<i>110.128.81.176 to 110.128.81.191</i>	<i>/28</i>
3rd Floor	6	<i>110.128.81.192 to 110.128.81.199</i>	<i>/29</i>
6th Floor	4	<i>110.128.81.200 to 110.128.81.207</i>	<i>/29</i>

# Class C Addresses

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

/24	/25	/26	/27	/28	/29	/30
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
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						36-39
					40-47	40-43
						44-47
				48-63	48-55	48-51
						52-55
					56-63	56-59
						60-63
		64-127	64-95	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
			96-127	96-103	96-99	96-99
						100-103
					104-111	104-107
						108-111
				112-127	112-119	112-115
						116-119
					120-127	120-123
						124-127
	128-255	128-191	128-159	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
			160-191	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
		192-255	192-223	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
			224-255	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 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	<i>75.0.0.0 to 75.127.255.255</i>	<i>/9</i>
China	4 million	<i>75.128.0.0 to 75.191.255.255</i>	<i>/10</i>
Japan	1 million	<i>75.192.0.0 to 75.207.255.255</i>	<i>/12</i>
Germany	500,000	<i>75.208.0.0 to 75.215.255.255</i>	<i>/13</i>
Russia	455,000	<i>75.216.0.0 to 75.223.255.255</i>	<i>/13</i>
Australia	450,000	<i>75.224.0.0 to 75.231.255.255</i>	<i>/13</i>
Brazil	125,000	<i>75.232.0.0 to 75.233.255.255</i>	<i>/15</i>
Canda	90,000	<i>75.234.0.0 to 75.235.255.255</i>	<i>/15</i>
Denmark	88,000	<i>75.236.0.0 to 75.237.255.255</i>	<i>/15</i>

# Class A Addresses

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

/8 255.0.0.0 16,777,216 Hosts	/9 255.128.0.0 8,388,608 Hosts	/10 255.192.0.0 4,194,304 Hosts	/11 255.224.0.0 2,097,152 Hosts	/12 255.240.0.0 1,048,576 Hosts	/13 255.248.0.0 524,288 Hosts	/14 255.252.0.0 262,144 Hosts	/15 255.254.0.0 131,072 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1
					8-15	4-7	2-3
				16-31	16-23	8-11	4-5
					24-31	12-15	6-7
						16-19	8-9
						20-23	10-11
		32-63	32-47	32-39	24-27	24-27	12-13
					28-31	28-31	14-15
				40-47	32-35	32-35	16-17
					36-39	36-39	18-19
					40-41	40-43	20-21
					42-43	44-47	22-23
		64-127	64-95	48-55	48-51	48-51	24-25
					52-55	52-55	26-27
				56-63	56-59	60-63	28-29
					64-71	64-67	30-31
					72-79	68-71	32-33
					80-87	72-75	34-35
		128-191	128-159	88-95	88-91	76-79	36-37
					96-99	80-83	38-39
				96-111	100-103	84-87	40-41
					104-107	88-91	42-43
					108-111	92-95	44-45
					112-119	96-99	46-47
		192-255	192-223	120-127	120-123	100-103	48-49
					124-127	104-107	50-51
				128-143	128-131	108-111	52-53
					132-135	112-115	54-55
					136-139	116-119	56-57
					140-143	120-123	58-59
		224-255	224-239	144-151	144-147	124-127	60-61
					148-151	128-129	62-63
				152-159	152-155	132-133	64-65
					156-159	136-139	66-67
					160-163	140-143	68-69
					164-167	144-147	70-71
		240-255	240-255	168-175	168-171	148-151	72-73
					172-175	152-155	74-75
				176-191	176-179	156-159	76-77
					180-183	160-163	78-79
					184-187	164-167	80-81
					188-191	168-171	82-83
		248-255	248-255	192-199	192-195	172-175	84-85
					196-199	176-179	86-87
				200-207	200-203	180-183	88-89
					204-207	184-187	90-91
					208-211	188-191	92-93
					212-215	192-195	94-95
		252-255	252-255	216-219	216-219	196-199	96-97
					220-223	200-203	98-99
				224-231	224-227	204-207	100-101
					228-231	208-211	102-103
					232-235	212-215	104-105
					236-239	216-219	106-107
		256-259	256-259	240-247	240-243	220-223	108-109
					244-247	224-227	110-111
				248-251	248-251	228-231	112-113
					252-255	232-235	114-115
						236-239	116-117
						240-243	118-119
		256-259	256-259	252-255	252-255	244-247	120-121
						248-251	122-123
						252-255	124-125
							126-127
							128-129
							130-131

# 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 to 75.31.255.255	/11
Client #2	1,000,000	75.32.0.0 to 75.47.255.255	/12
Client #3	950,000	75.48.0.0 to 75.63.255.255	/12
Client #4	700,000	75.64.0.0 to 75.79.255.255	/12
Client #5	550,000	75.80.0.0 to 75.95.255.255	/12
Client #6	500,000	75.96.0.0 to 75.103.255.255	/13
Client #7	450,000	75.104.0.0 to 75.111.255.255	/13

# Class A Addresses

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

/8 255.0.0.0 16,777,216 Hosts	/9 255.128.0.0 8,388,608 Hosts	/10 255.192.0.0 4,194,304 Hosts	/11 255.224.0.0 2,097,152 Hosts	/12 255.240.0.0 1,048,576 Hosts	/13 255.248.0.0 524,288 Hosts	/14 255.252.0.0 262,144 Hosts	/15 255.254.0.0 131,072 Hosts		
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1		
					4-7	4-7	2-3		
				16-31	8-15	8-11	4-5		
					16-23	12-15	6-7		
					24-31	20-23	18-19	8-9	
						24-27	22-23	10-11	
					32-63	28-31	24-25	12-13	
						32-35	26-27	14-15	
			32-47	36-39	28-29	16-17			
				40-47	30-31	18-19			
				48-63	42-43	32-33	20-21		
					44-45	34-35	22-23		
					46-47	36-37	24-25		
					48-49	38-39	26-27		
				64-95	64-79	50-51	40-41	28-29	
						52-53	42-43	30-31	
			54-55			44-45	32-33		
			56-57			46-47	34-35		
			80-95		58-59	48-49	36-37		
					60-61	50-51	38-39		
					62-63	52-53	40-41		
					64-65	54-55	42-43		
			64-127	96-127	96-111	66-67	56-57	44-45	
						68-71	58-59	46-47	
						72-75	60-61	48-49	
						76-77	62-63	50-51	
					112-127	78-79	64-65	52-53	
						80-81	66-67	54-55	
						82-83	68-69	56-57	
						84-85	70-71	58-59	
					128-159	128-143	86-87	72-73	60-61
							88-89	74-75	62-63
		90-91					76-77	64-65	
		92-93					78-79	66-67	
		144-159				94-95	80-81	68-69	
						96-97	82-83	70-71	
						98-99	84-85	72-73	
						100-101	86-87	74-75	
		128-191		160-191	160-175	102-103	88-89	76-77	
						104-105	90-91	78-79	
						106-107	92-93	80-81	
						108-109	94-95	82-83	
					176-191	110-111	96-97	84-85	
						112-113	98-99	86-87	
						114-115	100-101	88-89	
						116-117	102-103	90-91	
				192-223	192-207	118-119	104-105	92-93	
						120-121	106-107	94-95	
						122-123	108-109	96-97	
						124-125	110-111	98-99	
					208-223	126-127	112-113	100-101	
						128-129	114-115	102-103	
						130-131	116-117	104-105	
						132-133	118-119	106-107	
		128-255	128-191	128-159	128-143	134-135	110-111	108-109	
						136-139	112-113	110-111	
						140-143	114-115	112-113	
						144-147	116-117	114-115	
						148-151	118-119	116-117	
						152-155	120-121	118-119	
					144-159	156-157	122-123	120-121	
						158-159	124-125	122-123	
						160-161	126-127	124-125	
						162-163	128-129	126-127	
	164-165					130-131	128-129		
	166-167					132-133	130-131		
	160-191			160-175	134-135	134-135	132-133		
					136-137	136-139	134-135		
					138-139	140-143	136-137		
					142-143	144-145	138-139		
					144-145	146-147	140-141		
					146-147	148-149	142-143		
				176-191	148-149	144-145	144-145		
					150-151	146-147	146-147		
					152-155	148-151	148-149		
					156-157	150-151	150-151		
					158-159	152-155	152-153		
					160-161	154-155	154-155		
	192-255		192-223	192-207	162-163	156-157	156-157		
					164-167	158-159	158-159		
					166-167	160-161	160-161		
					168-169	162-163	162-163		
					168-171	164-165	164-165		
					172-175	166-167	166-167		
				208-223	170-171	168-169	168-169		
					172-173	170-171	170-171		
					174-175	172-173	172-173		
					176-177	174-175	174-175		
					178-179	176-177	176-177		
					180-181	178-179	178-179		
			224-255	224-239	182-183	180-181	180-181		
					184-185	182-183	182-183		
					184-187	184-185	184-185		
					188-191	186-187	186-187		
					192-195	188-189	188-189		
					196-199	190-191	190-191		
				240-255	192-199	192-193	192-193		
					200-207	194-195	194-195		
					208-215	196-197	196-197		
					216-223	198-199	198-199		
					224-231	200-201	200-201		
					232-239	202-203	202-203		
	128-255	128-191	128-159	204-207	204-205	204-205			
				208-209	206-207	206-207			
				210-211	208-209	208-209			
				212-213	210-211	210-211			
				214-215	212-213	212-213			
				216-217	214-215	214-215			
			144-159	218-219	216-217	216-217			
				220-221	218-219	218-219			
				222-223	220-221	220-221			
				224-225	222-223	222-223			
				226-227	224-225	224-225			
				228-229	226-227	226-227			
		160-191	160-175	230-231	228-229	228-229			
				232-233	230-231	230-231			
				234-235	232-233	232-233			
				236-237	234-235	234-235			
				238-239	236-237	236-237			
				240-241	238-239	238-239			
			176-191	242-243	240-241	240-241			
				244-245	242-243	242-243			
				246-247	244-245	244-245			
				248-249	246-247	246-247			
				250-251	248-249	248-249			
				252-253	250-251	250-251			

# 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	<i>75.104.0.0 to 75.104.255.255</i>	<i>/16</i>
Office #2	45,000	<i>75.105.0.0 to 75.105.255.255</i>	<i>/16</i>
Office #3	30,000	<i>75.106.0.0 to 75.106.127.255</i>	<i>/17</i>
Office #4	24,000	<i>75.106.128.0 to 75.106.255.255</i>	<i>/17</i>
Office #5	15,000	<i>75.107.0.0 to 75.107.63.255</i>	<i>/18</i>
Office #6	10,000	<i>75.107.64.0 to 75.107.127.255</i>	<i>/18</i>
Office #7	8,000	<i>75.107.128.0 to 75.107.159.255</i>	<i>/19</i>
Office #8	2,000	<i>75.107.160.0 to 75.107.167.255</i>	<i>/21</i>
Office #9	1,000	<i>75.107.168.0 to 75.107.171.255</i>	<i>/22</i>



# Class B Addresses

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

/16 255.255.0.0 65,536 Hosts	/17 255.255.128.0 32,768 Hosts	/18 255.255.192.0 16,384 Hosts	/19 255.255.224.0 8,192 Hosts	/20 255.255.240.0 4,096 Hosts	/21 255.255.248.0 2,048 Hosts	/22 255.255.252.0 1,024 Hosts	/23 255.255.254.0 512 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1
						4-7	2-3
					8-15	8-11	4-5
							6-7
							8-9
							10-11
				16-31		12-15	12-13
						16-19	14-15
					16-23	20-23	16-17
							18-19
					24-31	24-27	20-21
						28-31	22-23
			32-63	32-47			24-25
					32-39	32-35	26-27
						36-39	28-29
					40-47	40-43	30-31
						44-47	32-33
						48-51	34-35
				48-63	48-55	52-55	36-37
						56-59	38-39
					56-63	60-63	40-41
							42-43
		64-127	64-95	64-79	64-71	64-67	44-45
						68-71	46-47
					72-79	72-75	48-49
						76-79	50-51
			80-95	80-87		80-83	52-53
					88-95	84-87	54-55
						88-91	56-57
						92-95	58-59
			96-127	96-103	96-99	96-99	60-61
						100-103	62-63
				104-111		104-107	64-65
						108-111	66-67
				112-127	112-119	112-115	68-69
						116-119	70-71
					120-127	120-123	72-73
						124-127	74-75
	128-255	128-191	128-159	128-143	128-135	128-131	76-77
						132-135	78-79
					136-143	136-139	80-81
						140-143	82-83
			144-159	144-151		144-147	84-85
						148-151	86-87
					152-159	152-155	88-89
						156-159	90-91
			160-191	160-175	160-167	160-163	92-93
						164-167	94-95
					168-175	168-171	96-97
						172-175	98-99
				176-191	176-183	176-179	100-101
						180-183	102-103
					184-191	184-187	104-105
						188-191	106-107
		192-255	192-223	192-207	192-199	192-195	108-109
						196-199	110-111
					200-207	200-203	112-113
						204-207	114-115
			208-223	208-215		208-211	116-117
						212-215	118-119
					216-223	216-219	120-121
						220-223	122-123
			224-255	224-239	224-231	224-227	124-125
						228-231	126-127
					232-239	232-235	128-129
						236-239	130-131
				240-255	240-247	240-243	132-133
						244-247	134-135
					248-255	248-251	136-137
						252-255	138-139

# 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 to 75.107.143.255	/20
Branch #2	2,000	75.107.144.0 to 75.107.151.255	/21
Branch #3	1,000	75.107.152.0 to 75.107.155.255	/22
Branch #4	500	75.107.156.0 to 75.107.159.255	/23
Branch #5	450	75.107.160.0 to 75.107.161.255	/23

# Class B Addresses

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

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



# Reference Charts and Support Materials

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

[illegible]

### Class B Addresses

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

16	17	18	19	20	21	22	23
10,000 seats	20,000 seats	30,000 seats	40,000 seats	50,000 seats	60,000 seats	70,000 seats	80,000 seats
			9-01	9-15	9-15	9-15	9-15
				10-01	10-01	10-01	10-01
			9-01	9-01	9-01	9-01	9-01
				10-01	10-01	10-01	10-01
				11-01	11-01	11-01	11-01
				12-01	12-01	12-01	12-01
				13-01	13-01	13-01	13-01
				14-01	14-01	14-01	14-01
				15-01	15-01	15-01	15-01
				16-01	16-01	16-01	16-01
				17-01	17-01	17-01	17-01
				18-01	18-01	18-01	18-01
				19-01	19-01	19-01	19-01
				20-01	20-01	20-01	20-01
				21-01	21-01	21-01	21-01
				22-01	22-01	22-01	22-01
				23-01	23-01	23-01	23-01
				24-01	24-01	24-01	24-01
				25-01	25-01	25-01	25-01
				26-01	26-01	26-01	26-01
				27-01	27-01	27-01	27-01
				28-01	28-01	28-01	28-01
				29-01	29-01	29-01	29-01
				30-01	30-01	30-01	30-01
				31-01	31-01	31-01	31-01
				32-01	32-01	32-01	32-01
				33-01	33-01	33-01	33-01
				34-01	34-01	34-01	34-01
				35-01	35-01	35-01	35-01
				36-01	36-01	36-01	36-01
				37-01	37-01	37-01	37-01
				38-01	38-01	38-01	38-01
				39-01	39-01	39-01	39-01
				40-01	40-01	40-01	40-01
				41-01	41-01	41-01	41-01
				42-01	42-01	42-01	42-01
				43-01	43-01	43-01	43-01
				44-01	44-01	44-01	44-01
				45-01	45-01	45-01	45-01
				46-01	46-01	46-01	46-01
				47-01	47-01	47-01	47-01
				48-01	48-01	48-01	48-01
				49-01	49-01	49-01	49-01
				50-01	50-01	50-01	50-01
				51-01	51-01	51-01	51-01
				52-01	52-01	52-01	52-01
				53-01	53-01	53-01	53-01
				54-01	54-01	54-01	54-01
				55-01	55-01	55-01	55-01
				56-01	56-01	56-01	56-01
				57-01	57-01	57-01	57-01
				58-01	58-01	58-01	58-01
				59-01	59-01	59-01	59-01
				60-01	60-01	60-01	60-01
				61-01	61-01	61-01	61-01
				62-01	62-01	62-01	62-01
				63-01	63-01	63-01	63-01
				64-01	64-01	64-01	64-01
				65-01	65-01	65-01	65-01
				66-01	66-01	66-01	66-01
				67-01	67-01	67-01	67-01
				68-01	68-01	68-01	68-01
				69-01	69-01	69-01	69-01
				70-01	70-01	70-01	70-01
				71-01	71-01	71-01	71-01
				72-01	72-01	72-01	72-01
				73-01	73-01	73-01	73-01
				74-01	74-01	74-01	74-01
				75-01	75-01	75-01	75-01
				76-01	76-01	76-01	76-01
				77-01	77-01	77-01	77-01
				78-01	78-01	78-01	78-01
				79-01	79-01	79-01	79-01
				80-01	80-01	80-01	80-01
				81-01	81-01	81-01	81-01
				82-01	82-01	82-01	82-01
				83-01	83-01	83-01	83-01
				84-01	84-01	84-01	84-01
				85-01	85-01	85-01	85-01
				86-01	86-01	86-01	86-01
				87-01	87-01	87-01	87-01
				88-01	88-01	88-01	88-01
				89-01	89-01	89-01	89-01
				90-01	90-01	90-01	90-01
				91-01	91-01	91-01	91-01
				92-01	92-01	92-01	92-01
				93-01	93-01	93-01	93-01
				94-01	94-01	94-01	94-01
				95-01	95-01	95-01	95-01
				96-01	96-01	96-01	96-01
				97-01	97-01	97-01	97-01
				98-01	98-01	98-01	98-01
				99-01	99-01	99-01	99-01
				100-01	100-01	100-01	100-01
				101-01	101-01	101-01	101-01
				102-01	102-01	102-01	102-01
				103-01	103-01	103-01	103-01
				104-01	104-01	104-01	104-01
				105-01	105-01	105-01	105-01
				106-01	106-01	106-01	106-01
				107-01	107-01	107-01	107-01
				108-01	108-01	108-01	108-01
				109-01	109-01	109-01	109-01
				110-01	110-01	110-01	110-01
				111-01	111-01	111-01	111-01
				112-01	112-01	112-01	112-01
				113-01	113-01	113-01	113-01
				114-01	114-01	114-01	114-01
				115-01	115-01	115-01	115-01
				116-01	116-01	116-01	116-01
				117-01	117-01	117-01	117-01
				118-01	118-01	118-01	118-01
				119-01	119-01	119-01	119-01
				120-01	120-01	120-01	120-01
				121-01	121-01	121-01	121-01
				122-01	122-01	122-01	122-01
				123-01	123-01	123-01	123-01
				124-01	124-01	124-01	124-01
				125-01	125-01	125-01	125-01
				126-01	126-01	126-01	126-01
				127-01	127-01	127-01	127-01
				128-01	128-01	128-01	128-01
				129-01	129-01	129-01	129-01
				130-01	130-01	130-01	130-01
				131-01	131-01	131-01	131-01
				132-01	132-01	132-01	132-01
				133-01	133-01	133-01	133-01
				134-01	134-01	134-01	134-01
				135-01	135-01	135-01	135-01
				136-01	136-01	136-01	136-01
				137-01	137-01	137-01	137-01
				138-01	138-01	138-01	138-01
				139-01	139-01	139-01	139-01
				140-01	140-01	140-01	140-01
				141-01	141-01	141-01	141-01
				142-01	142-01	142-01	142-01
				143-01	143-01	143-01	143-01
				144-01	144-01	144-01	144-01
				145-01	145-01	145-01	145-01
				146-01	146-01	146-01	146-01
				147-01	147-01	147-01	147-01
				148-01	148-01	148-01	148-01
				149-01	149-01	149-01	149-01
				150-01	150-01	150-01	150-01
				151-01	151-01	151-01	151-01
				152-01	152-01	152-01	152-01
				153-01	153-01	153-01	153-01
				154-01	154-01	154-01	154-01
				155-01	155-01	155-01	155-01
				156-01	156-01	156-01	156-01
				157-01	157-01	157-01	157-01
				158-01	158-01	158-01	158-01
				159-01	159-01	159-01	159-01
				160-01	160-01	160-01	160-01
				161-01	161-01	161-01	161-01
				162-01	162-01	162-01	162-01
				163-01	163-01	163-01	163-01
				164-01	164-01	164-01	164-01
				165-01	165-01	165-01	165-01
				166-01	166-01	166-01	166-01
				167-01	167-01	167-01	167-01
				168-01	168-01	168-01	168-01
				169-01	169-01	169-01	169-01
				170-01	170-01	170-01	170-01
				171-01	171-01	171-01	171-01
				172-01	172-01	172-01	172-01
				173-01	173-01	173-01	173-01
				174-01	174-01	174-01	174-01
				175-01	175-01	175-01	175-01
				176-01	176-01	176-01	176-01
				177-01	177-01	177-01	177-01
				178-01	178-01	178-01	178-01
				179-01	179-01	179-01	179-01
				180-01	180-01	180-01	180-01
				181-01	181-01	181-01	181-01
				182-01	182-01	182-01	182-01
				183-01	183-01	183-01	183-01
				184-01	184-01	184-01	184-01
				185-01	185-01	185-01	185-01
				186-01	186-01	186-01	186-01
				187-01	187-01	187-01	187-01
				188-01	188-01	188-01	188-01
				189-01	189-01	189-01	189-01
				190-01	190-01	190-01	190-01
				191-01	191-01	191-01	191-01
				192-01	192-01	192-01	192-01
				193-01	193-01	193-01	193-01
				194-01	194-01	194-01	194-01
				195-01	195-01	195-01	195-01
				196-01	196-01	196-01	196-01
				197-01	197-01	197-01	197-01
				198-01	198-01	198-01	198-01
				199-01	199-01	199-01	199-01
				200-01	200-01	200-01	200-01
				201-01	201-01	201-01	201-01
				202-01	202-01	202-01	202-01
				203-01	203-01	203-01	

### Class C Addresses

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

[illegible]

# Class A Addresses

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

/8 255.0.0.0 16,777,216 Hosts	/9 255.128.0.0 8,388,608 Hosts	/10 255.192.0.0 4,194,304 Hosts	/11 255.224.0.0 2,097,152 Hosts	/12 255.240.0.0 1,048,576 Hosts	/13 255.248.0.0 524,288 Hosts	/14 255.252.0.0 262,144 Hosts	/15 255.254.0.0 131,072 Hosts	
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1	
					8-15	4-7	2-3	
				16-31	16-23	8-11	4-5	
						12-15	6-7	
					24-31	20-23	10-11	8-9
							22-23	12-13
						24-25	14-15	
						32-63	32-39	16-19
			20-23	18-19				
			24-27	20-21				
			28-31	22-23				
			40-47	24-25	24-26			
				26-27	26-27			
				28-29	28-29			
				30-31	30-31			
			32-47	32-35	32-33	32-33		
		34-35			34-35			
		36-37			36-37			
		38-39			38-39			
		48-63		40-41	40-41	40-41		
					42-43	42-43		
				44-45	44-45	44-45		
					46-47	46-47		
		64-127	64-95	48-55	48-51	48-49		
					50-51	50-51		
					52-53	52-53		
					54-55	54-55		
				56-63	56-57	56-57		
					58-59	58-59		
					60-61	60-61		
					62-63	62-63		
			80-95	64-71	64-67	64-65		
					68-71	66-67		
					72-75	68-69		
					76-79	70-71		
				88-95	72-73	72-73		
					74-75	74-75		
					76-77	76-77		
					78-79	78-79		
		96-127	80-87	80-83	80-81			
				84-87	82-83			
				88-91	84-85			
				92-95	86-87			
			96-103	88-89	88-89			
				90-91	90-91			
				92-93	92-93			
				94-95	94-95			
		112-127	96-111	96-97	96-97			
				98-99	98-99			
				100-101	100-101			
				102-103	102-103			
			120-127	104-105	104-105			
				106-107	106-107			
				108-111	108-109			
				110-111	110-111			
		128-255	128-191	128-159	128-143	128-135	128-131	128-129
						136-143	132-133	130-131
						140-143	134-135	132-133
						144-147	136-137	134-135
					144-159	144-145	136-137	136-137
						148-151	138-139	138-139
						152-155	140-141	140-141
						156-159	142-143	142-143
				160-191	160-175	160-167	144-145	144-145
	164-167					146-147	146-147	
	168-171					148-149	148-149	
	172-175					150-151	150-151	
	176-191				164-165	152-153	152-153	
					166-167	154-155	154-155	
					168-169	156-157	156-157	
					170-171	158-159	158-159	
	192-255			192-223	192-207	160-163	160-161	160-161
						164-165	162-163	162-163
						166-167	164-165	164-165
						168-169	166-167	166-167
					208-223	172-175	168-169	168-169
						176-179	170-171	170-171
						180-183	172-173	172-173
						184-187	174-175	174-175
				224-239	192-199	176-177	176-177	176-177
						180-183	178-179	178-179
						184-187	180-181	180-181
						188-191	182-183	182-183
					200-207	184-191	184-185	184-185
						192-195	186-187	186-187
						196-199	188-189	188-189
						200-201	190-191	190-191
			224-255	208-215	192-193	192-193	192-193	
					196-199	194-195	194-195	
					200-203	196-197	196-197	
					204-207	198-199	198-199	
				216-223	200-201	200-201	200-201	
					202-203	202-203	202-203	
					204-205	204-205	204-205	
					206-207	206-207	206-207	
	240-255		224-231	208-209	208-209	208-209		
				210-211	210-211	210-211		
				212-213	212-213	212-213		
				214-215	214-215	214-215		
			248-255	216-217	216-217	216-217		
				218-219	218-219	218-219		
				220-221	220-221	220-221		
				222-223	222-223	222-223		

# Class B Addresses

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

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

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

/24	/25	/26	/27	/28	/29	/30
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
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						36-39
					40-47	40-43
						44-47
				48-63	48-55	48-51
						52-55
					56-63	56-59
						60-63
		64-127	64-95	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
			96-127	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
	128-255	128-191	128-159	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
			160-191	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
		192-255	192-223	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
			224-255	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



Class A Addressing Guide					
CIDR	# of Bits Borrowed	Subnet Mask	Total # of Subnets	Total # of Hosts	Usable # of Hosts
/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					
CIDR	# of Bits Borrowed	Subnet Mask	Total # of Subnets	Total # of Hosts	Usable # of Hosts
/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					
CIDR	# of Bits Borrowed	Subnet Mask	Total # of Subnets	Total # of Hosts	Usable # of Hosts
/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