

VLSM

Variable-Length Subnet Mask

Workbook

Version 2.0

192.168

192.168.10.96

192.168.10.126

172.31.15.0

10.250.1.0

Student Name:

Loo Zi Xuan

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](#).

Produced by: Robb Jones
jonesr@careertech.net and/or Robert.Jones@fcps.org
Frederick County Career & Technology Center
Cisco Networking Academy
Frederick County Public Schools
Frederick, Maryland, USA

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

Workbooks included in the series:

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

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

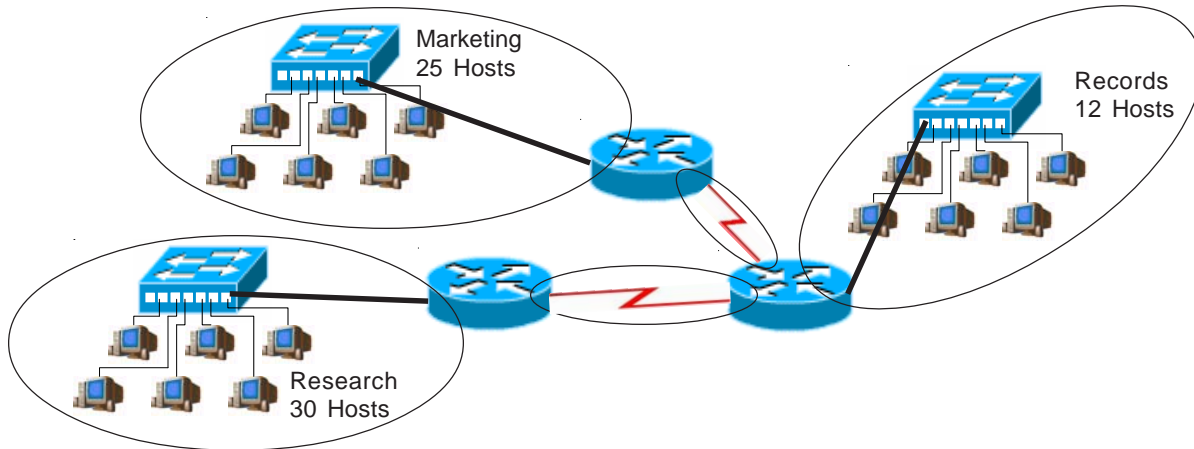
This workbook explores three different methods to figure out sub-subnets: the box method, the circle method, and a VLSM chart.

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			

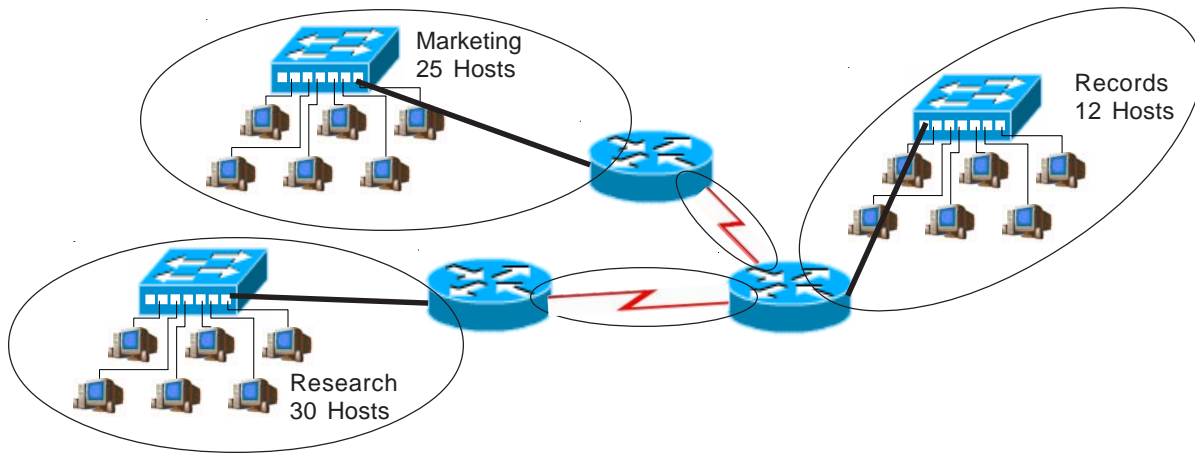
0 31	32 63	128 159	160 191
64 95	96 127	192 223	224 255

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

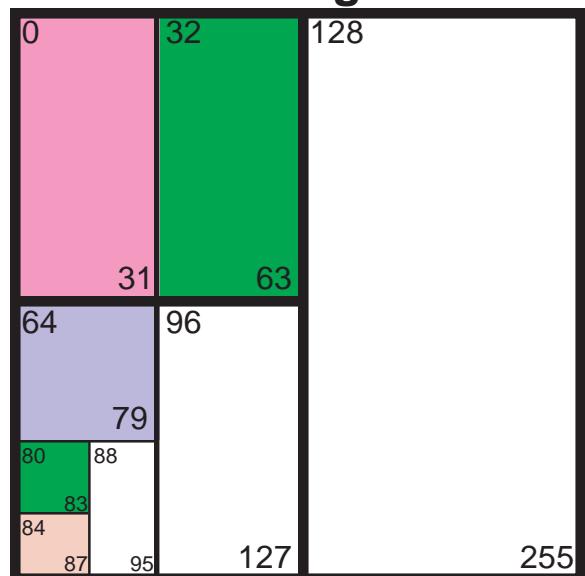


By adjusting the subnet masks you can cut your address usage by almost half in this example. This type of subnetting requires a network protocol which will support it such as: RIP version 2, EIGRP, OSPF, or BGP.

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

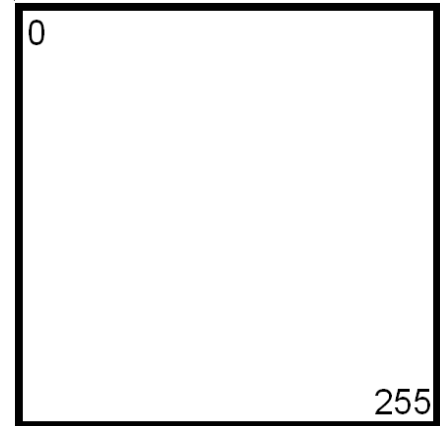


Visualizing Subnets Using The Box Method

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.

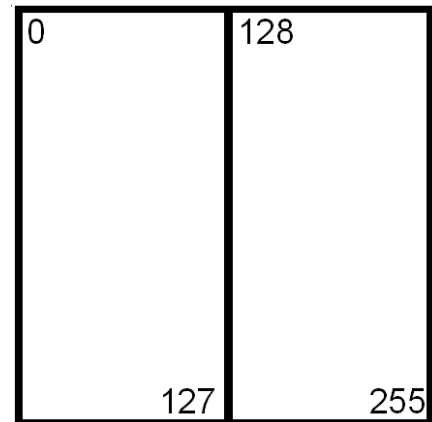
Start with a square. The whole square is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



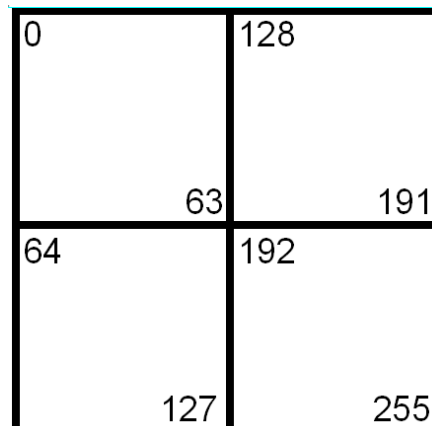
Split the box in half and you get two subnets with 128 addresses.

/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

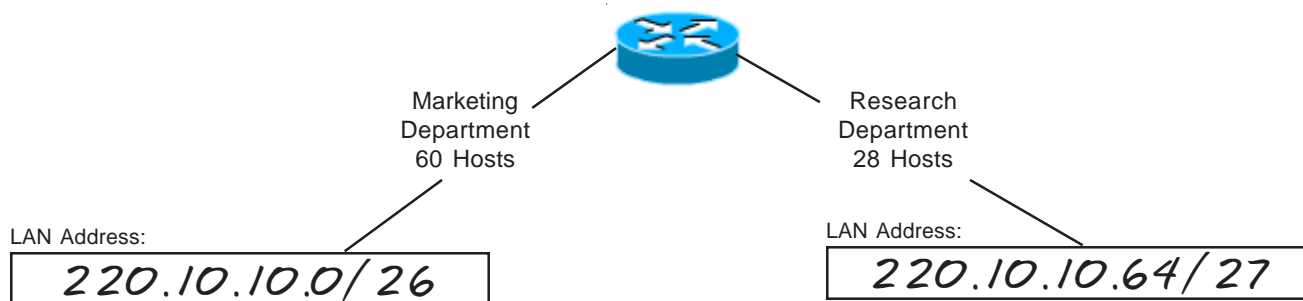
VLSM Addressing

Box Method

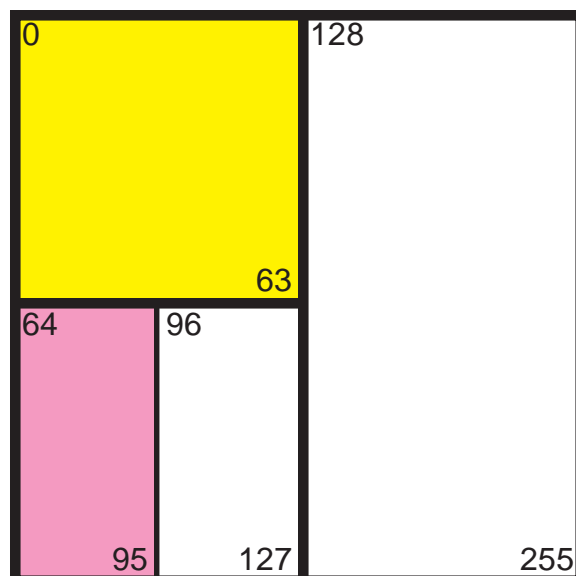
(Sample)

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.



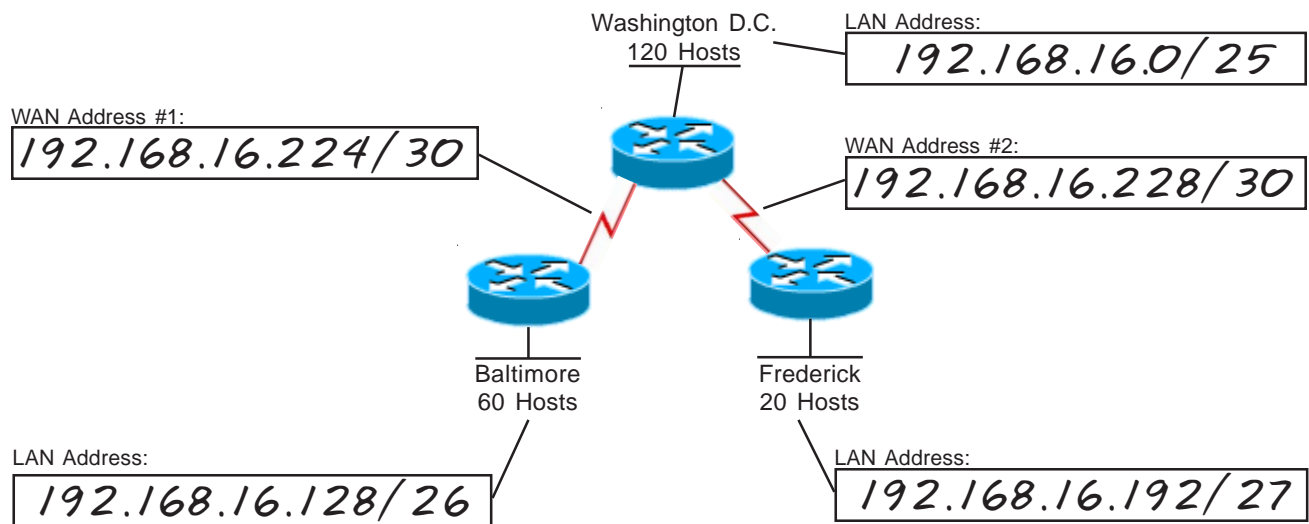
VLSM Addressing

Box Method

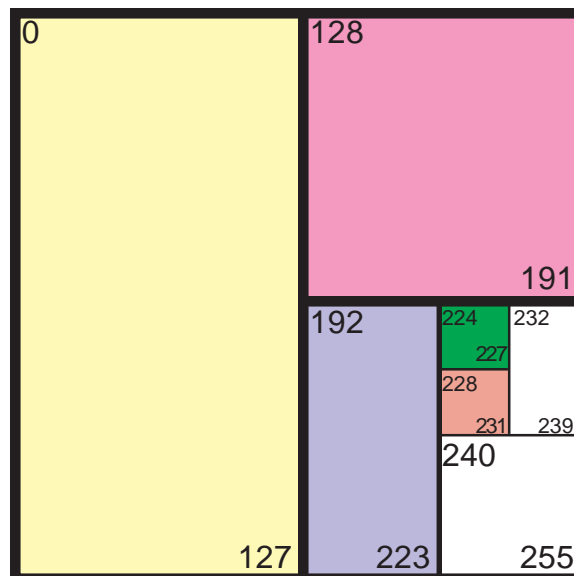
(Sample)

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.

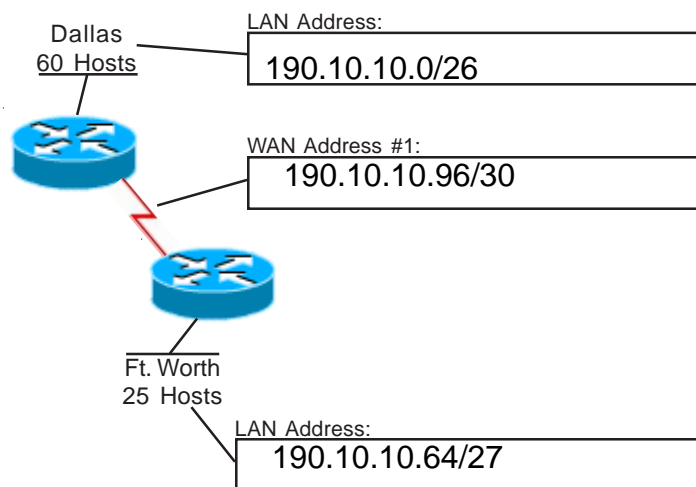


VLSM Addressing

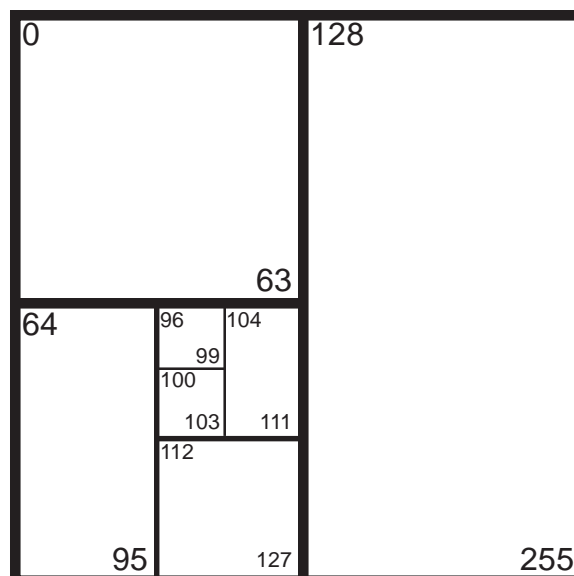
Box Method

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.

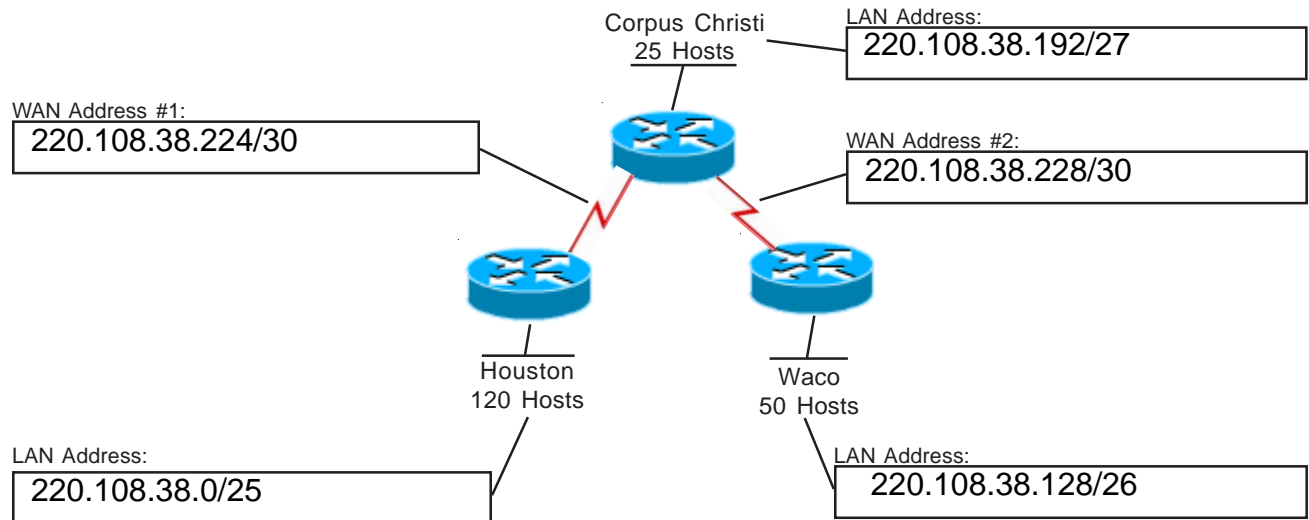


VLSM Addressing

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.

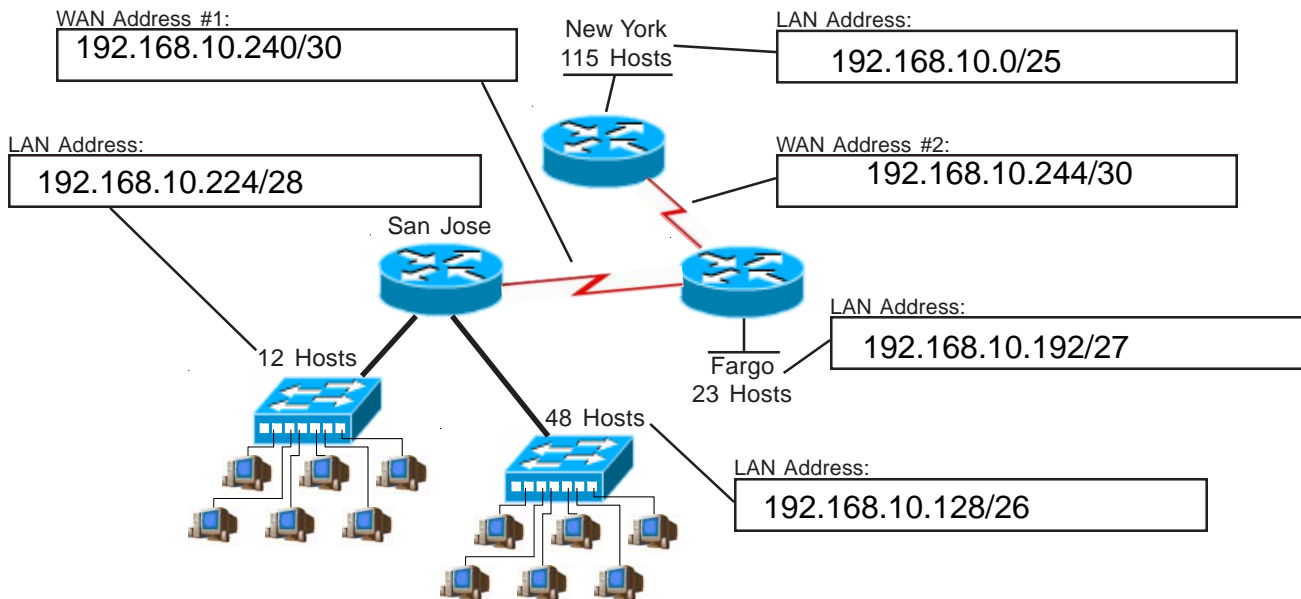
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	163
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	167
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103	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.

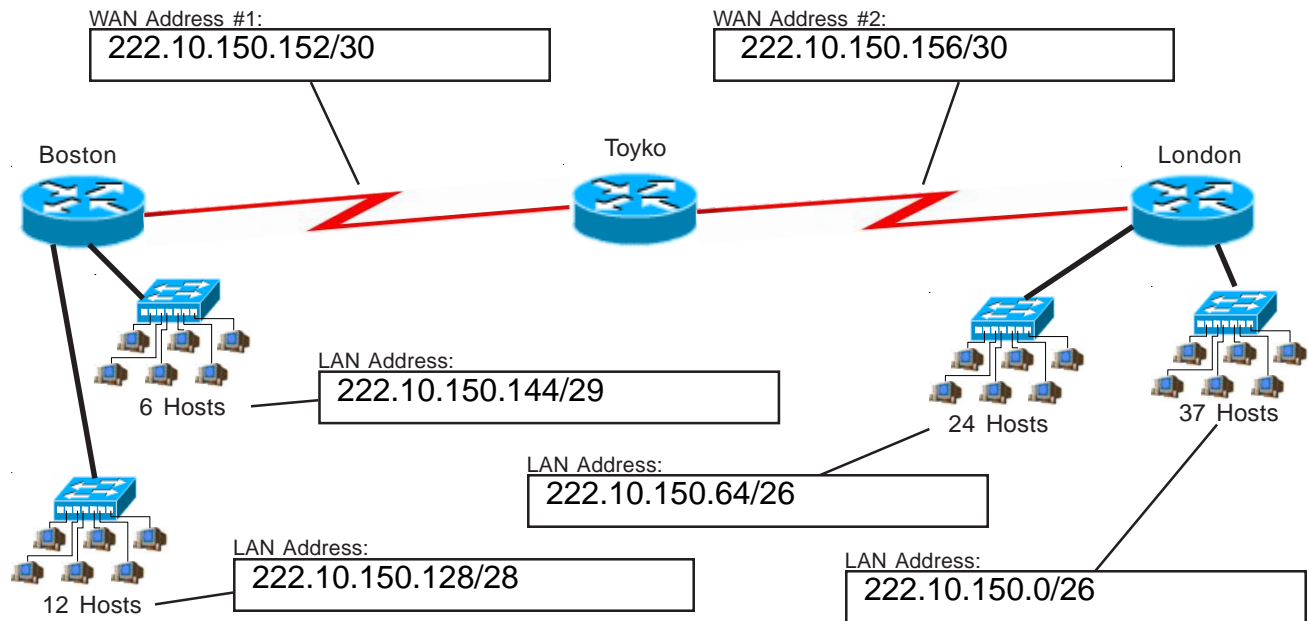
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	163
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	167
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103	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.

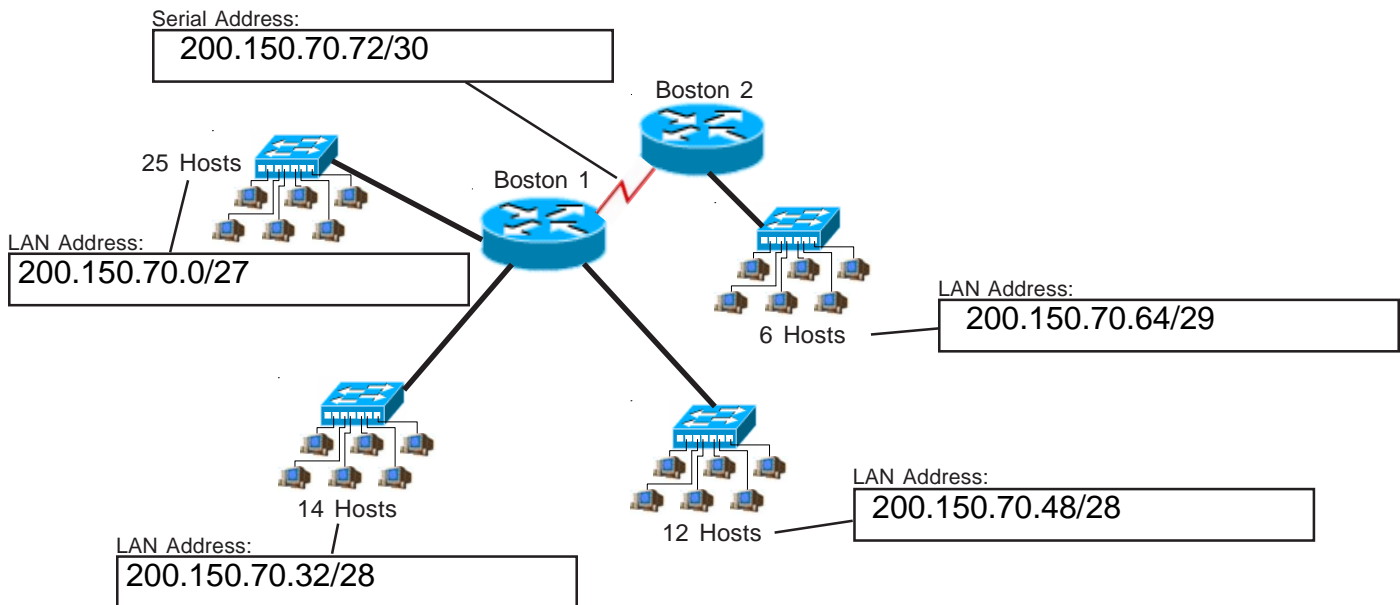
0	32	128	160
31	63	159	191
64	96	192	224
95	127	223	255

VLSM Addressing

Box Method

Problem 7

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



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

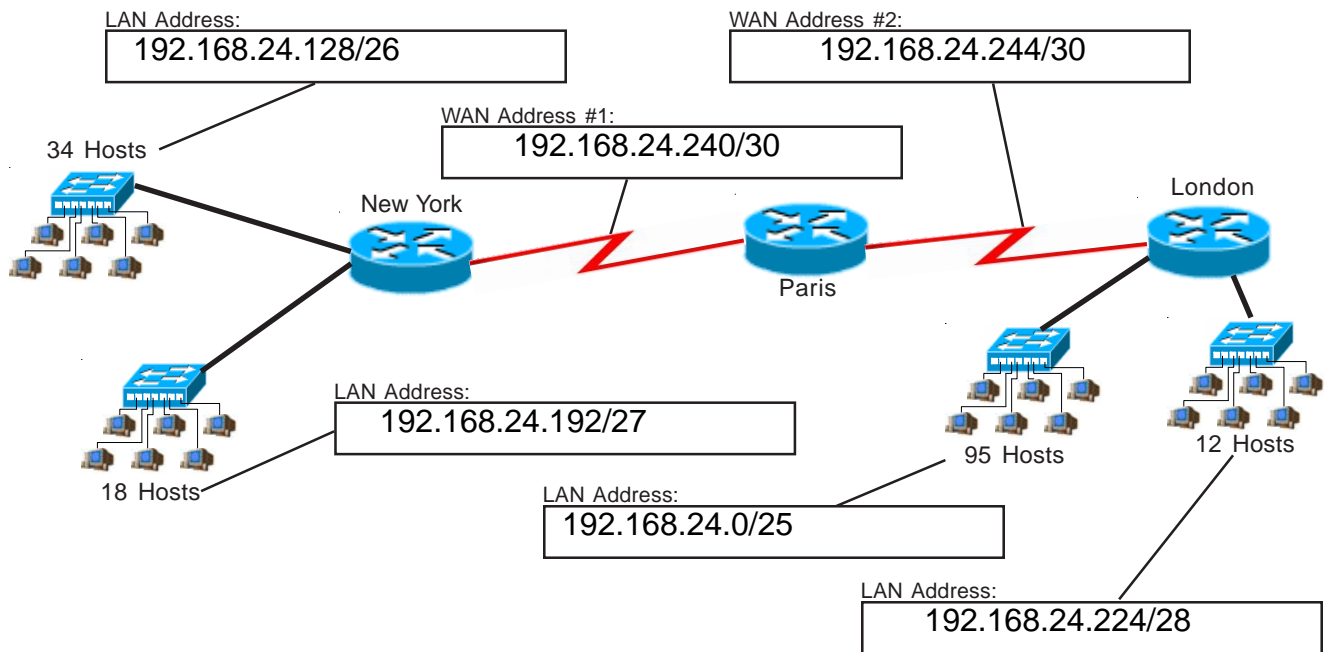
0	128
63	191
64	192
127	255

VLSM Addressing

Box Method

Problem 8

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



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

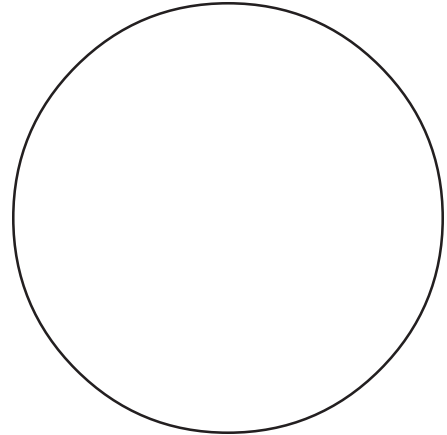
0
255

Visualizing Subnets Using The Circle Method

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

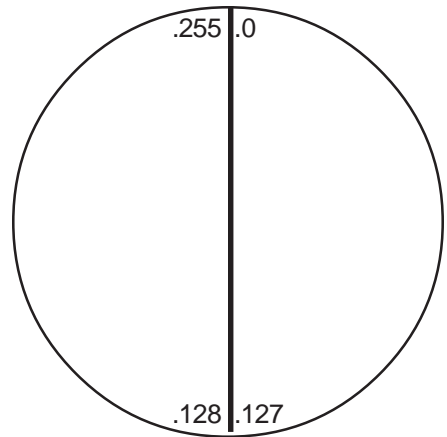
Start with a circle. The whole circle is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



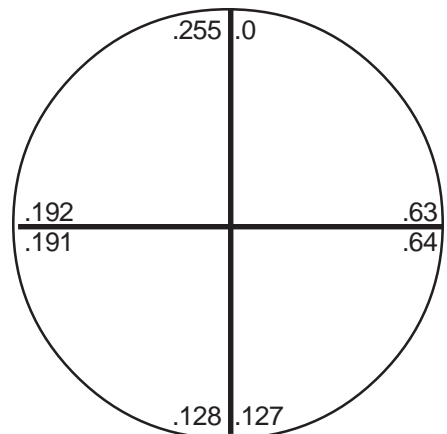
Split the circle in half and you get two subnets with 128 addresses.

/25
255.255.255.128
128 Hosts
2 Subnets



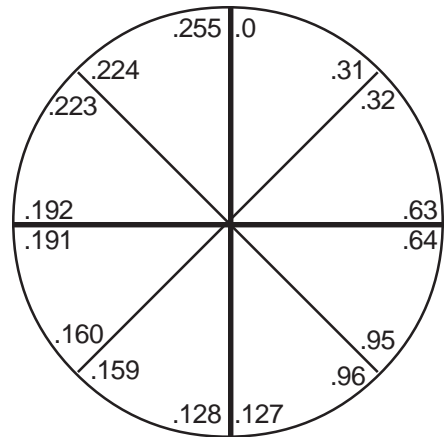
Divide the circle into quarters and you get four subnets with 64 addresses.

/26
255.255.255.192
64 Hosts
4 Subnets



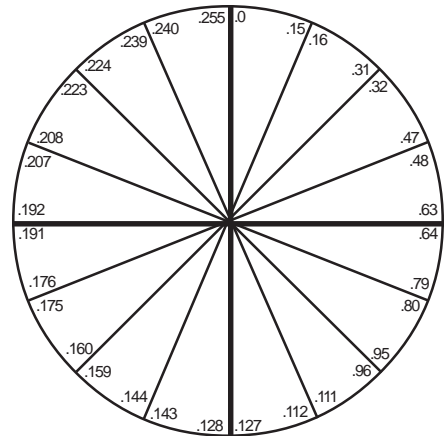
Split each quarter and you get eight subnets with 32 addresses.

/27
255.255.255.224
32 Hosts
8 Subnets



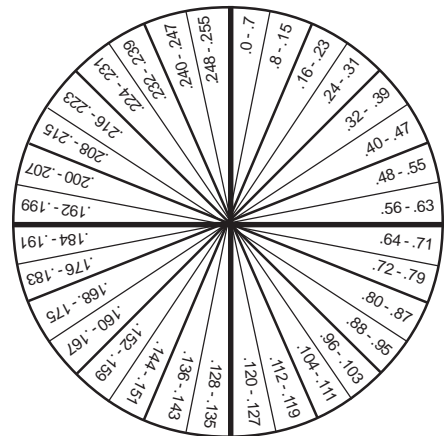
Split the boxes in half again and you get sixteen subnets with sixteen addresses.

/28
255.255.255.240
16 Hosts
16 Subnets



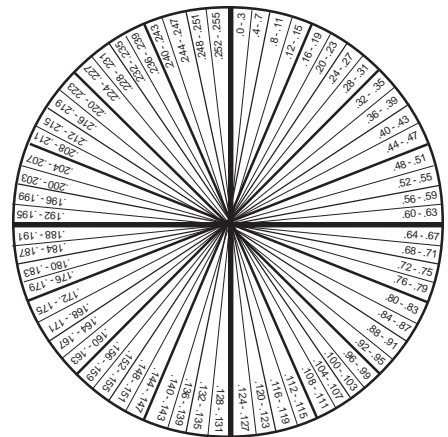
The next split gives you thirty two subnets with eight addresses.

/29
255.255.255.248
8 Hosts
32 Subnets



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

/30
255.255.255.252
4 Hosts
64 Subnets



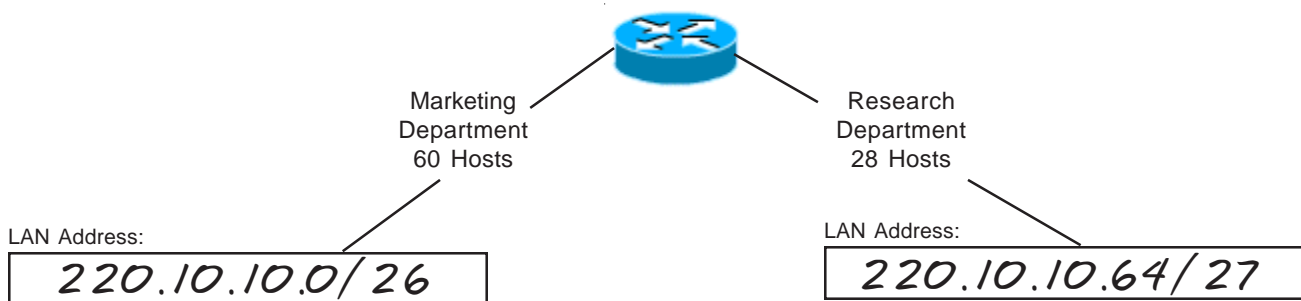
VLSM Addressing

Circle Method

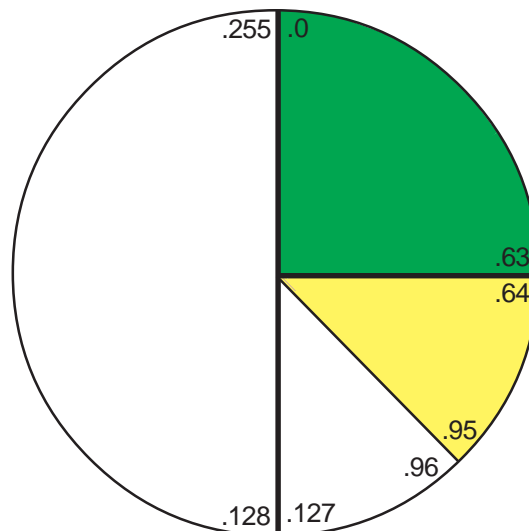
(Sample)

Problem 9

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



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



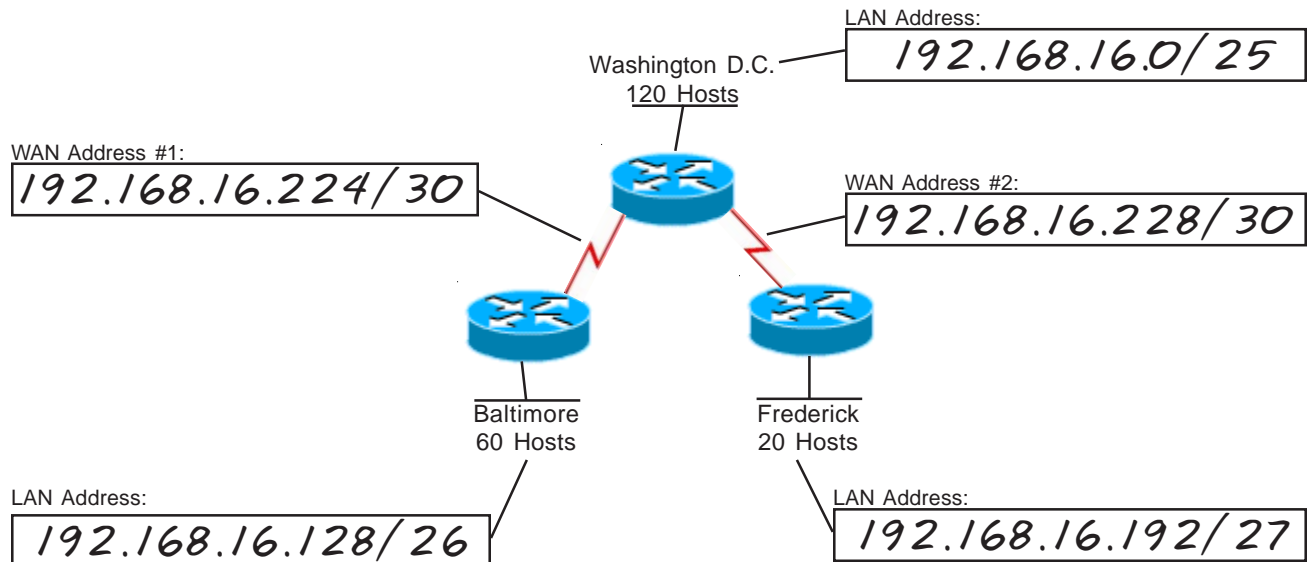
VLSM Addressing

Circle Method

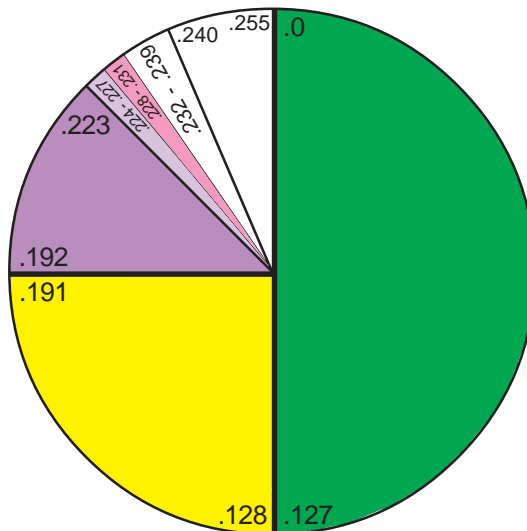
(Sample)

Problem 10

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



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

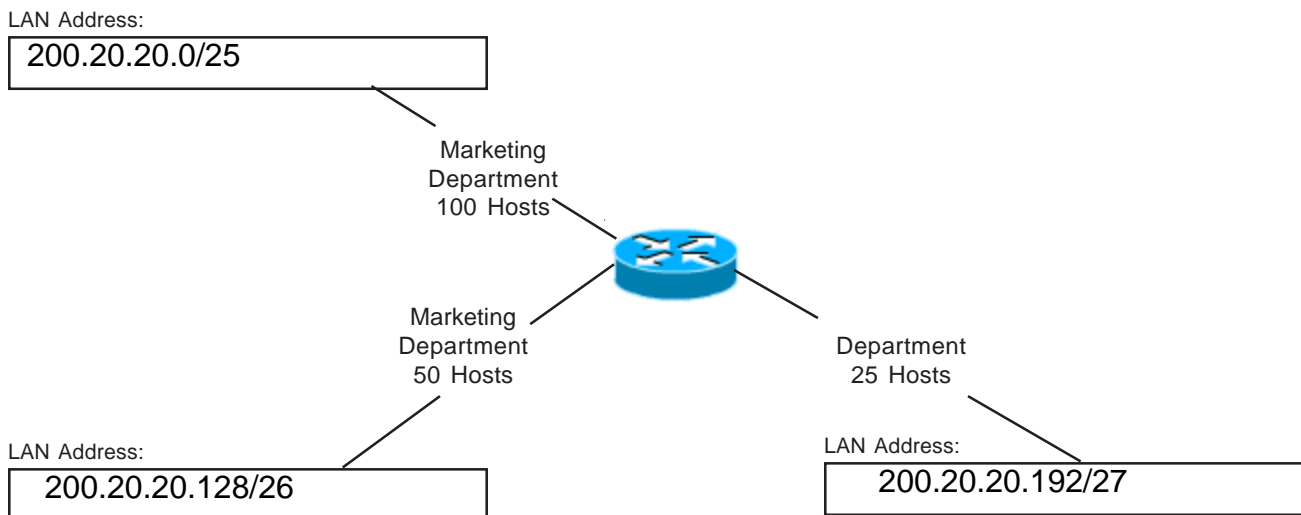


VLSM Addressing

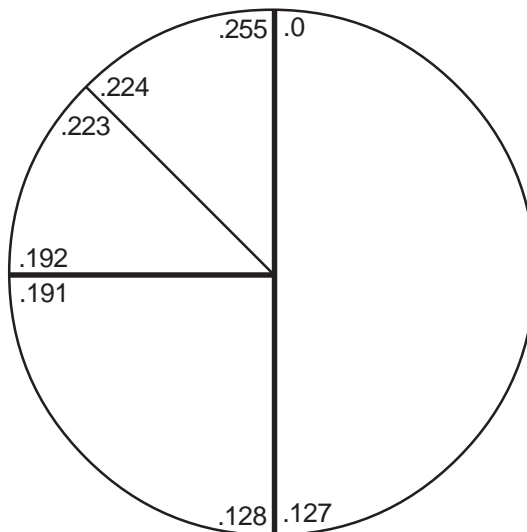
Circle Method

Problem 11

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



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

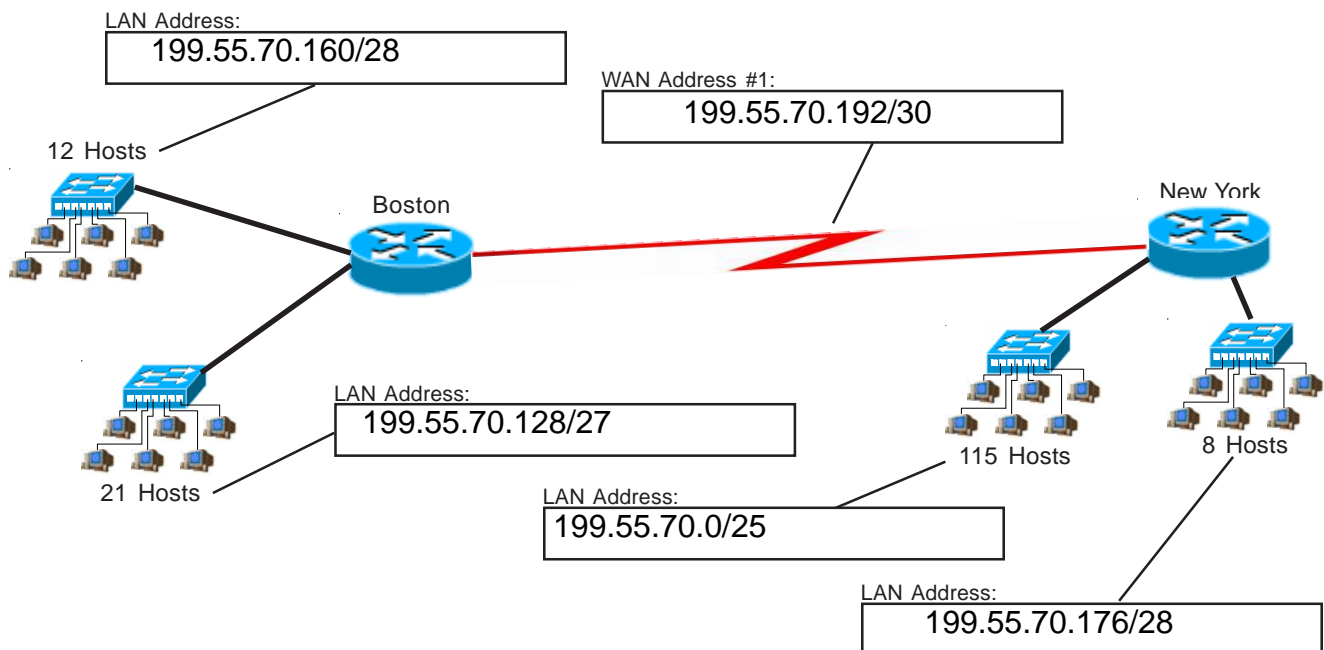


VLSM Addressing

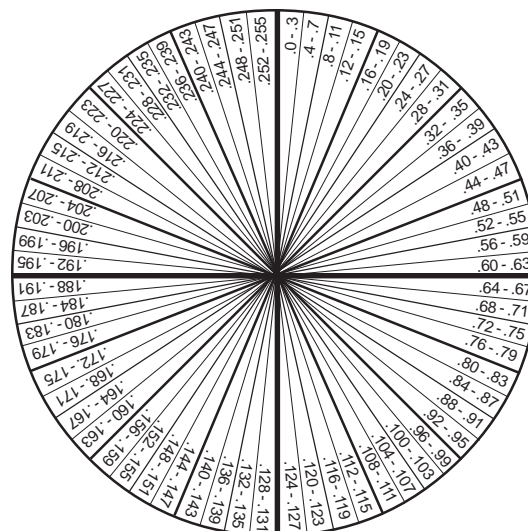
Circle Method

Problem 12

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



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

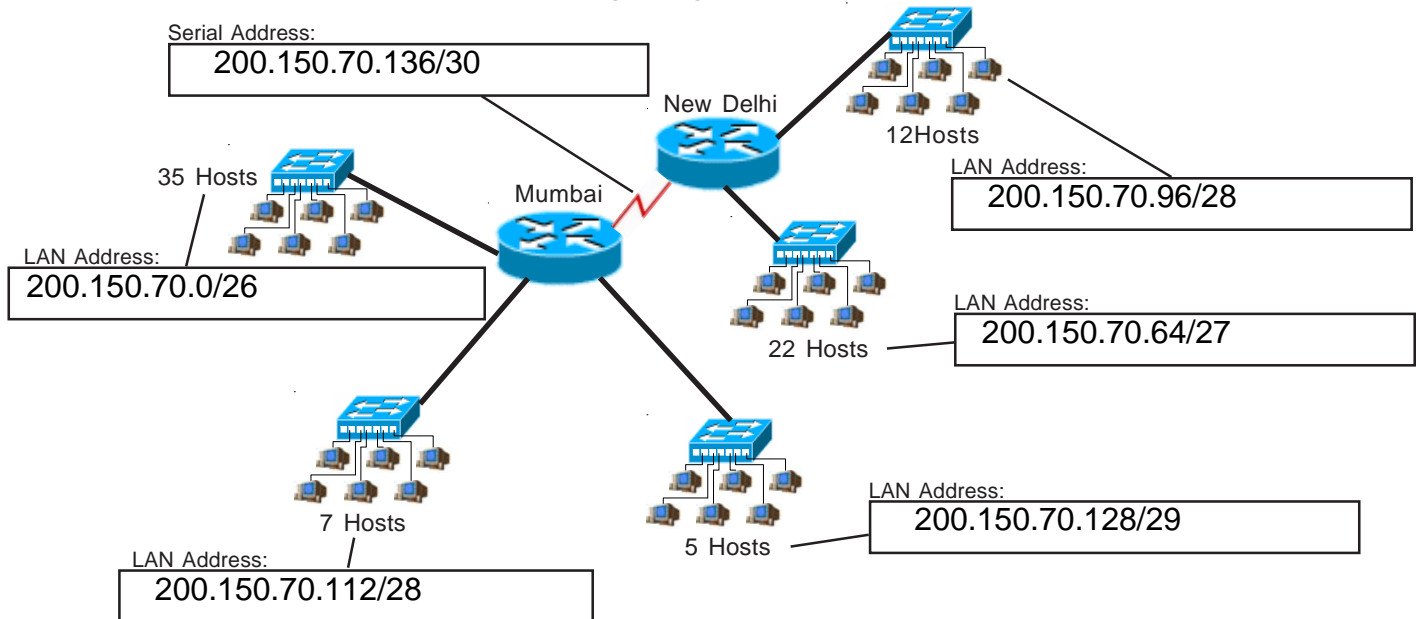


VLSM Addressing

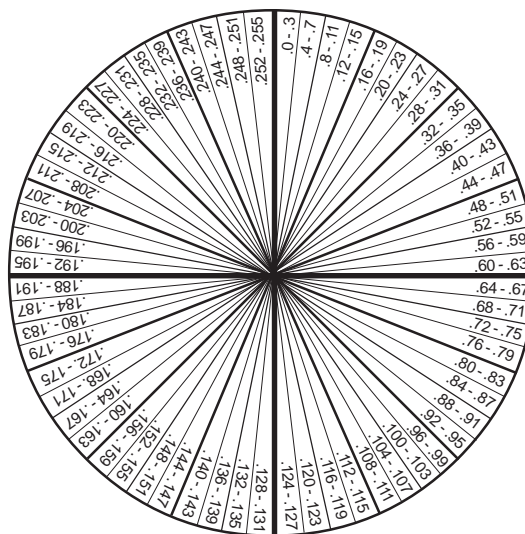
Circle Method

Problem 13

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



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

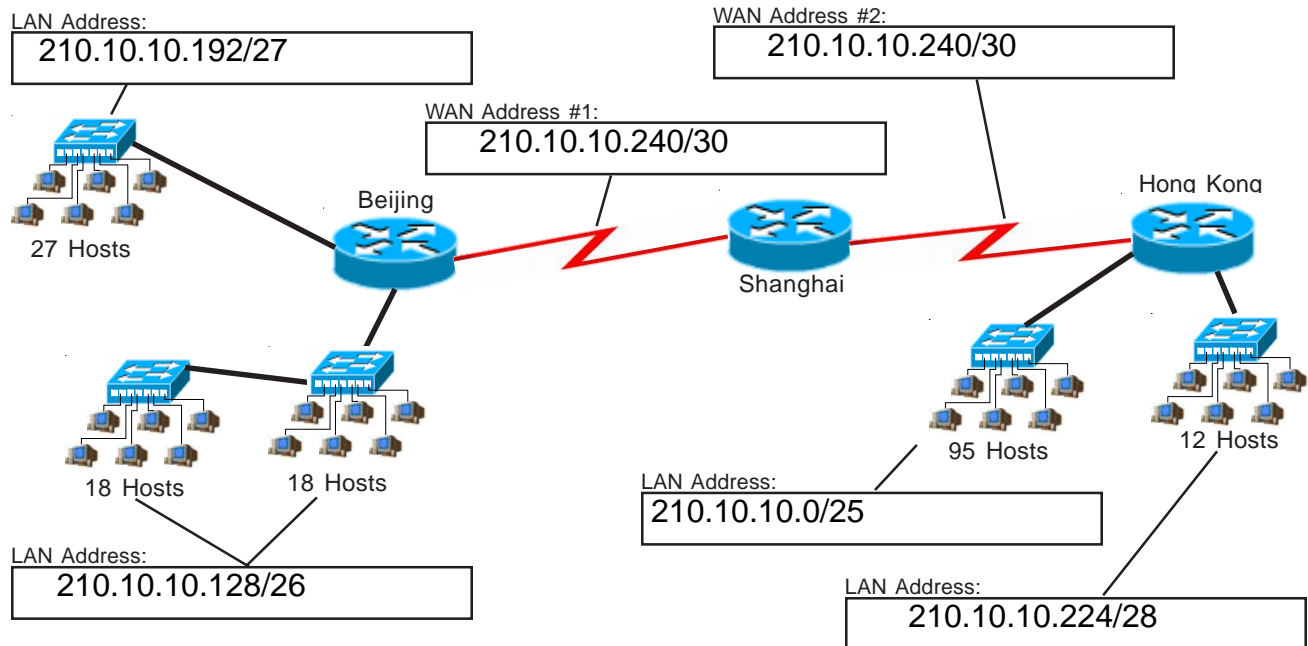


VLSM Addressing

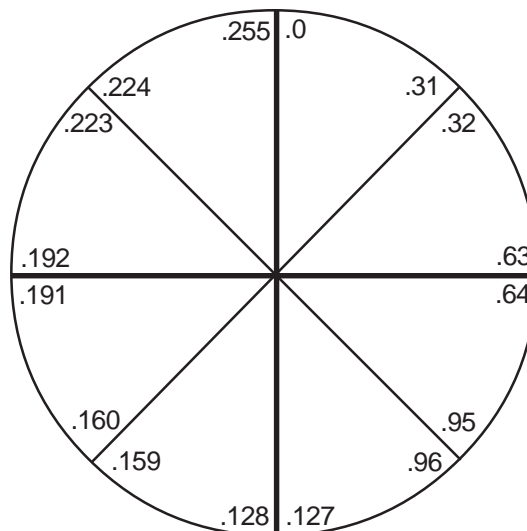
Circle Method

Problem 14

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



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

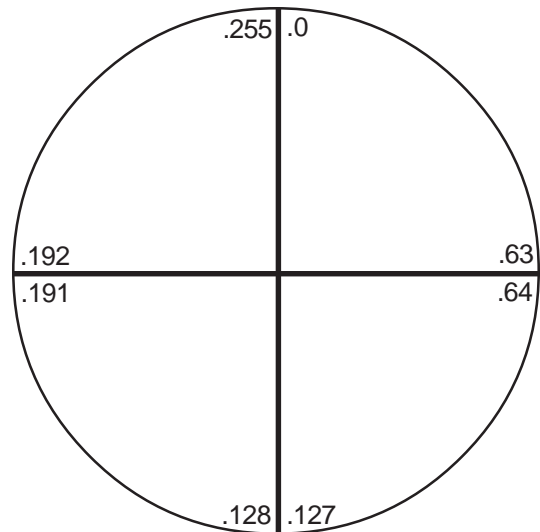
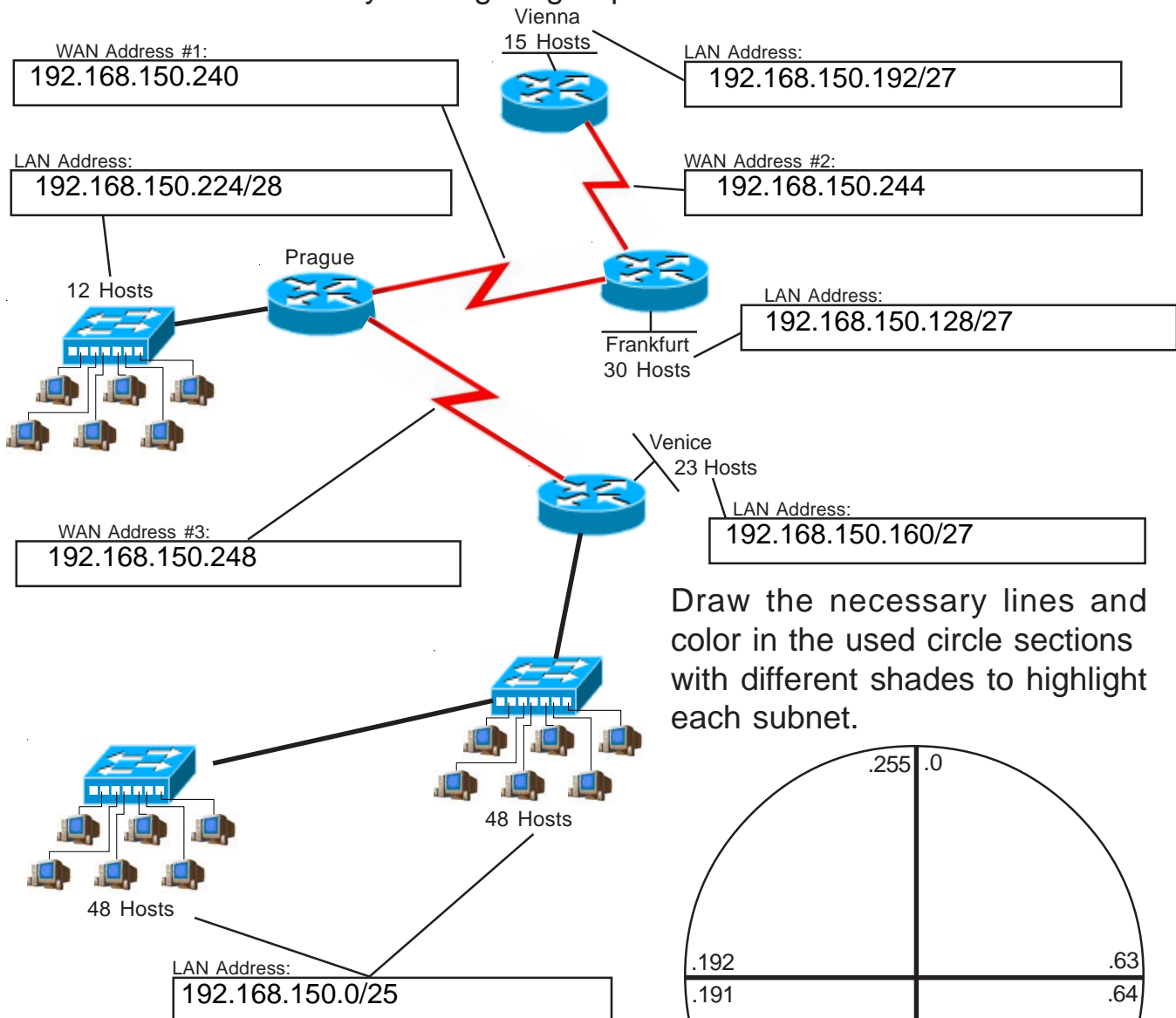


VLSM Addressing

Circle Method

Problem 15

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

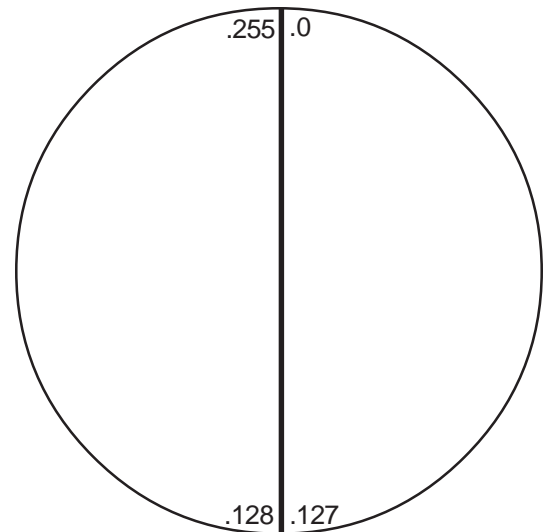
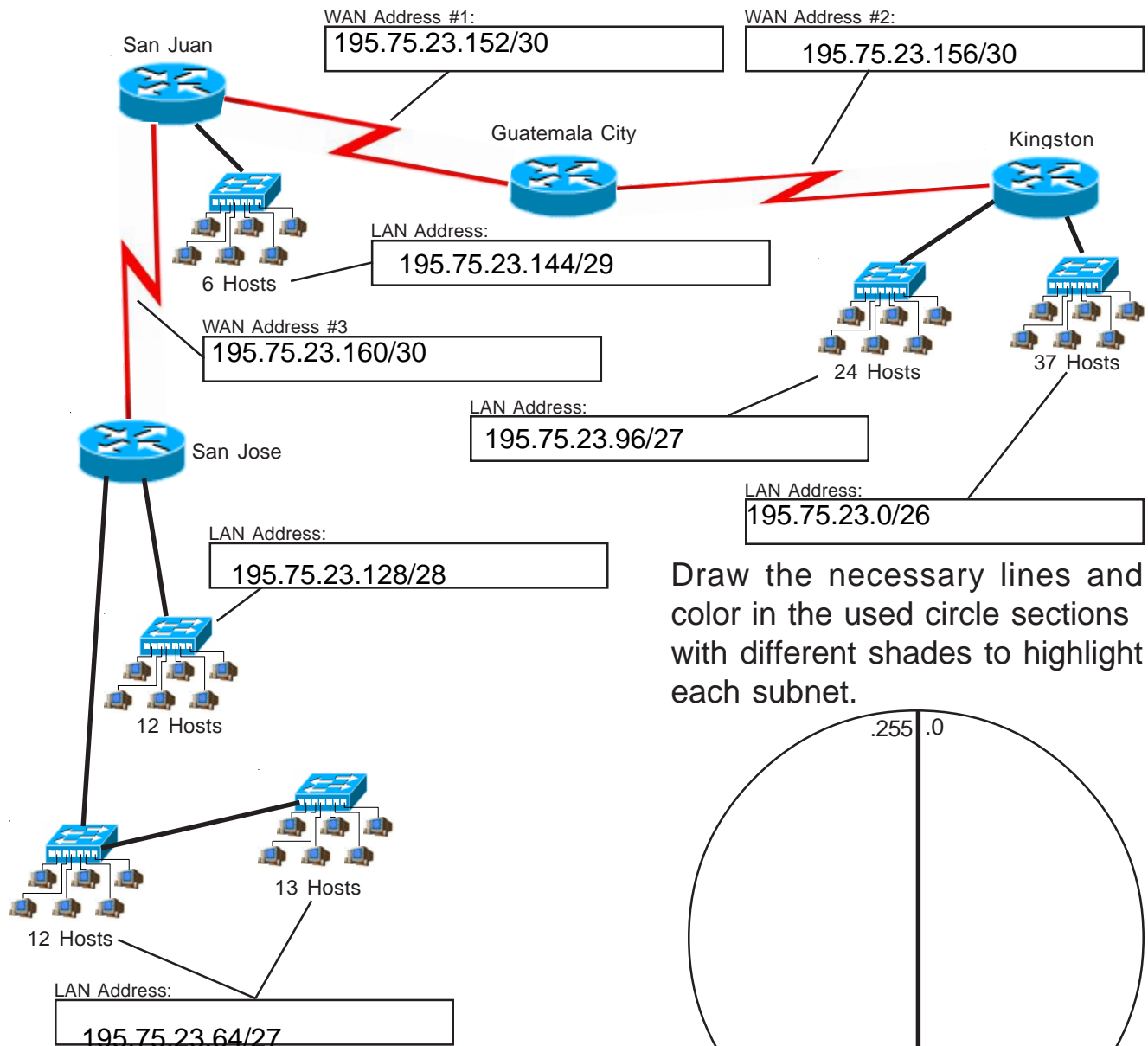


VLSM Addressing

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.

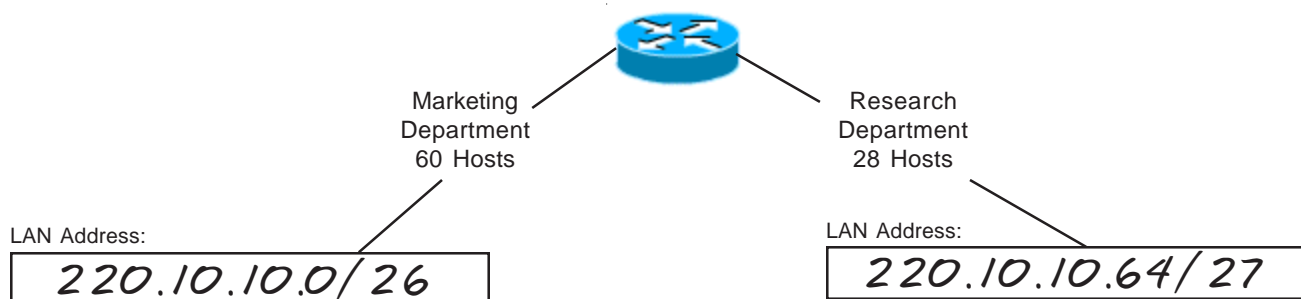
VLSM Addressing

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

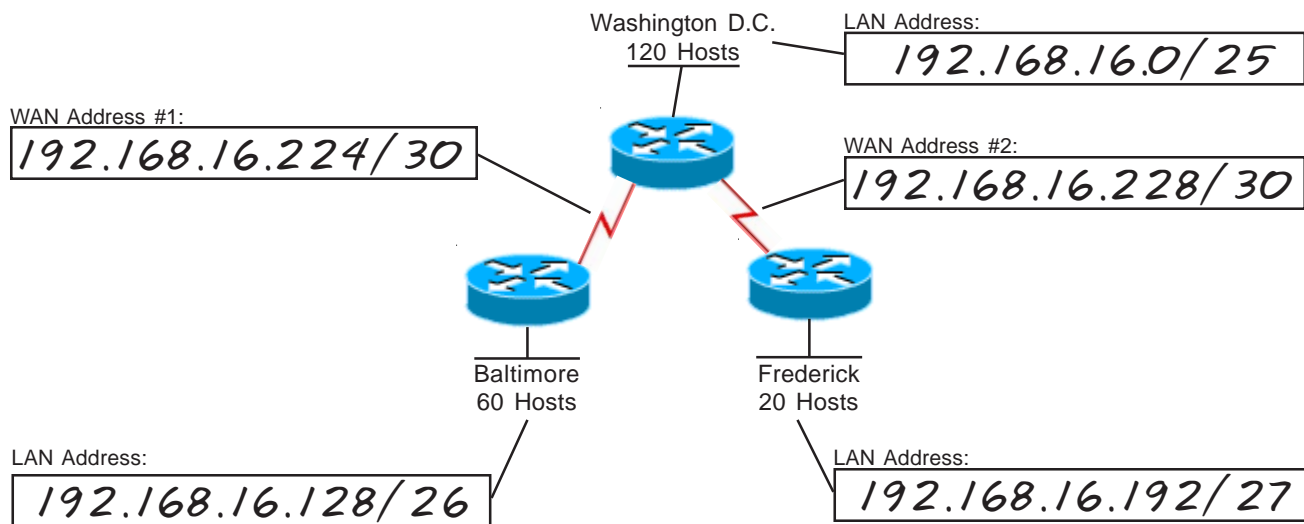
VLSM Addressing

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)

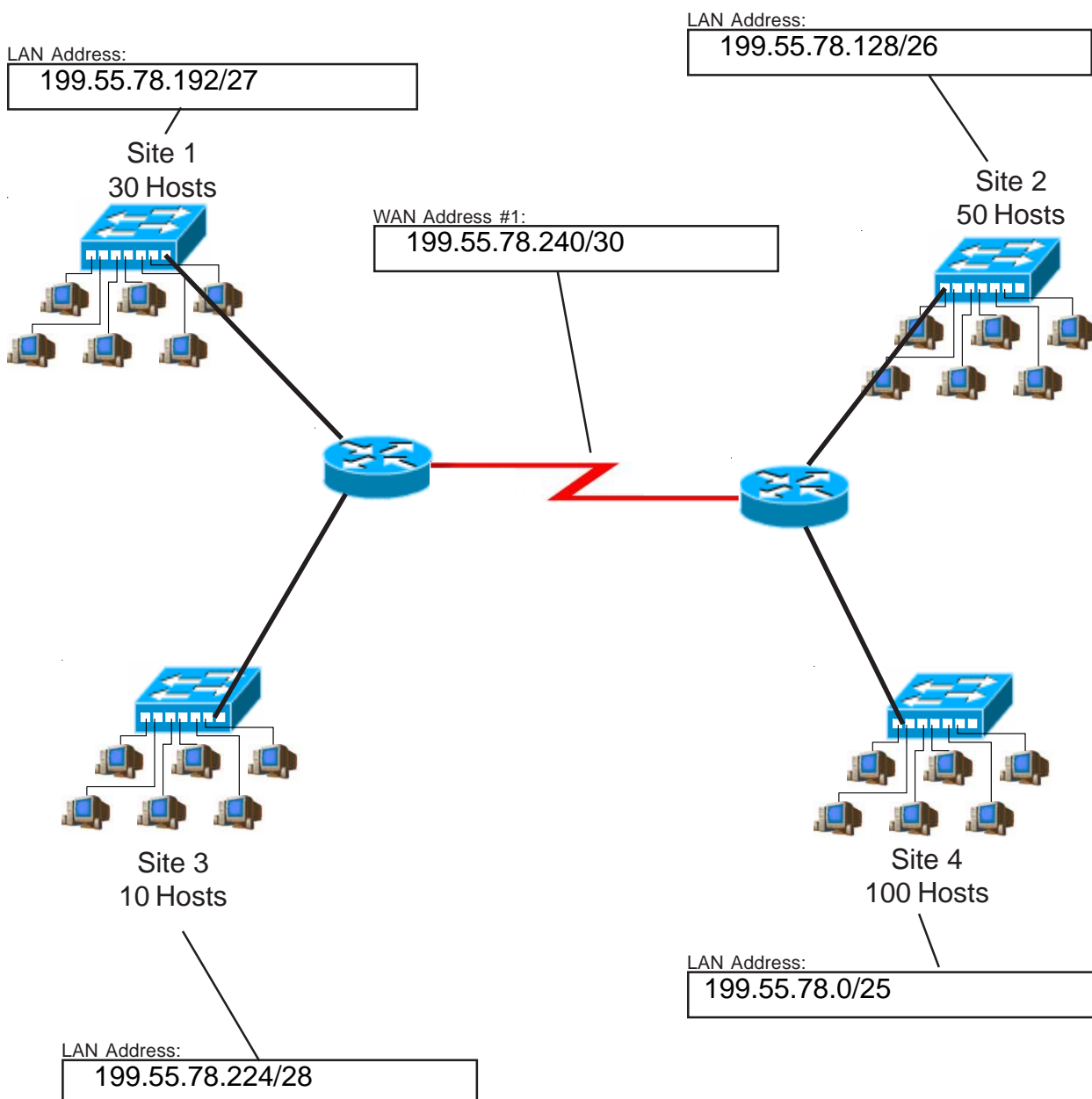
/24	/25	/26	/27	/28	/29	/30			
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts			
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3			
					4-7	4-7			
				16-31	8-15	8-11			
					12-15	12-15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

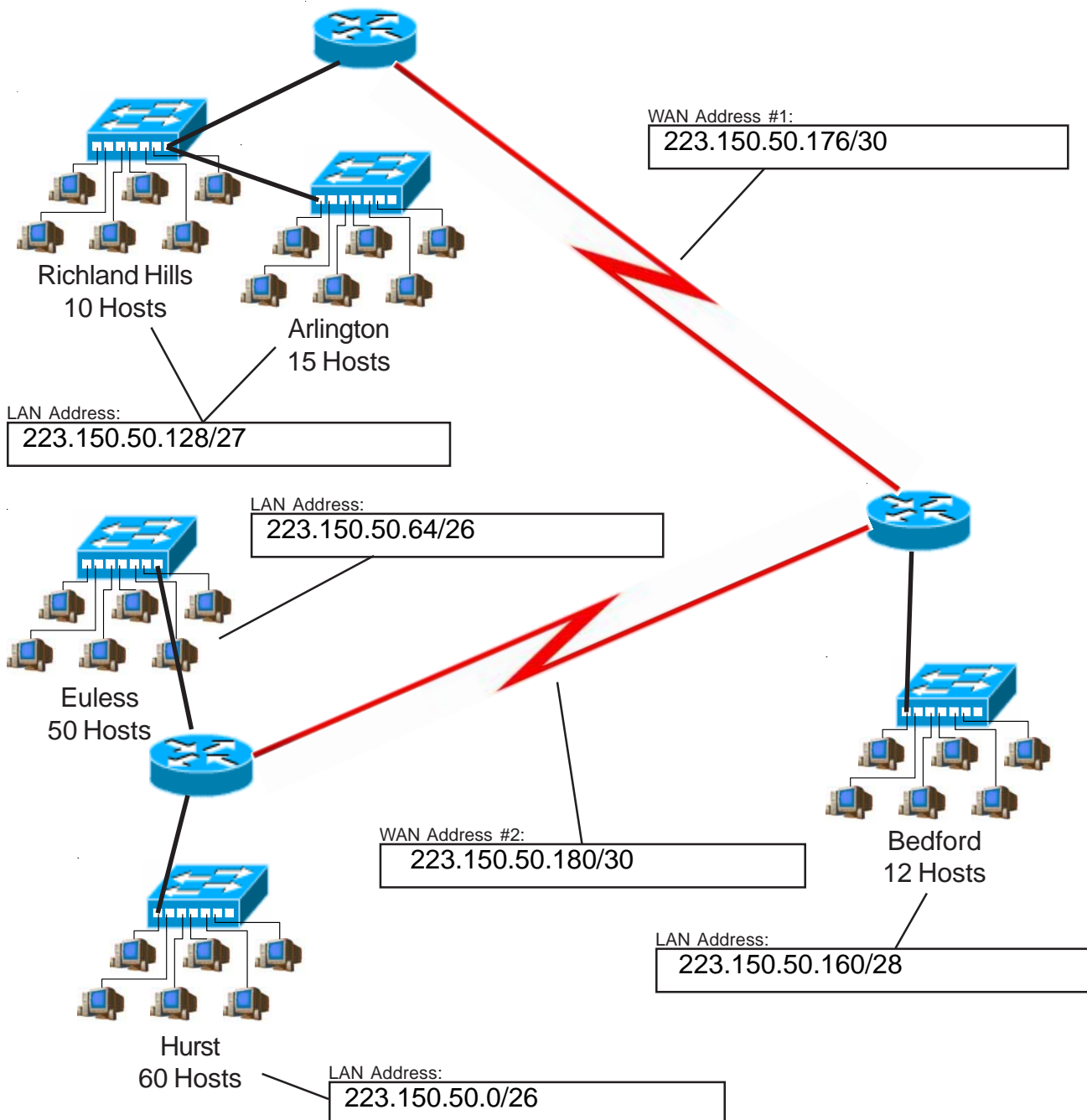
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
					4-7	4-7
				16-31	8-15	8-11
					12-15	12-15
			32-63	32-47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

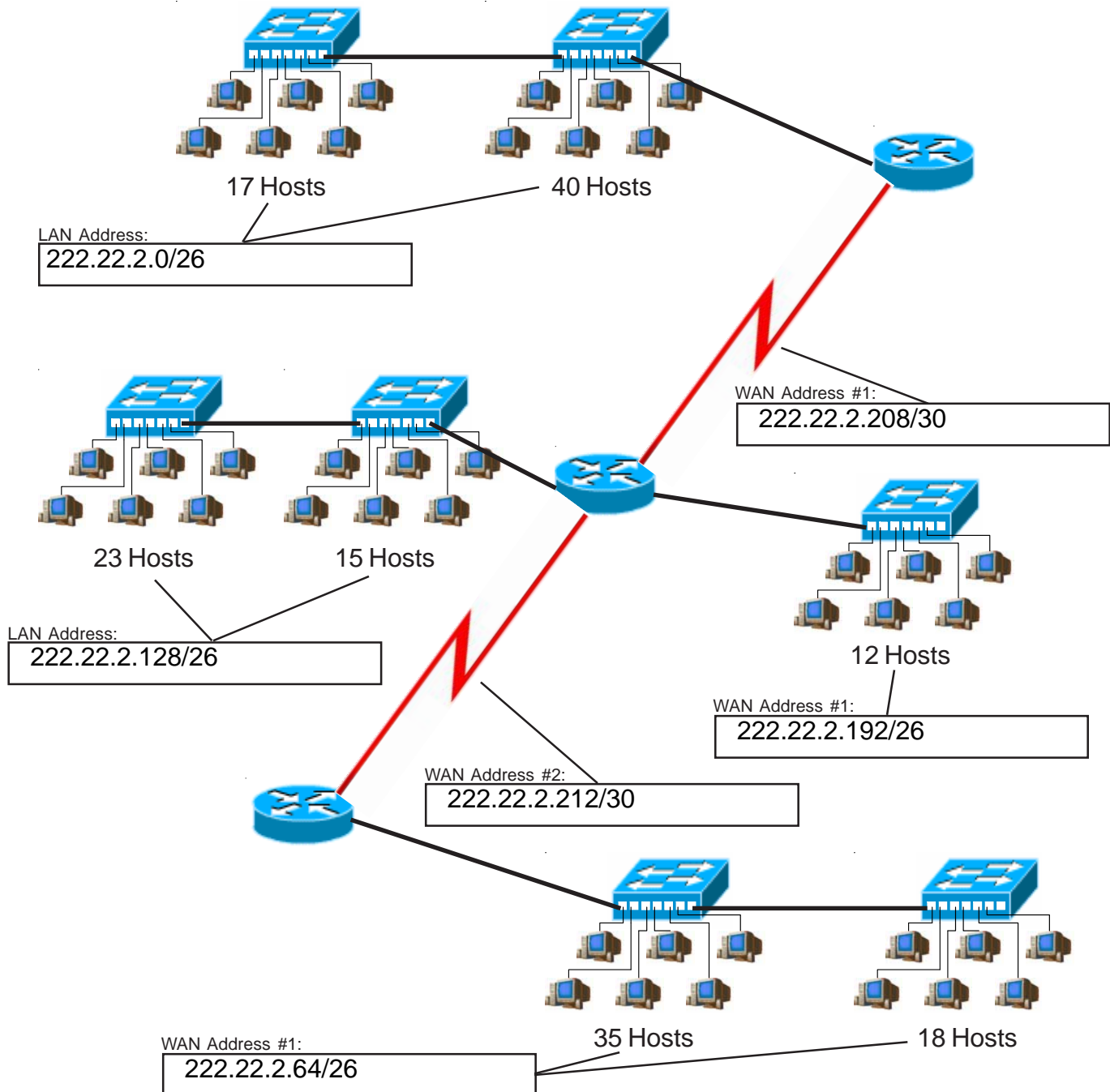
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31	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)

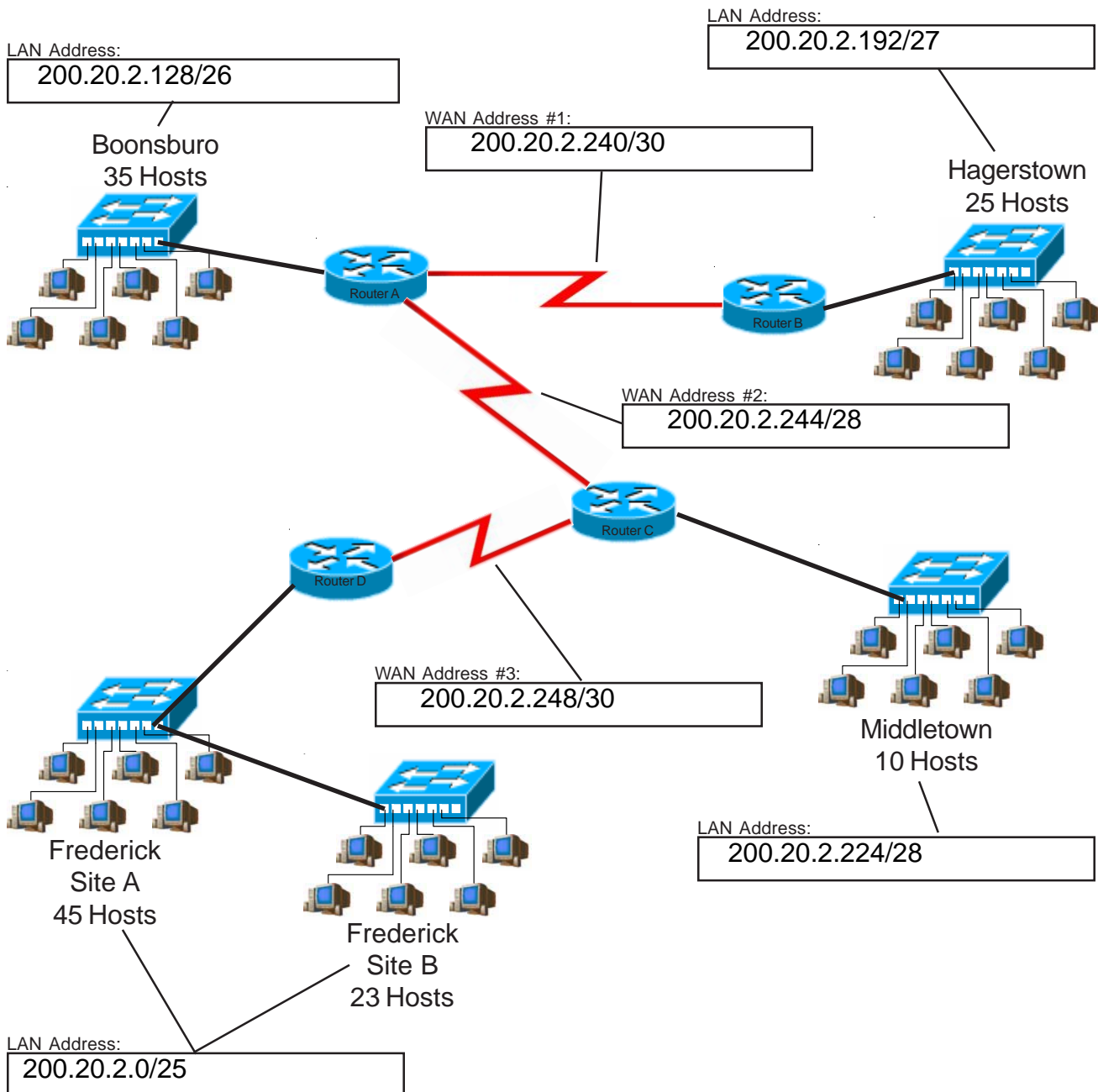
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						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 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)

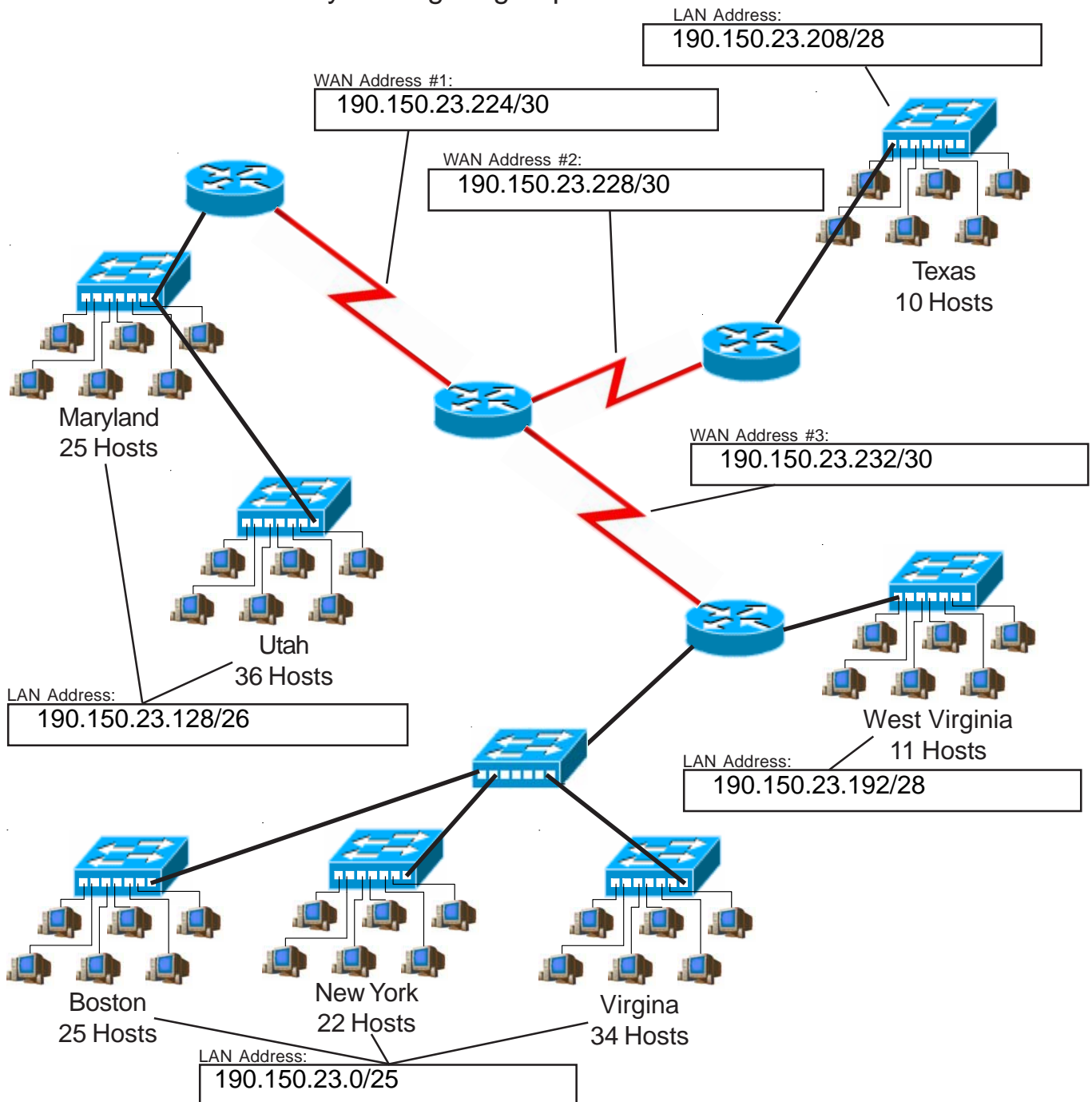
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						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 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)

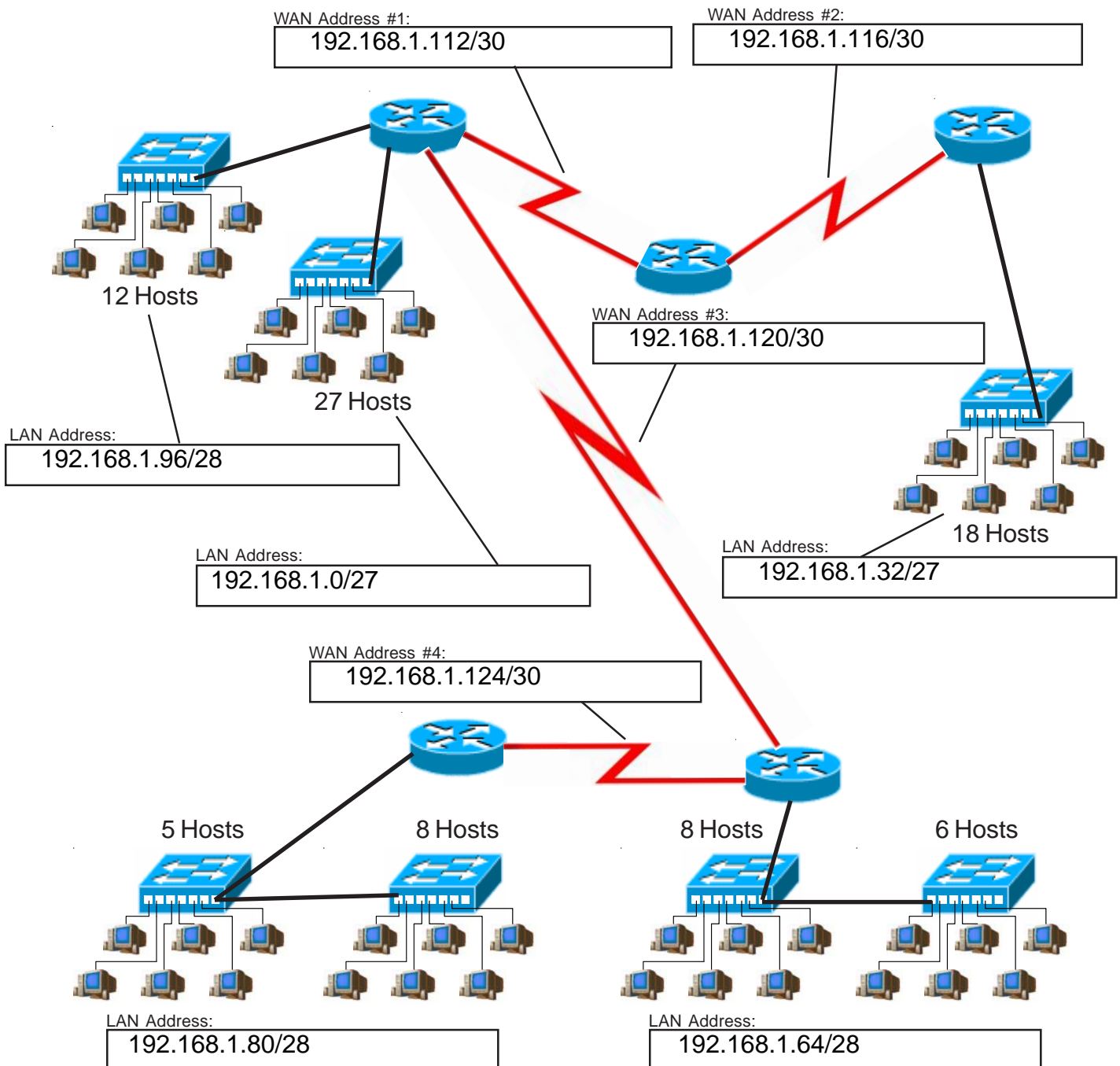
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
					4-7	4-7
				16-31	8-15	8-11
					12-15	12-15
		32-63	32-47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

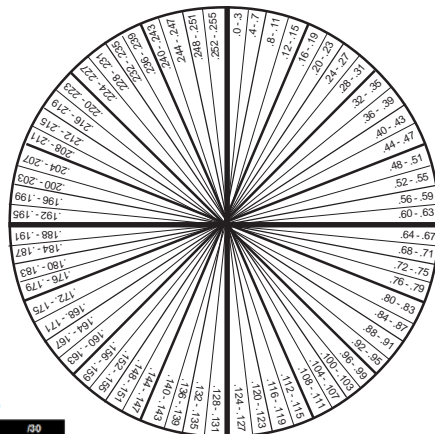
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						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

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					
6					
7					
8					
9					
10					
11					
12					
13					
14					

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	Prefix/CIDR	1st usable	Last Usable	Broadcast
1	223.37.34.0	/25	223.37.34.1	223.37.34.126	223.37.34.127
2	223.37.34.128	/26	223.37.34.129	223.37.34.190	223.37.34.191
3	223.37.34.192	/27	223.37.34.193	223.37.34.221	223.37.34.222
4	223.37.34.224	/28	223.37.34.225	223.37.34.238	223.37.34.239
5	223.37.34.240	/29	223.37.34.241	223.37.34.146	223.37.34.147
6					
7					
8					
9					
10					

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	Prefix/CIDR	1st usable	Last Usable	Broadcast	
1	192.168.10.0	/27	192.168.10.1	192.168.10.30	192.168.10.31	last ss
2	192.168.10.32	/29	192.168.10.33	192.168.10.38	192.168.10.39	
3	192.168.10.40	/39	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						

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	Prefix/CIDR	1st usable	Last Usable	Broadcast
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					

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.


Host	Subnet Address	Prefix/CIDR	1st usable	Last Usable	Broadcast
35	192.168.250.0	/26	192.168.250.1	192.168.250.63	192.168.250.64
30	192.168.250.64	/27	192.168.250.65	192.168.250.95	192.168.250.96
30	192.168.250.96	/27	192.168.250.97	192.168.250.127	192.168.250.128
20	192.168.250.128	/27	192.168.250.129	192.168.250.159	192.168.250.160
20	192.168.250.160	/27	192.168.250.161	192.168.250.191	192.168.250.192
15	192.168.250.192	/27	192.168.250.193	192.168.250.222	192.168.250.223

12					
13					
14					

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	Prefix/CIDR	1st usable	Last Usable	Broadcast
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					

Suk	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					
/						

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	Prefix/CIDR	1st usable	Last Usable	Broadcast
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					

ast

ss

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	Prefix/CIDR	1st usable	Last Usable	Broadcast
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					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

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	Prefix/CIDR	1st usable	Last Usable	Broadcast	1st usable
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	195.20.5.126	195.20.5.127	
6						
7						
8						
9						
10						

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
					212-215	160-163	82-83
				224-239		164-167	84-85
					224-227	168-171	86-87
					228-231	172-175	88-89
					232-235	176-179	90-91
				240-255	236-239	180-183	92-93
					240-243	184-187	94-95
					244-247	188-191	96-97
					248-251	192-195	98-99
				248-255		196-199	100-101
						200-203	102-103
						204-207	104-105
						208-211	106-107
						212-215	108-109
						216-219	110-111
						220-223	112-113
						224-227	114-115
						228-231	116-117
						232-235	118-119
						236-239	120-121
						240-243	122-123
						244-247	124-125
						248-251	126-127
						252-255	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

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

N N H H
11111111 11111111 00000000 00000000
11111111 10000000 00000000 00000000

School System Address 172.32.0.0^{/9}

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)		CIDR
North High	2,400	2¹²	172.32.0.0	/20
South High	2,000	2¹¹	172.32.16.0	/21
North Middle	1,200	2¹¹	172.32.24.0	/21
South Middle	1,000	2¹⁰	172.32.32.0	/22
Central Elem.	550	2¹⁰	172.32.36.0	/22
Southern Elem.	475	2⁹	172.32.40.0	/23
Eastern Elem.	450	2⁹	172.32.42.0	/23
Central Office	400	2⁹	172.32.44.0	/23
Western Elem.	300	2⁹	172.32.46.0 172.32.47.255	/23
	55	2⁶	172.32.48.0 172.32.48.63	/26
			172.32.48.64 /16	
			172.33.0.0	

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	16-23	16-19	10-11
						20-23	12-13
			32-63	32-47	24-31	24-27	14-15
						28-31	16-17
				40-47	32-39	32-35	18-19
						36-39	20-21
				48-63	40-43	40-43	22-23
						44-47	24-25
				56-63	48-55	48-51	26-27
						52-55	28-29
			64-127	64-79	56-59	56-59	30-31
					60-63	60-63	32-33
				80-95	64-71	64-67	34-35
						68-71	36-37
				96-111	72-79	72-75	38-39
						76-79	40-41
				112-127	80-87	80-83	42-43
						84-87	44-45
			128-191	128-143	88-95	88-91	46-47
						92-95	48-49
				144-159	96-103	96-99	50-51
						100-103	52-53
				160-175	104-111	104-107	54-55
						108-111	56-57
				176-191	112-119	112-115	58-59
						116-119	60-61
			192-255	192-207	120-127	120-123	62-63
						124-127	64-65
				208-223	128-135	128-131	66-67
						132-135	68-69
				224-239	136-143	136-139	70-71
						140-143	72-73
				240-255	144-151	144-147	74-75
						148-151	76-77
				248-255	152-159	152-155	78-79
						156-159	80-81
				252-255	160-167	160-163	82-83
						164-167	84-85
				256-259	168-175	168-171	86-87
						172-175	88-89
				260-263	176-183	176-179	90-91
						180-183	92-93
				264-267	184-191	184-187	94-95
						188-191	96-97
				268-271	192-199	192-195	98-99
						196-199	100-101
				272-275	200-207	200-203	102-103
						204-207	104-105
				276-279	208-215	208-211	106-107
						212-215	108-109
				280-283	216-223	216-219	110-111
						220-223	112-113
				284-287	224-231	224-227	114-115
						228-231	116-117
				288-291	232-239	232-235	118-119
						236-239	120-121
				292-295	240-247	240-243	122-123
						244-247	124-125
				296-299	248-255	248-251	126-127
						252-255	128-129
				300-303			130-131
							132-133
				304-307			134-135
							136-137
				308-311			138-139
							140-141
				312-315			142-143
							144-145
				316-319			146-147
							148-149
				320-323			150-151
							152-153
				324-327			154-155
							156-157
				328-331			158-159
							160-161
				332-335			162-163
							164-165
				336-339			166-167
							168-169
				340-343			170-171
							172-173
				344-347			174-175
							176-177
				348-351			178-179
							180-181
				352-355			182-183
							184-185
				356-359			186-187
							188-189
				360-363			190-191
							192-193
				364-367			194-195
							196-197
				368-371			198-199
							200-201
				372-375			202-203
							204-205
				376-379			206-207
							208-209
				380-383			210-211
							212-213
				384-387			214-215
							216-217
				388-391			218-219
							220-221
				392-395			222-223
							224-225
				396-399			226-227
							228-229
				400-403			230-231
							232-233
				404-407			234-235
							236-237
				408-411			238-239
							240-241
				412-415			242-243
							244-245
				416-419			246-247
							248-249
				420-423			250-251
							252-253
				424-427			254-255

VLSM

with

Class A and B Addresses

Problem 36

Part 2 of 3

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

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

Hint:

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

Eastern Elementary School
Address Range 172.32.42.0 to 172.32.43.255

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

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 172.32.23.255	/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
				16-31	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 37

Part 1 of 3

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

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

Company Address 110.0.0.0

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Moskva	3,050,000	110.0.0.0 to 110.63.255.255	/10
New York	1,540,000	110.64.0.0 to 110.95.255.255	/11
St. Petersburg	1,075,000	110.96.0.0 to 110.127.255.255	/11
London	975,000	110.128.0.0 to 110.143.255.255	/12
Ekaterinoburg	525,000	110.144.0.0 to 110.159.255.255	/12
Munchen	450,000	110.160.0.0 to 110.167.255.255	/13
Napoli	150,000	110.168.0.0 to 110.171.255.255	/14
Birmingham	130,000	110.172.0.0 to 110.173.255.255	/15
Rotterdam	95,000	110.174.0.0 to 110.175.255.255	/15

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

VLSM

with

Class A and B Addresses

Problem 37

Part 2 of 3

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

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

London
Address Range 110.128.0.0 to 110.143.255.255

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Office #1	6,450	110.128.0.0 to 110.128.31.255	/19
Office #2	3,780	110.128.32.0 to 110.128.47.255	/19
Office #3	2,750	110.128.48.0 to 110.128.63.255	/19
Office #4	2,000	110.128.64.0 to 110.128.71.255	/21
Office #5	1,000	110.128.72.0 to 110.128.75.255	/21
Office #6	845	110.128.76.0 to 110.128.79.255	/21
Office #7	500	110.128.80.0 to 110.128.81.255	/22
Office #8	450	110.128.82.0 to 110.128.83.255	/22
Office #9	300	110.128.84.0 to 110.128.85.255	/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
						4-7	4-5
					8-15	8-11	6-7
						12-15	8-9
				16-31	16-23	16-19	10-11
					24-31	20-23	12-13
		32-63	32-47	32-39	32-35	24-27	14-15
					36-39	28-31	16-17
					40-47	30-31	18-19
						32-33	20-21
				48-63	48-55	34-35	22-23
					56-63	36-37	24-25
		64-127	64-95	64-79	64-71	38-39	26-27
					72-79	40-41	28-29
					80-87	42-43	30-31
					88-95	44-45	32-33
			96-127	96-111	96-103	46-47	34-35
					104-111	48-49	36-37
				112-127	112-119	50-51	38-39
					120-127	52-53	40-41
	128-255	128-191	128-159	128-143	128-135	54-55	42-43
					136-143	56-57	44-45
				144-159	144-151	58-59	46-47
					152-159	60-61	48-49
			160-191	160-175	160-167	62-63	50-51
					168-175	64-65	52-53
				176-191	176-183	66-67	54-55
					184-191	68-69	56-57
		192-255	192-223	192-207	192-199	70-71	58-59
					200-207	72-73	60-61
				208-223	208-215	74-75	62-63
					216-223	76-77	64-65
			224-255	224-239	224-231	78-79	66-67
					232-239	80-81	68-69
				240-255	240-247	82-83	70-71
					248-255	84-85	72-73
						86-87	74-75
						88-89	76-77
						90-91	78-79
						92-93	80-81
						94-95	82-83
						96-97	84-85
						98-99	86-87
						100-101	88-89
						102-103	90-91
						104-105	92-93
						106-107	94-95
						108-109	96-97
						110-111	98-99
						112-113	100-101
						114-115	102-103
						116-117	104-105
						118-119	106-107
						120-121	108-109
						122-123	110-111
						124-125	112-113
						126-127	114-115
						128-129	116-117
						130-131	118-119
						132-133	120-121
						134-135	122-123
						136-137	124-125
						138-139	126-127
						140-141	128-129
						142-143	130-131
						144-145	132-133
						146-147	134-135
						148-149	136-137
						150-151	138-139
						152-153	140-141
						154-155	142-143
						156-157	144-145
						158-159	146-147
						160-161	148-149
						162-163	150-151
						164-165	152-153
						166-167	154-155
						168-169	156-157
						170-171	158-159
						172-173	160-161
						174-175	162-163
						176-177	164-165
						178-179	166-167
						180-181	168-169
						182-183	170-171
						184-185	172-173
						186-187	174-175
						188-189	176-177
						190-191	178-179
						192-193	180-181
						194-195	182-183
						196-197	184-185
						198-199	186-187
						200-201	188-189
						202-203	190-191
						204-205	192-193
						206-207	194-195
						208-209	196-197
						210-211	198-199
						212-213	200-201
						214-215	202-203
						216-217	204-205
						218-219	206-207
						220-221	208-209
						222-223	210-211
						224-225	212-213
						226-227	214-215
						228-229	216-217
						230-231	218-219
						232-233	220-221
						234-235	222-223
						236-237	224-225
						238-239	226-227
						240-241	228-229
						242-243	230-231
						244-245	232-233
						246-247	234-235
						248-249	236-237
						250-251	238-239
						252-253	240-241
						254-255	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	110.128.80.0 to 110.128.80.127	/25
2nd Floor	75	110.128.80.128 to 110.128.80.255	/25
5th Floor	50	110.128.81.0 to 110.128.81.63	/26
8th Floor	45	110.128.81.64 to 110.128.81.127	/26
4th Floor	30	110.128.81.128 to 110.128.81.159	/27
Basement	14	110.128.81.160 to 110.128.81.175	/28
7th Floor	12	110.128.81.176 to 110.128.81.191	/28
3rd Floor	6	110.128.81.192 to 110.128.81.199	/29
6th Floor	4	110.128.81.200 to 110.128.81.207	/29

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

VLSM

with

Class A and B Addresses

Problem 38

Part 1 of 4

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

Addresses 75.0.0.0

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

Class A Addresses

VLSM Chart 8-15 Bits (2nd octet)

/8	/9	/10	/11	/12	/13	/14	/15
255.0.0.0 16,777,216 Hosts	255.128.0.0 8,388,608 Hosts	255.192.0.0 4,194,304 Hosts	255.224.0.0 2,097,152 Hosts	255.240.0.0 1,048,576 Hosts	255.248.0.0 524,288 Hosts	255.252.0.0 262,144 Hosts	255.254.0.0 131,072 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1
						4-7	2-3
				16-31	8-15	8-11	4-5
						12-15	6-7
					16-23	16-19	8-9
						20-23	10-11
					24-31	24-27	12-13
						28-31	14-15
			32-63	32-47	32-39	32-35	16-17
						36-39	18-19
					40-47	40-43	20-21
						44-47	22-23
					48-55	48-51	24-25
						52-55	26-27
					56-63	60-63	28-29
						64-67	30-31
				64-79	64-71	64-67	32-33
						68-71	34-35
					72-75	66-67	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
			96-127	96-103	96-99	48-49	
					100-103	50-51	
					104-107	52-53	
					108-111	54-55	
					112-115	56-57	
					116-117	58-59	
					120-123	60-61	
					124-127	62-63	
		112-127		112-119	112-115	64-65	
					116-119	66-67	
				120-127	120-123	68-69	
					124-127	70-71	
				128-159	128-143	128-135	72-73
						136-143	74-75
					144-159	144-151	76-77
						152-159	78-79
		160-175	160-163		80-81		
			168-175		82-83		
		176-191	176-183		84-85		
			184-191		86-87		
		128-191	128-255	192-207	192-199	88-89	
					200-207	90-91	
					208-215	92-93	
					216-223	94-95	
					224-231	96-97	
					232-239	98-99	
					240-247	100-101	
					248-255	102-103	
				208-223	208-215	208-211	104-105
						212-215	106-107
					216-223	216-219	108-109
						220-223	110-111
					224-231	224-227	112-113
						232-235	114-115
					240-247	240-243	116-117
						244-247	118-119
			192-255	224-255	224-231	224-227	120-121
						232-235	122-123
					240-247	240-243	124-125
						244-247	126-127
	248-255				248-251	128-129	
					252-255	130-131	
	244-255				244-247	244-245	132-133
						248-249	134-135
				252-255	252-253	136-137	
					254-255	138-139	
				252-255	252-253	252-251	140-141
						254-255	142-143
					256-257	256-255	144-145
						258-259	146-147
	260-261				260-259	148-149	
					262-263	150-151	
	264-265	264-263	152-153				
		266-267	154-155				

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	/9	/10	/11	/12	/13	/14	/15		
255.0.0.0 16,777,216 Hosts	255.128.0.0 8,388,608 Hosts	255.192.0.0 4,194,304 Hosts	255.224.0.0 2,097,152 Hosts	255.240.0.0 1,048,576 Hosts	255.248.0.0 524,288 Hosts	255.252.0.0 262,144 Hosts	255.254.0.0 131,072 Hosts		
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1		
					8-15	4-7	2-3		
				16-31	16-23	8-11	4-5	6-7	
						12-15	8-9	10-11	
					24-31	16-19	12-13	14-15	
						20-23	16-17	18-19	
			24-27			20-21	22-23		
			28-31			24-25	26-27		
			32-63	32-39	32-35	28-29	30-31		
					36-39	32-33	34-35		
					40-43	36-37	38-39		
				40-47	44-47	40-41	42-43		
		48-51			44-45	46-47			
		52-55			48-49	50-51			
		48-63	56-59	52-53	54-55	56-57			
				60-63	58-59	60-61			
			64-79	64-71	64-67	66-67	68-69		
					68-71	70-71	72-73		
				72-79	76-79	74-75	76-77		
					80-83	80-81	82-83		
		80-95	80-87	84-87	86-87	88-89			
				88-91	90-91	92-93			
			96-103	96-99	100-101	102-103	104-105		
					104-107	106-107	108-109		
	104-111			108-111	110-111	112-113			
				112-127	112-119	116-119	114-115	116-117	
	120-127	118-119	120-121						
	124-127	128-129	122-123		124-125				
		128-135	132-135		126-127	128-129			
	128-143		136-143	140-143	134-135	136-137			
		144-147		138-139	140-141				
		144-159	148-151	152-155	144-145	146-147			
				156-159	148-149	150-151			
			160-191	160-167	164-167	152-153	154-155		
					168-175	156-157	158-159		
	176-191	176-183		180-183	160-161	162-163			
				184-191	164-165	166-167			
		188-191		192-195	168-169	170-171			
				192-207	192-199	196-199	172-173	174-175	
	200-207	176-177	178-179						
	208-223	208-215	212-215		180-181	182-183			
			216-223		184-185	186-187			
		224-239	224-231		228-231	188-189	190-191		
					232-235	192-193	194-195		
	240-255		240-247	244-247	196-197	198-199			
				248-255	200-201	202-203			
			128-255	128-191	128-159	128-135	128-131	204-205	206-207
							136-139	208-209	210-211
144-159	144-147	148-151				212-213	214-215		
		152-155				216-217	218-219		
	156-159	160-163				220-221	222-223		
		164-167				224-225	226-227		
160-191	160-175	168-175	172-175		228-229	230-231			
			176-179		232-233	234-235			
	176-191	176-183	180-183		236-237	238-239			
			184-191		240-241	242-243			
		192-223	192-207		200-207	204-207	244-245	246-247	
						208-215	248-249	250-251	
208-223	216-223		220-223	252-253	254-255				
			224-227	256-257	258-259				
	224-255		224-231	232-235	236-239	260-261	262-263		
					240-243	264-265	266-267		
240-255		240-247	248-251	252-255	268-269	270-271			
				256-259	272-273	274-275			

VLSM

with

Class A and B Addresses

Sample Problem 38

Part 3 of 4

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

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

ISP Addresses 75.104.0.0 to 75.111.255.255

Customer Name	Number of Addresses	Address Range	CIDR
Office #1	60,000	75.104.0.0 to 75.104.255.255	/16
Office #2	45,000	75.105.0.0 to 75.105.255.255	/16
Office #3	30,000	75.106.0.0 to 75.106.127.255	/17
Office #4	24,000	75.106.128.0 to 75.106.255.255	/17
Office #5	15,000	75.107.0.0 to 75.107.63.255	/18
Office #6	10,000	75.107.64.0 to 75.107.127.255	/18
Office #7	8,000	75.107.128.0 to 75.107.159.255	/19
Office #8	2,000	75.107.160.0 to 75.107.167.255	/21
Office #9	1,000	75.107.168.0 to 75.107.171.255	/22

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
						16-19	8-9
						20-23	10-11
		32-63	32-47	24-31	24-27	24-25	12-13
					28-31	26-27	14-15
					32-39	32-35	16-17
						36-39	18-19
						40-43	20-21
						44-47	22-23
			48-63	40-47	48-51	48-49	24-25
					52-55	50-51	26-27
				48-55	56-59	52-53	28-29
					60-63	54-55	30-31
					64-71	64-67	32-33
						68-71	34-35
		64-127	64-95	72-79	72-75	72-73	36-37
					76-79	74-75	38-39
				80-95	80-83	80-81	40-41
					84-87	82-83	42-43
					88-91	84-85	44-45
					92-95	86-87	46-47
			96-127	96-103	96-99	88-89	48-49
					100-103	90-91	50-51
				104-111	104-107	92-93	52-53
					108-111	94-95	54-55
			112-127	112-119	112-115	96-97	56-57
					116-119	98-99	58-59
				120-127	120-123	100-101	60-61
					124-127	102-103	62-63
	128-255	128-191	128-159	128-143	128-135	104-105	64-65
					136-143	106-107	66-67
				144-159	144-147	108-109	68-69
					148-151	110-111	70-71
					152-155	112-113	72-73
					156-159	114-115	74-75
		160-191	160-175	160-167	160-163	116-117	76-77
					164-167	118-119	78-79
				168-175	168-171	120-121	80-81
					172-175	122-123	82-83
			176-191	176-183	176-179	124-125	84-85
					180-183	126-127	86-87
				184-191	184-187	128-129	88-89
					188-191	130-131	90-91
		192-255	192-223	192-207	192-199	132-133	92-93
					200-207	134-135	94-95
				208-223	204-207	136-137	96-97
					208-211	138-139	98-99
				216-223	212-215	140-141	100-101
					216-219	142-143	102-103
		224-255	224-239	224-231	220-223	144-145	104-105
					224-227	146-147	106-107
				232-239	228-231	148-149	108-109
					232-235	150-151	110-111
					236-239	152-153	112-113
			240-255	240-247	240-243	154-155	114-115
					244-247	156-157	116-117
				248-255	248-251	158-159	118-119
					252-255	160-161	120-121
						162-163	122-123
						164-165	124-125

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

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 16-20 20,000 seeds	17 17-21 21,700 seeds	18 18-22 22,500 seeds	19 19-23 23,100 seeds	20 20-24 24,000 seeds	21 21-25 25,000 seeds	22 22-26 26,000 seeds	23 23-27 27,000 seeds
			9-81	3-15	6-15	2-15	1-15
				13-21	5-21	2-21	1-21
				19-21	10-21	5-21	3-21
			9-81	50-47	30-49	10-49	5-49
				41-47	21-47	10-47	5-47
				40-55	40-55	30-55	20-55
				50-55	50-55	40-55	30-55
				60-71	60-71	50-71	40-71
				71-75	71-75	60-75	50-75
				80-87	80-87	70-87	60-87
				88-95	88-95	78-95	68-95
				96-111	96-111	86-111	76-111
				912-107	152-109	102-109	52-109
				108-127	108-127	98-127	88-127
				128-145	128-145	118-145	108-145
				146-161	146-161	136-161	126-161
				162-192	162-192	152-192	142-192
				193-198	193-198	183-198	173-198
				199-175	199-175	189-175	179-175
				176-191	176-191	166-191	156-191
				176-191	176-191	166-191	156-191
				192-207	192-207	182-207	172-207
				208-225	208-225	198-225	188-225
				226-228	226-228	216-228	206-228
				229-239	229-239	219-239	209-239
				240-255	240-255	230-255	220-255
				256-257	256-257	246-257	236-257
				258-259	258-259	248-259	238-259
				260-265	260-265	250-265	240-265
				266-267	266-267	256-267	246-267
				268-269	268-269	258-269	248-269
				270-275	270-275	260-275	250-275
				276-281	276-281	261-281	251-281
				282-287	282-287	262-287	252-287
				288-293	288-293	263-293	253-293
				294-299	294-299	264-299	254-299
				300-305	300-305	265-305	255-305
				306-311	306-311	266-311	256-311
				312-317	312-317	267-317	257-317
				318-323	318-323	268-323	258-323
				324-329	324-329	269-329	259-329
				330-335	330-335	270-335	260-335
				336-341	336-341	271-341	261-341
				342-347	342-347	272-347	262-347
				348-353	348-353	273-353	263-353
				354-359	354-359	274-359	264-359
				360-365	360-365	275-365	265-365
				366-371	366-371	276-371	266-371
				372-377	372-377	277-377	267-377
				378-383	378-383	278-383	268-383
				384-389	384-389	279-389	269-389
				390-395	390-395	280-395	270-395
				396-401	396-401	281-401	271-401
				402-407	402-407	282-407	272-407
				408-413	408-413	283-413	273-413
				414-419	414-419	284-419	274-419
				420-4			

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

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

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