

VLSM

Variable-Length Subnet Mask

Workbook

Version 2.0

192.168

192.168.10.96

192.168.10.126

172.31.15.0

10.250.1.0

Student Name:

IP Address Classes

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

Private Address Space

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

Default Subnet Masks

Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

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

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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

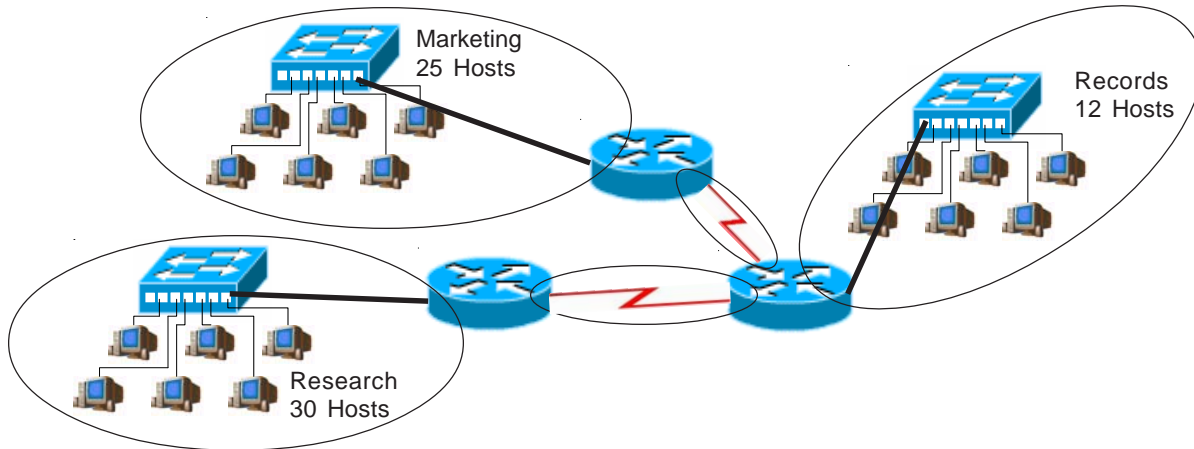
This workbook explores three different methods to figure out sub-subnets: the box method, the circle method, and a VLSM chart.

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			

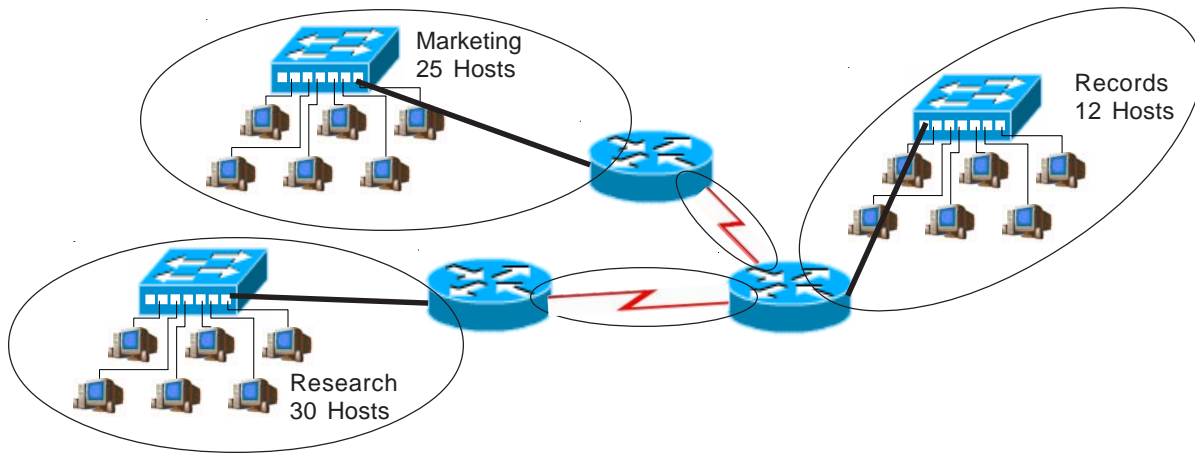
0 31	32 63	128 159	160 191
64 95	96 127	192 223	224 255

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

IP Address: 192.168.1.0

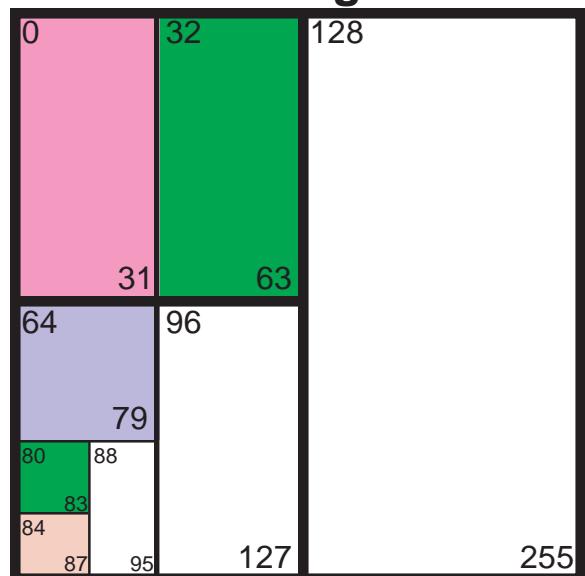


By adjusting the subnet masks you can cut your address usage by almost half in this example. This type of subnetting requires a network protocol which will support it such as: RIP version 2, EIGRP, OSPF, or BGP.

The Box Method for visualizing subnets

Classless Subnet Ranges

192.168.1.0	to	192.168.1.31	/27
192.168.1.32	to	192.168.1.63	/27
192.168.1.64	to	192.168.1.79	/28
192.168.1.80	to	192.168.1.87	/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

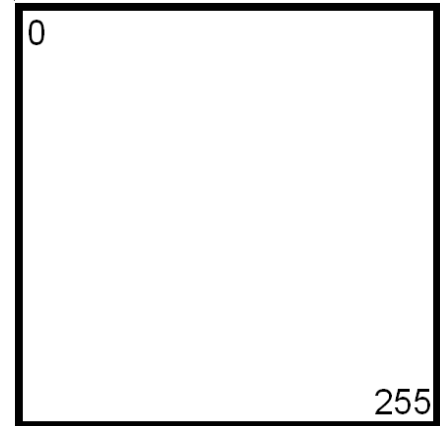


Visualizing Subnets Using The Box Method

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.

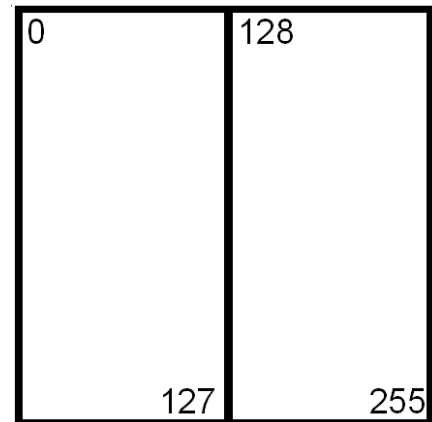
Start with a square. The whole square is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



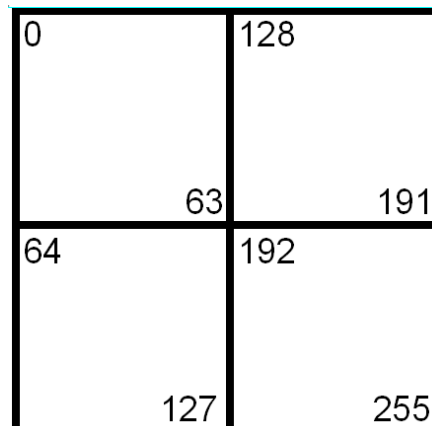
Split the box in half and you get two subnets with 128 addresses.

/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

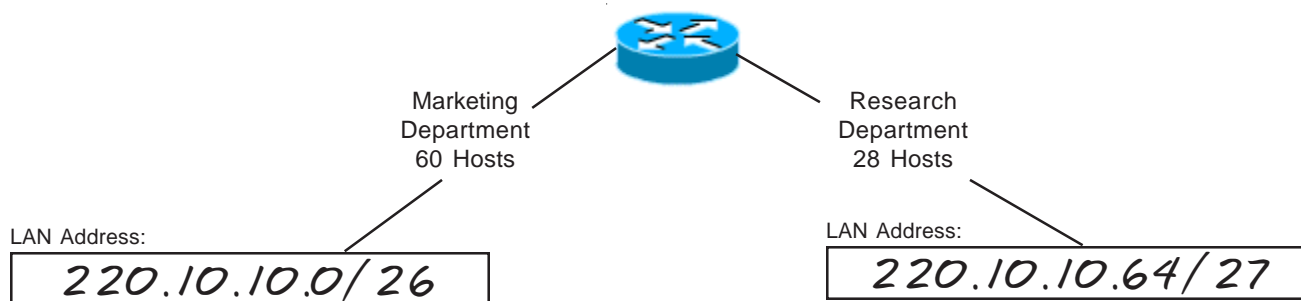
VLSM Addressing

Box Method

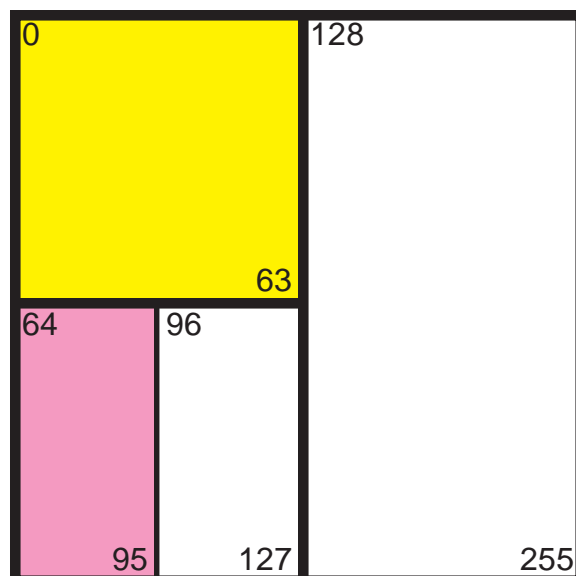
(Sample)

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.



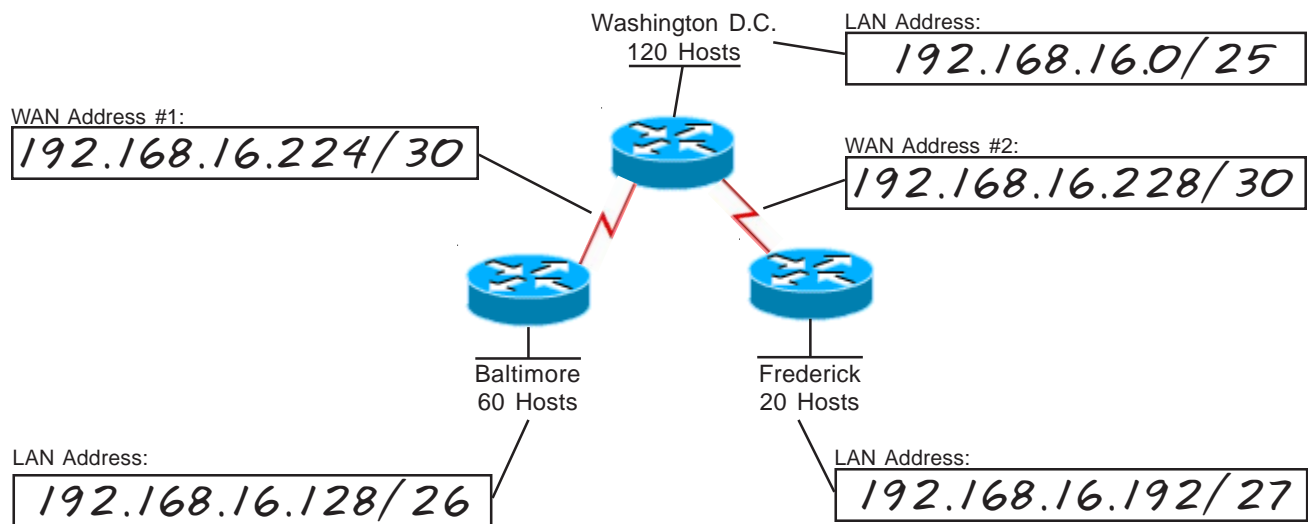
VLSM Addressing

Box Method

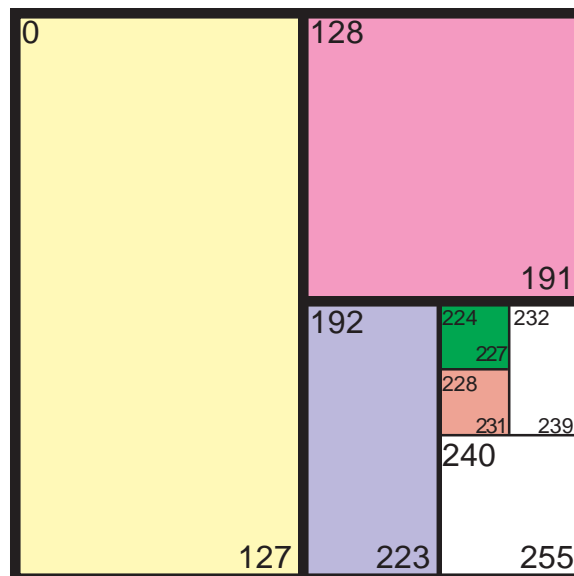
(Sample)

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.

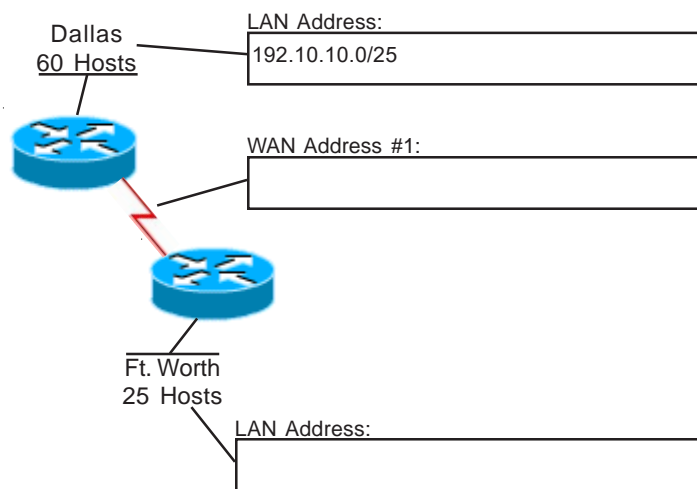


VLSM Addressing

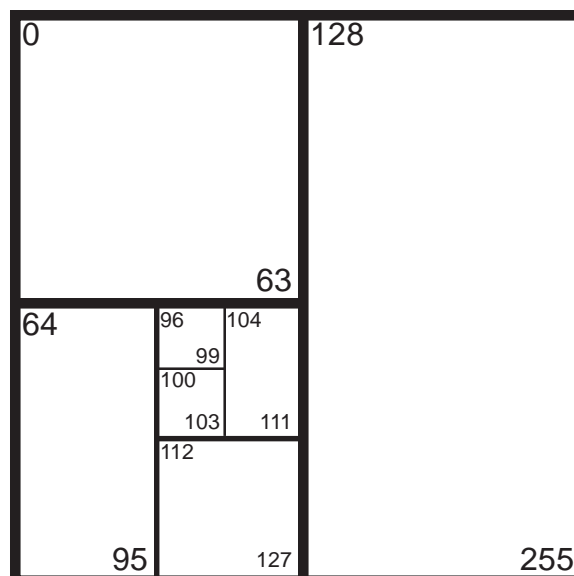
Box Method

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 192.10.10.0. Remember to start with your largest groups first.



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

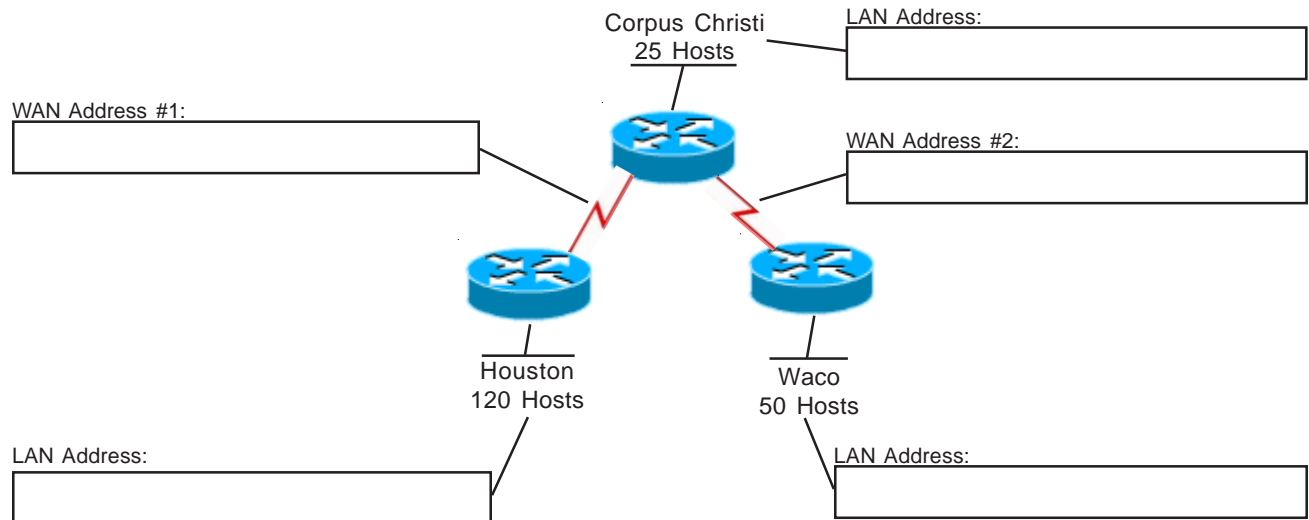


VLSM Addressing

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.

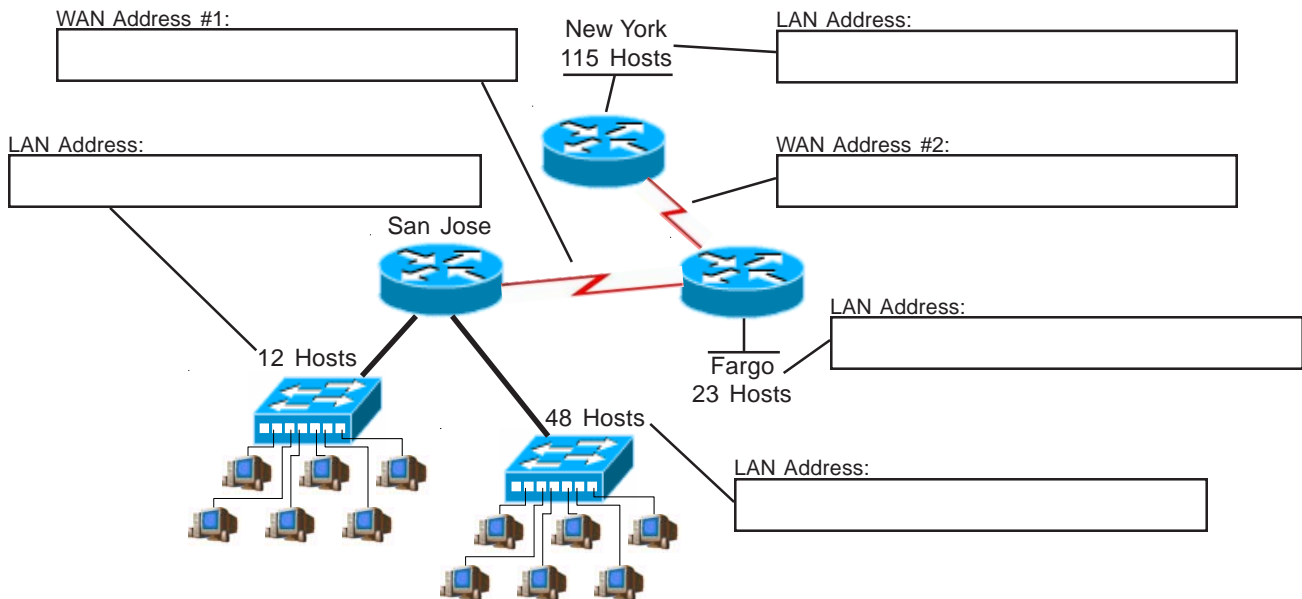
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	163
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	167
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103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

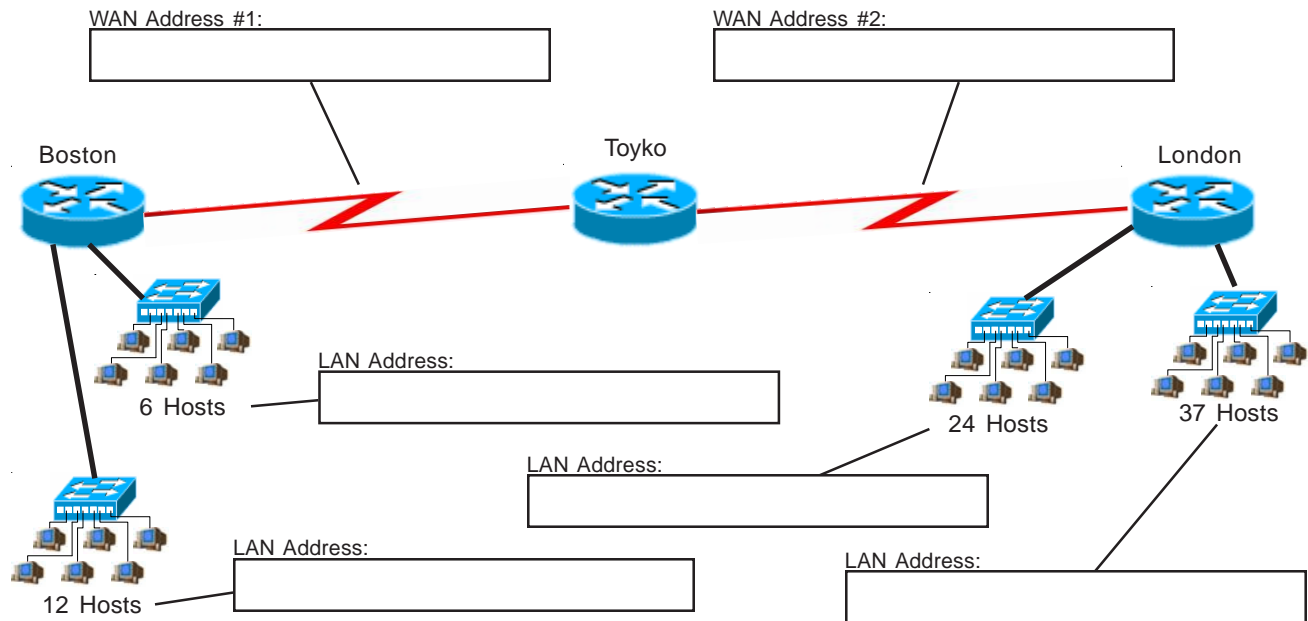
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	171
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	175
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103	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.

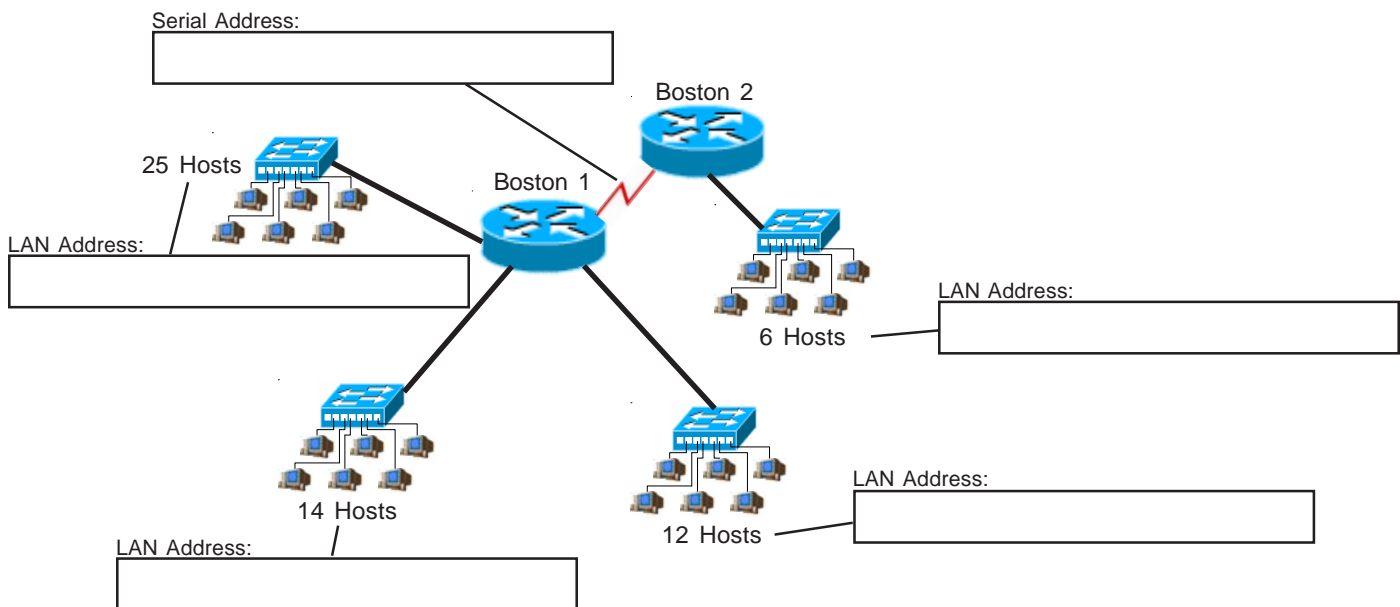
0	32	128	160
31	63	159	191
64	96	192	224
95	127	223	255

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.



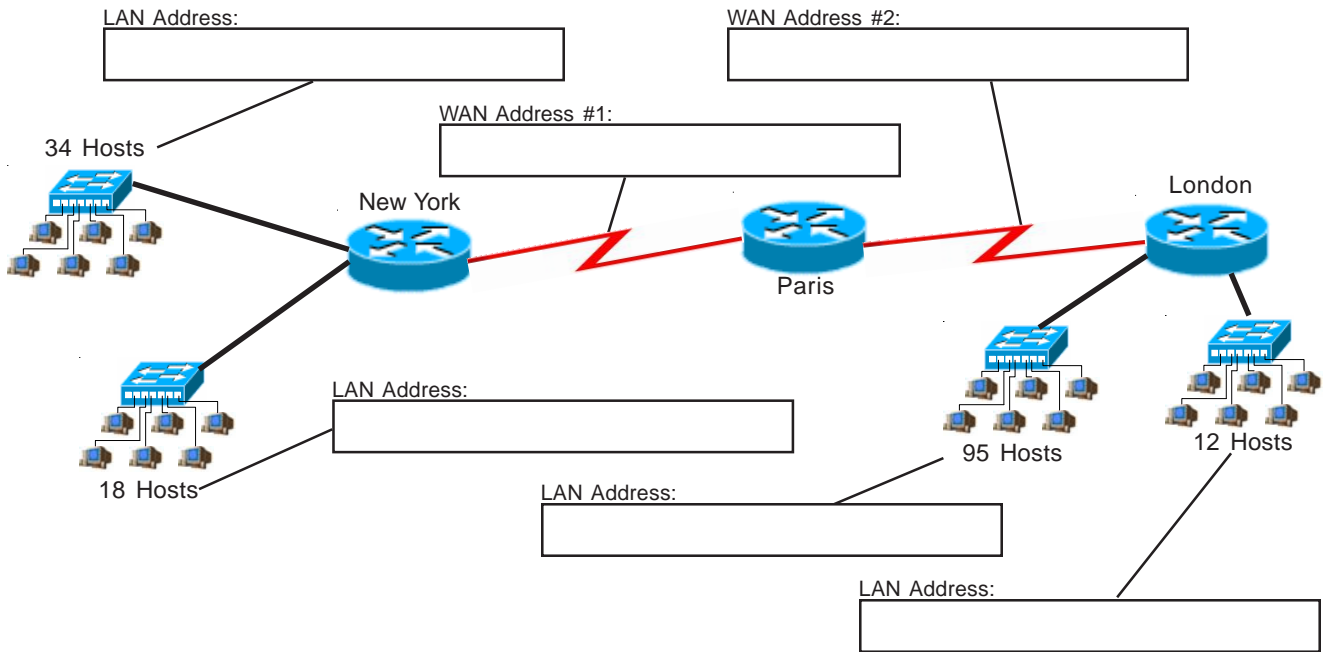
Draw the necessary lines and color in the used squares with different shades to highlight each subnet.

0	128
63	191
64	192
127	255

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

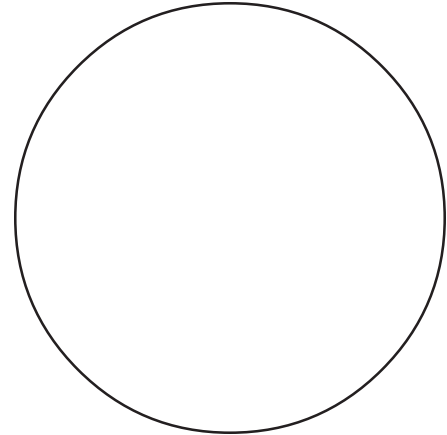
255

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.

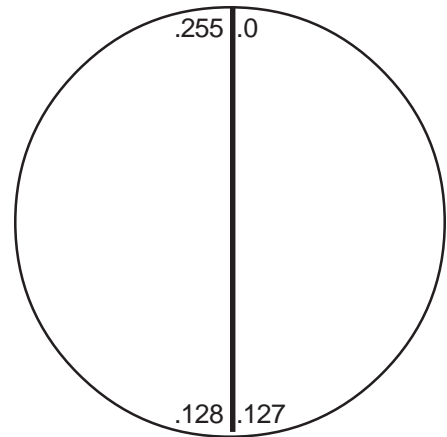
Start with a circle. The whole circle is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



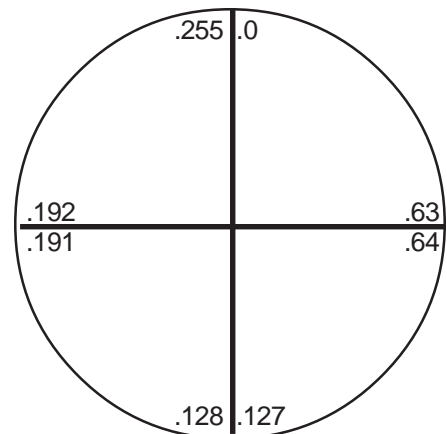
Split the circle in half and you get two subnets with 128 addresses.

/25
255.255.255.128
128 Hosts
2 Subnets



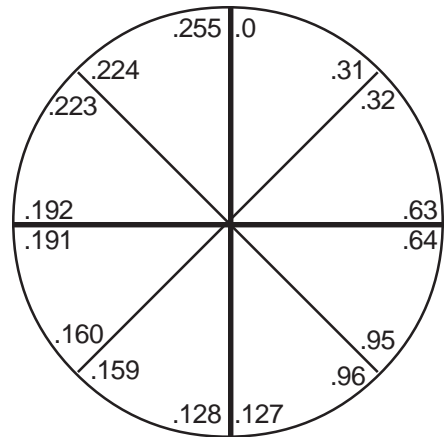
Divide the circle into quarters and you get four subnets with 64 addresses.

/26
255.255.255.192
64 Hosts
4 Subnets



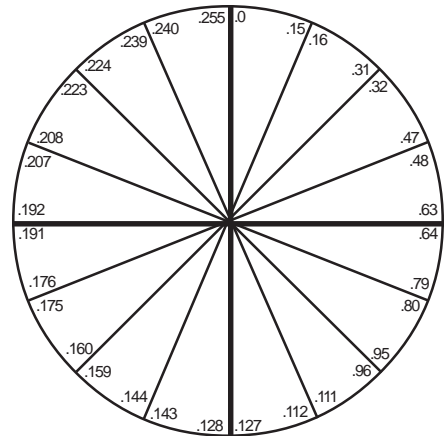
Split each quarter and you get eight subnets with 32 addresses.

/27
255.255.255.224
32 Hosts
8 Subnets



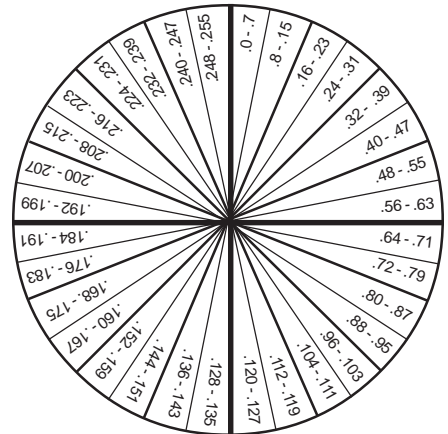
Split the boxes in half again and you get sixteen subnets with sixteen addresses.

/28
255.255.255.240
16 Hosts
16 Subnets



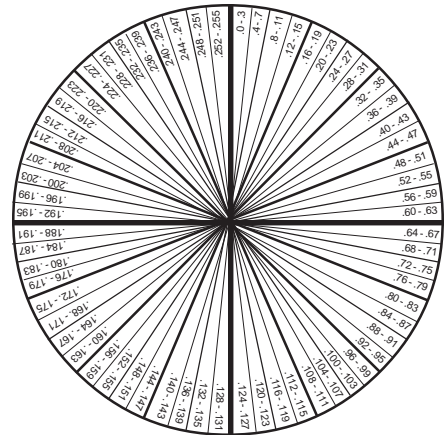
The next split gives you thirty two subnets with eight addresses.

/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



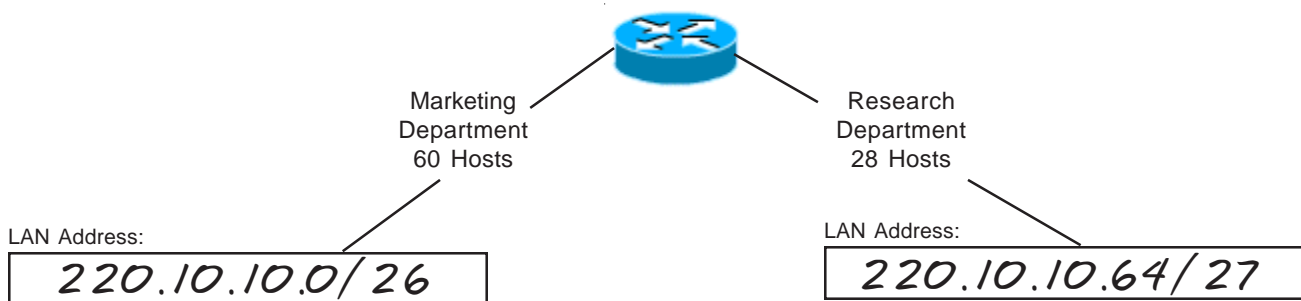
VLSM Addressing

Circle Method

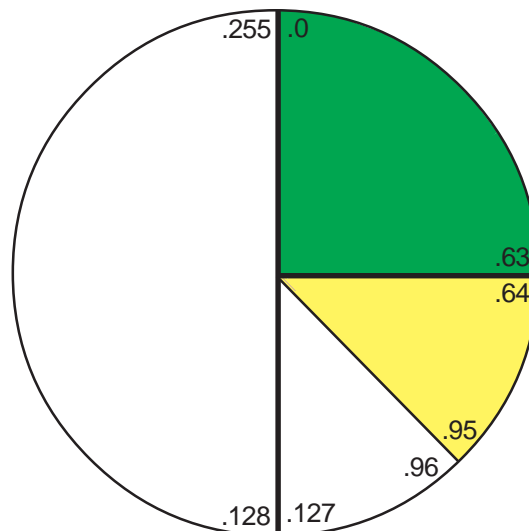
(Sample)

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.



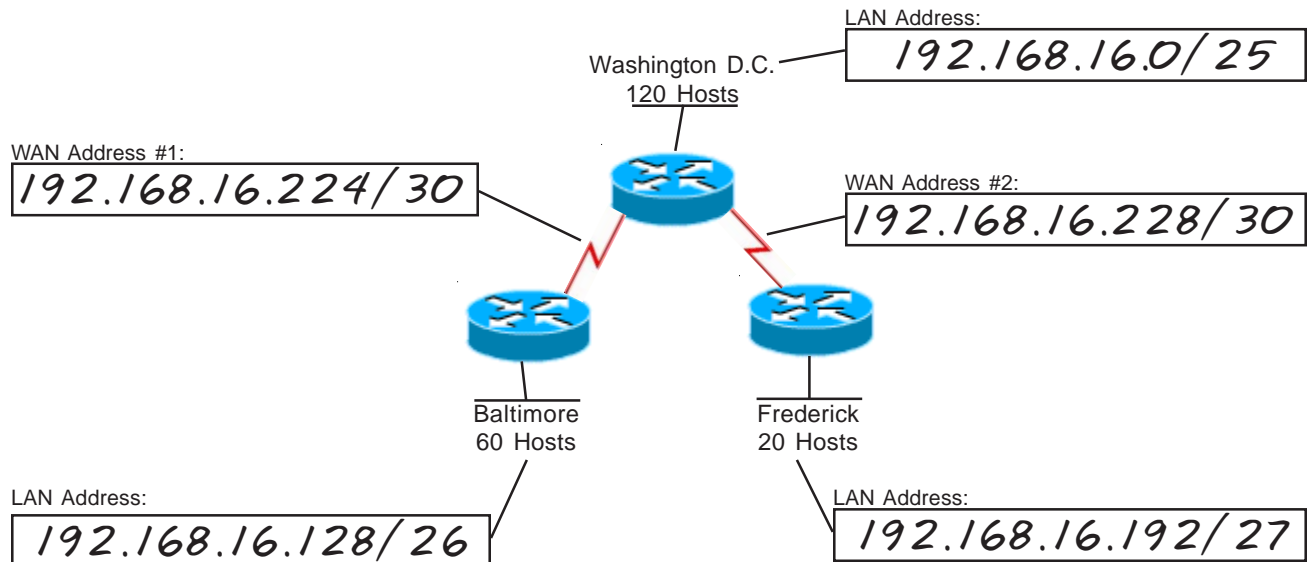
VLSM Addressing

Circle Method

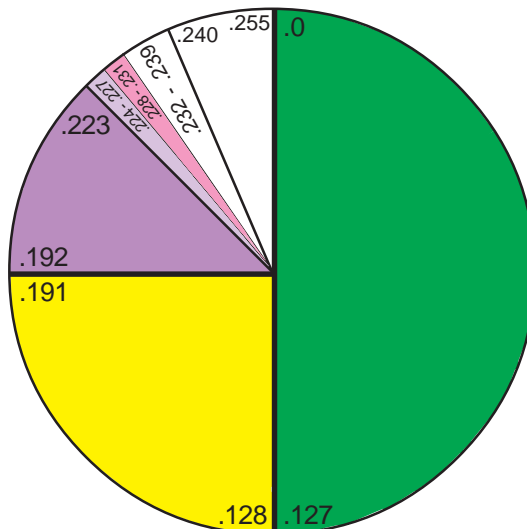
(Sample)

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.

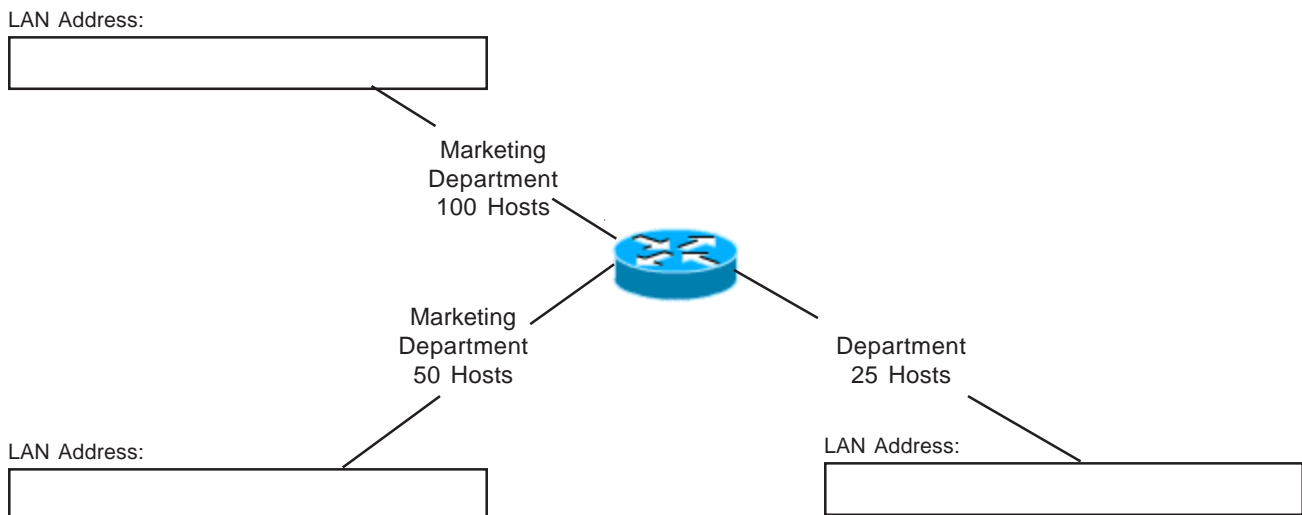


VLSM Addressing

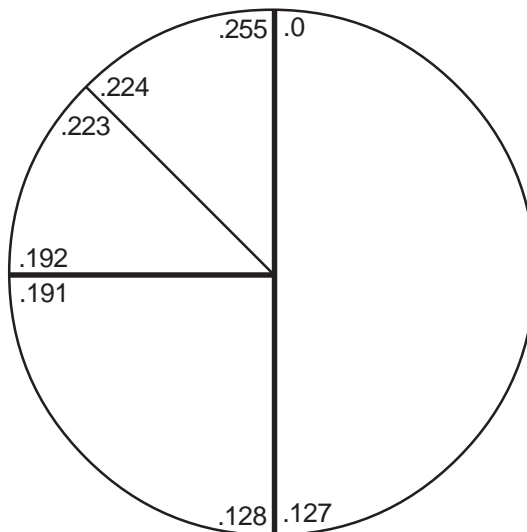
Circle Method

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.

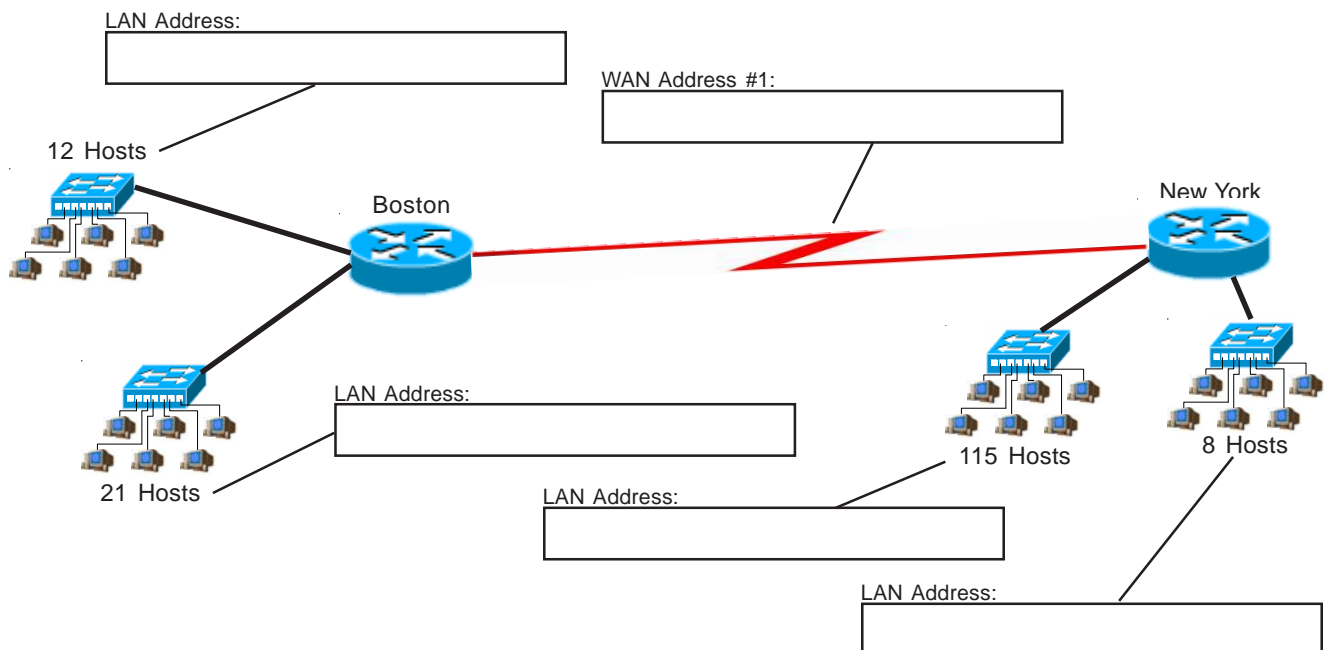


VLSM Addressing

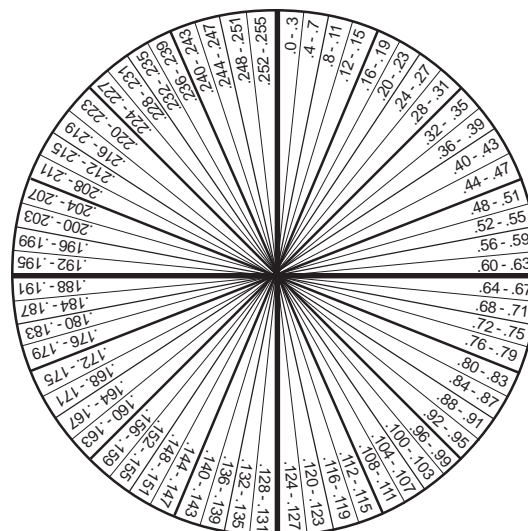
Circle Method

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.

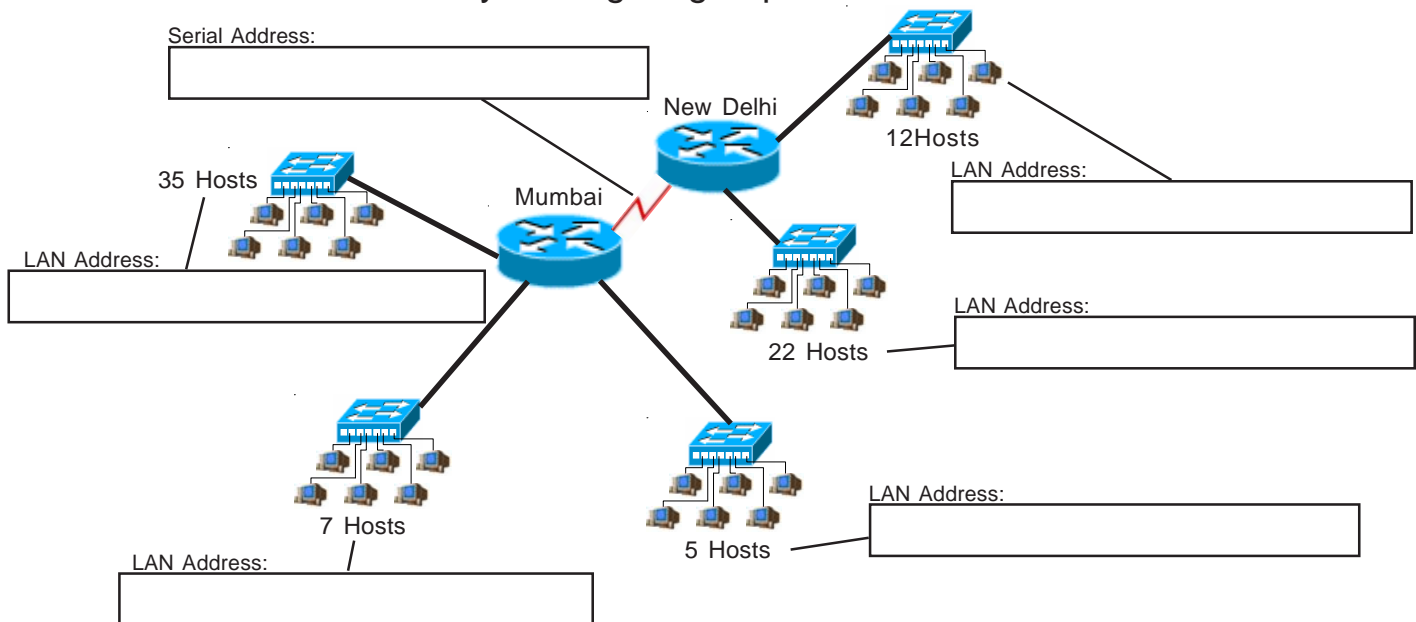


VLSM Addressing

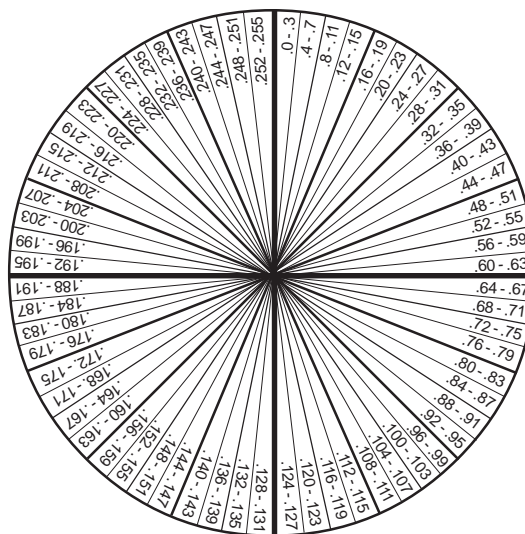
Circle Method

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.

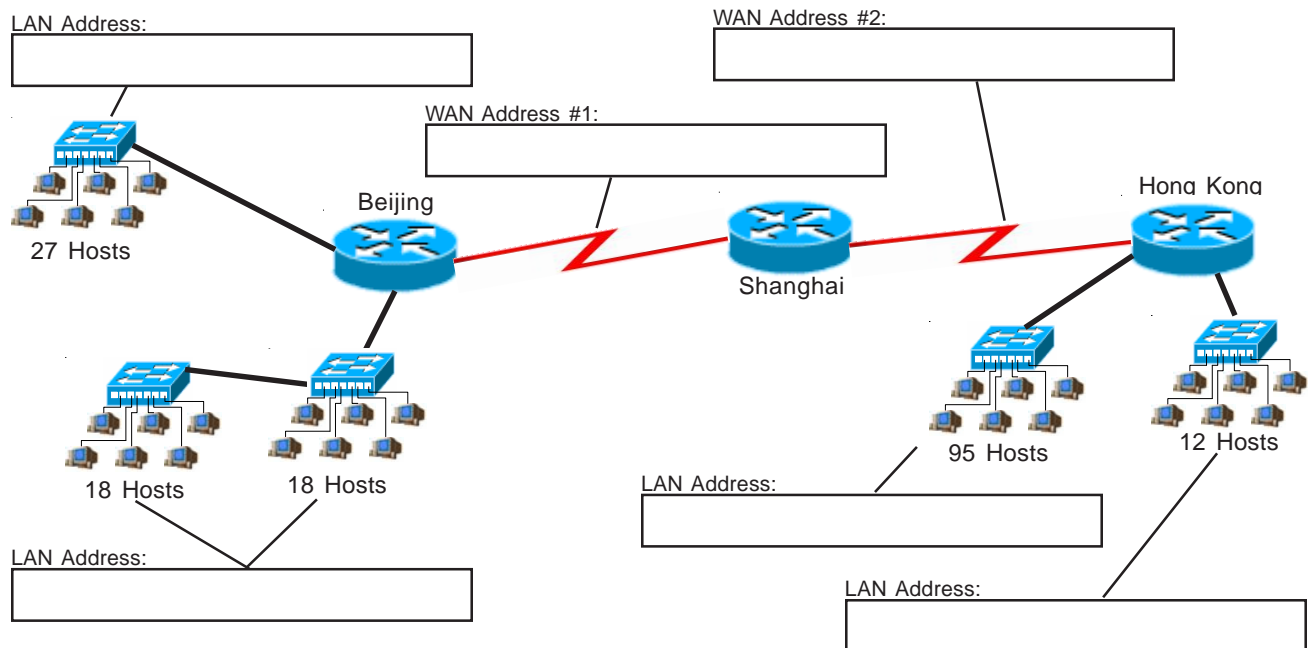


VLSM Addressing

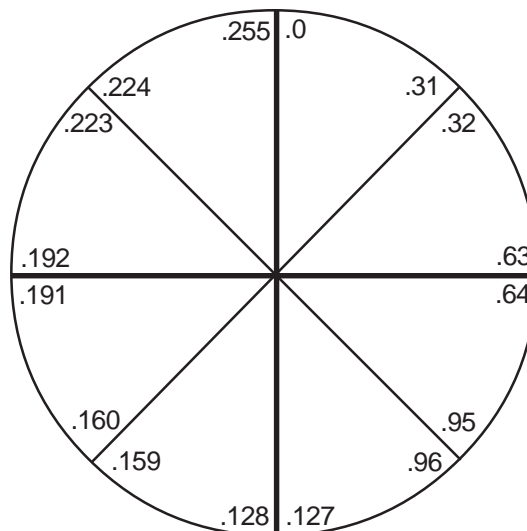
Circle Method

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.



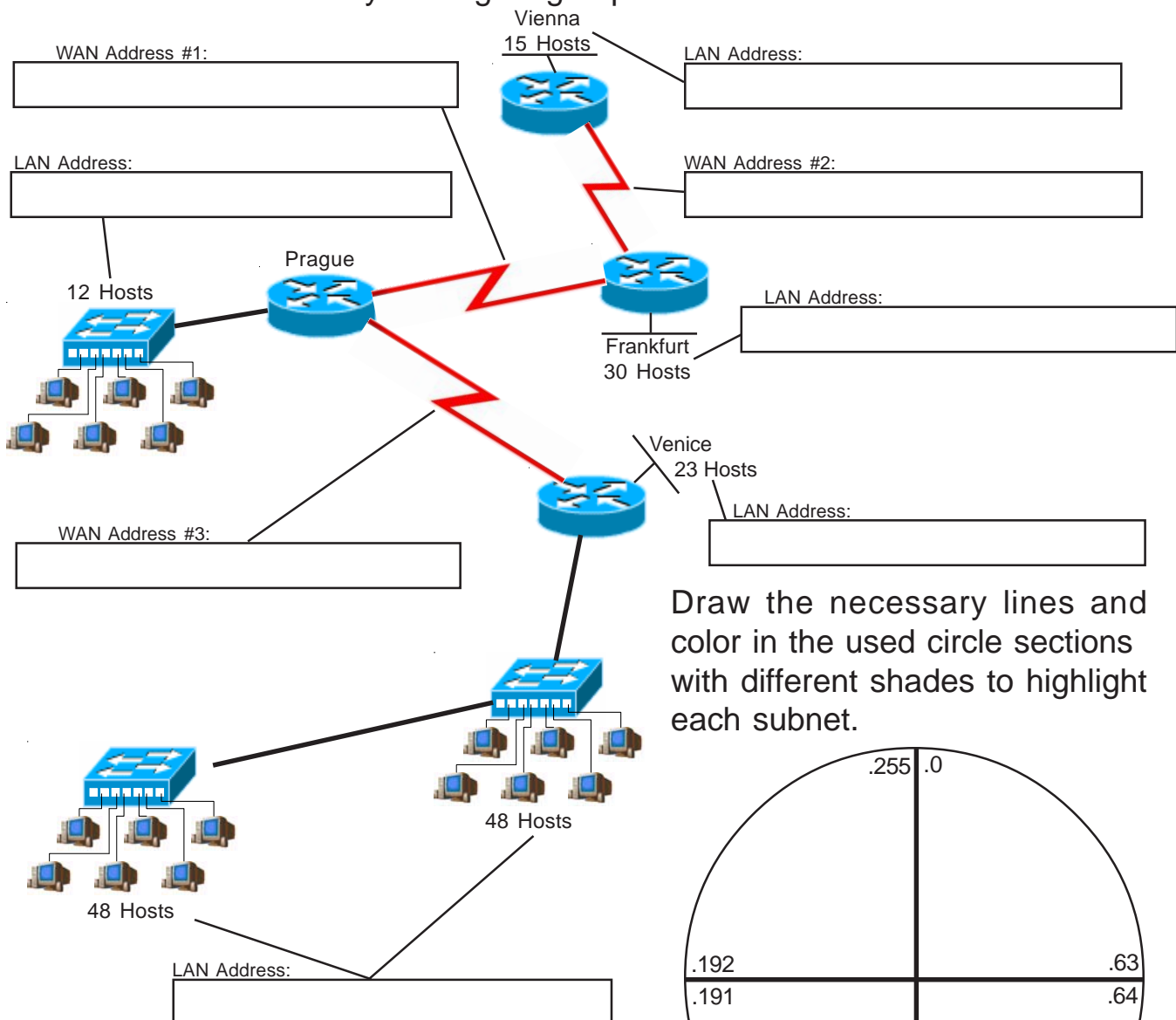
Draw the necessary lines and color in the used circle sections with different shades to highlight each subnet.



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.

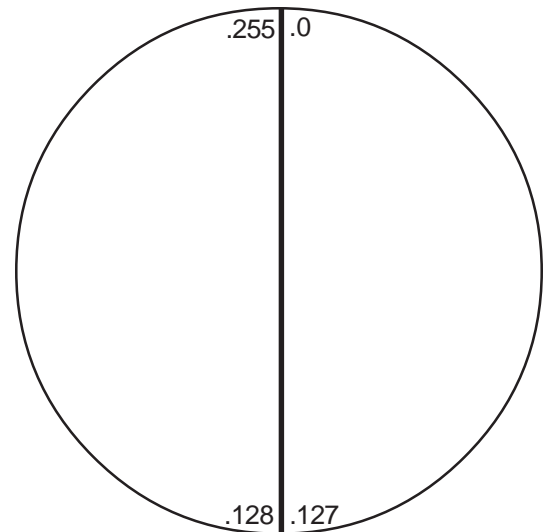
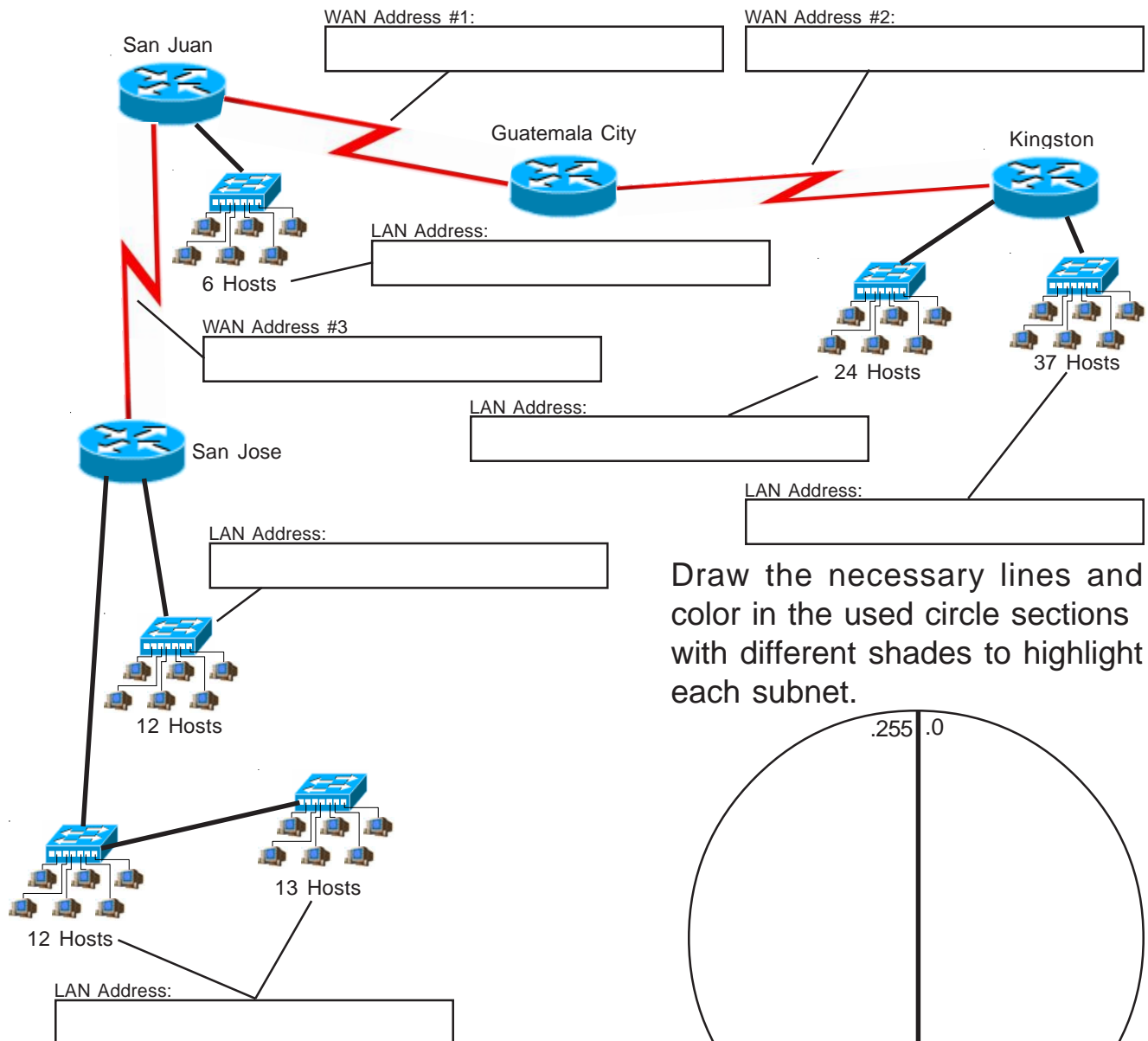


VLSM Addressing

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.

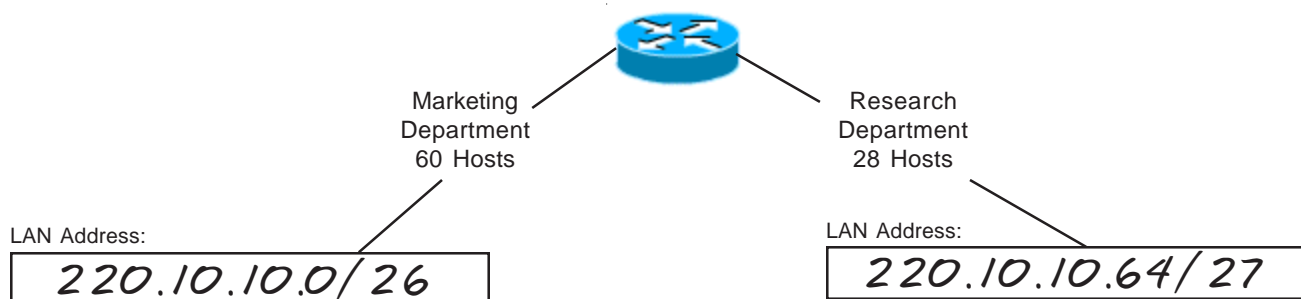
VLSM Addressing

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

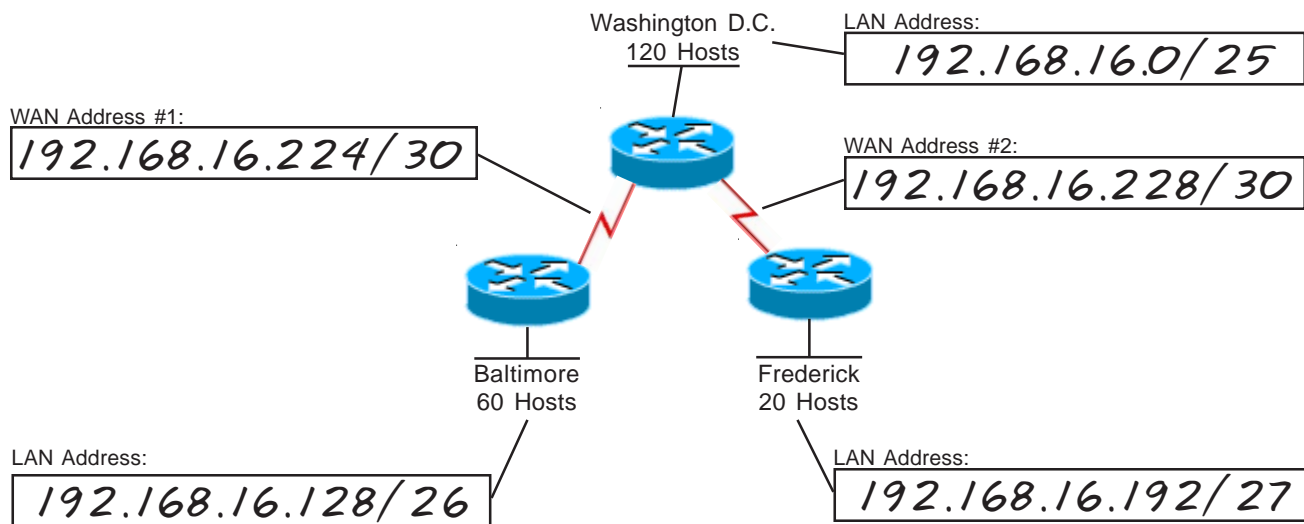
VLSM Addressing

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)

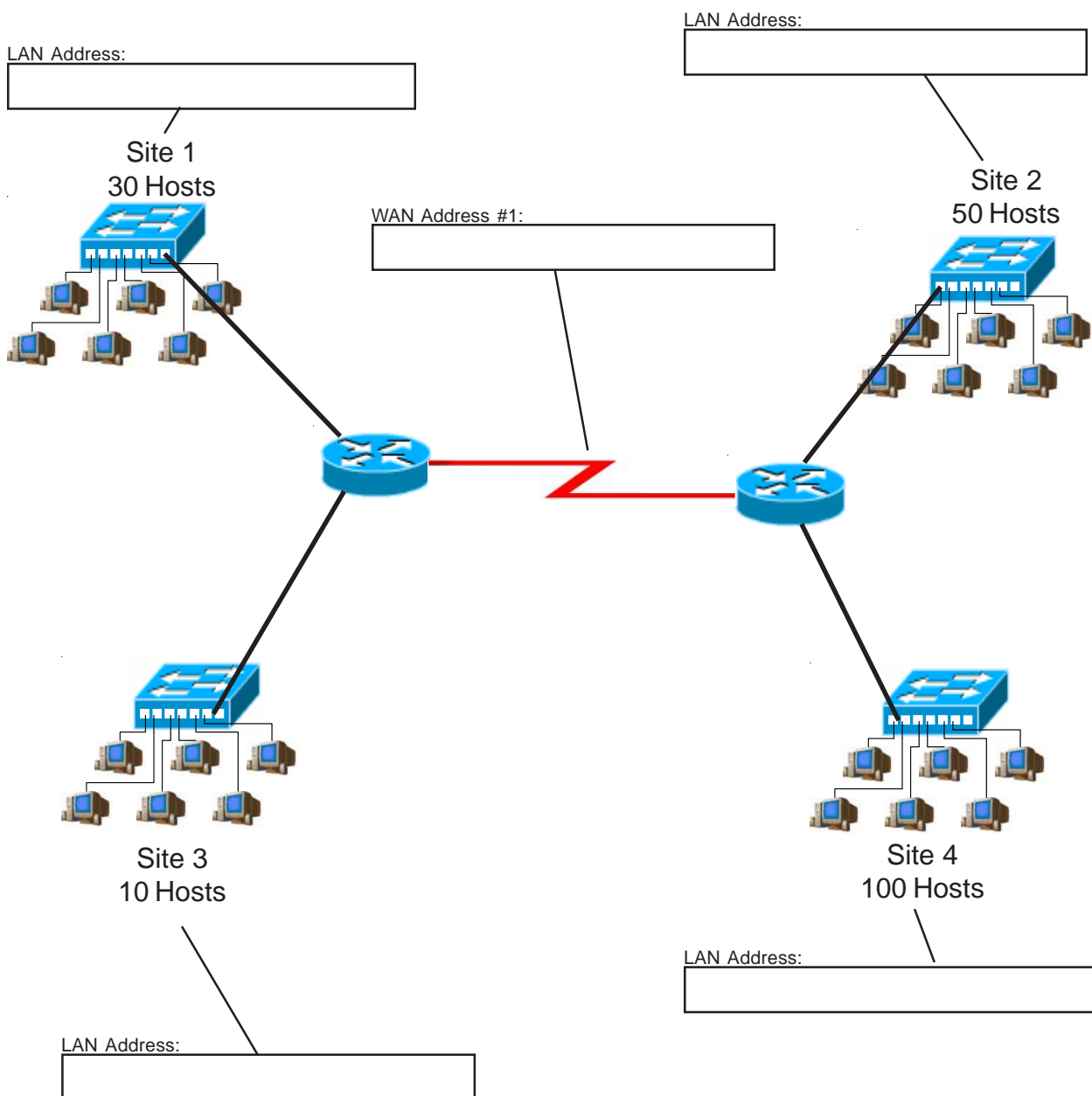
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

VLSM Addressing

VLSM Chart Method

Problem 19

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

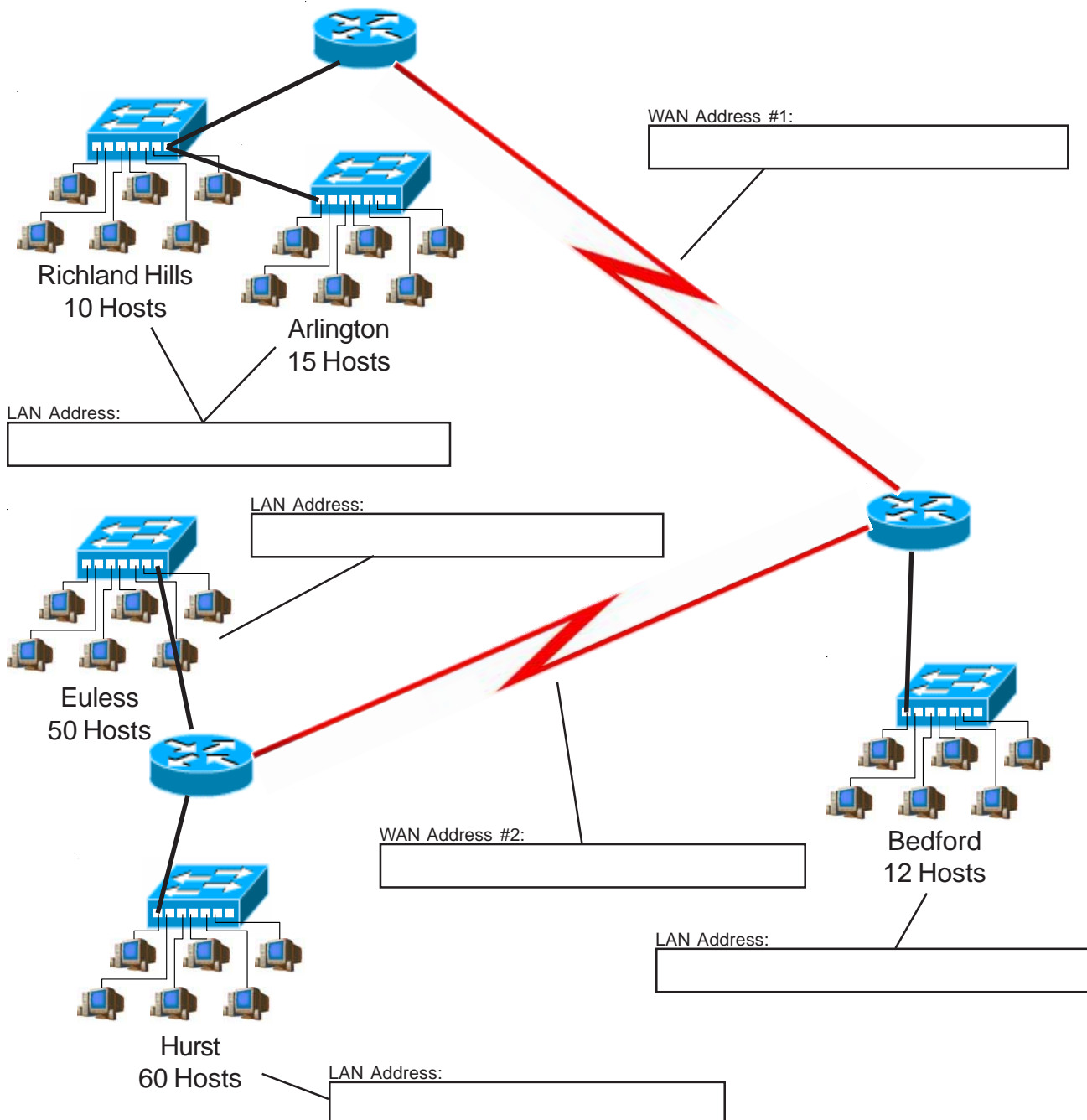
/24	/25	/26	/27	/28	/29	/30			
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts			
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3			
					4-7	4-7			
				16-31	8-15	8-11			
					12-15	12-15			
			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		176-183	88-95	88-91	
							92-95	92-95	
			192-255			192-223	192-207	96-99	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			
	160-191			160-175	144-151	144-147			
					148-151	148-151			
				176-191	176-183	152-159	152-155		
						156-159	156-159		
					192-223	192-207	192-199	160-167	160-163
								164-167	164-167
	200-207	168-175	168-171						
		172-175	172-175						
	208-223	208-215	176-179	176-179					
			180-183	180-183					
		216-223	184-191	184-187					
			188-191	188-191					
	192-255	192-223	192-207	192-195		192-195			
				196-199		196-199			
			208-223	200-207		200-203			
				204-207		204-207			
		224-255	224-239	208-215	208-211				
				212-215	212-215				
			240-255	216-223	216-219				
				220-223	220-223				
			248-255	248-251	224-231	224-227			
					228-231	228-231			
	252-255	232-239		232-235					
		236-239		236-239					

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)

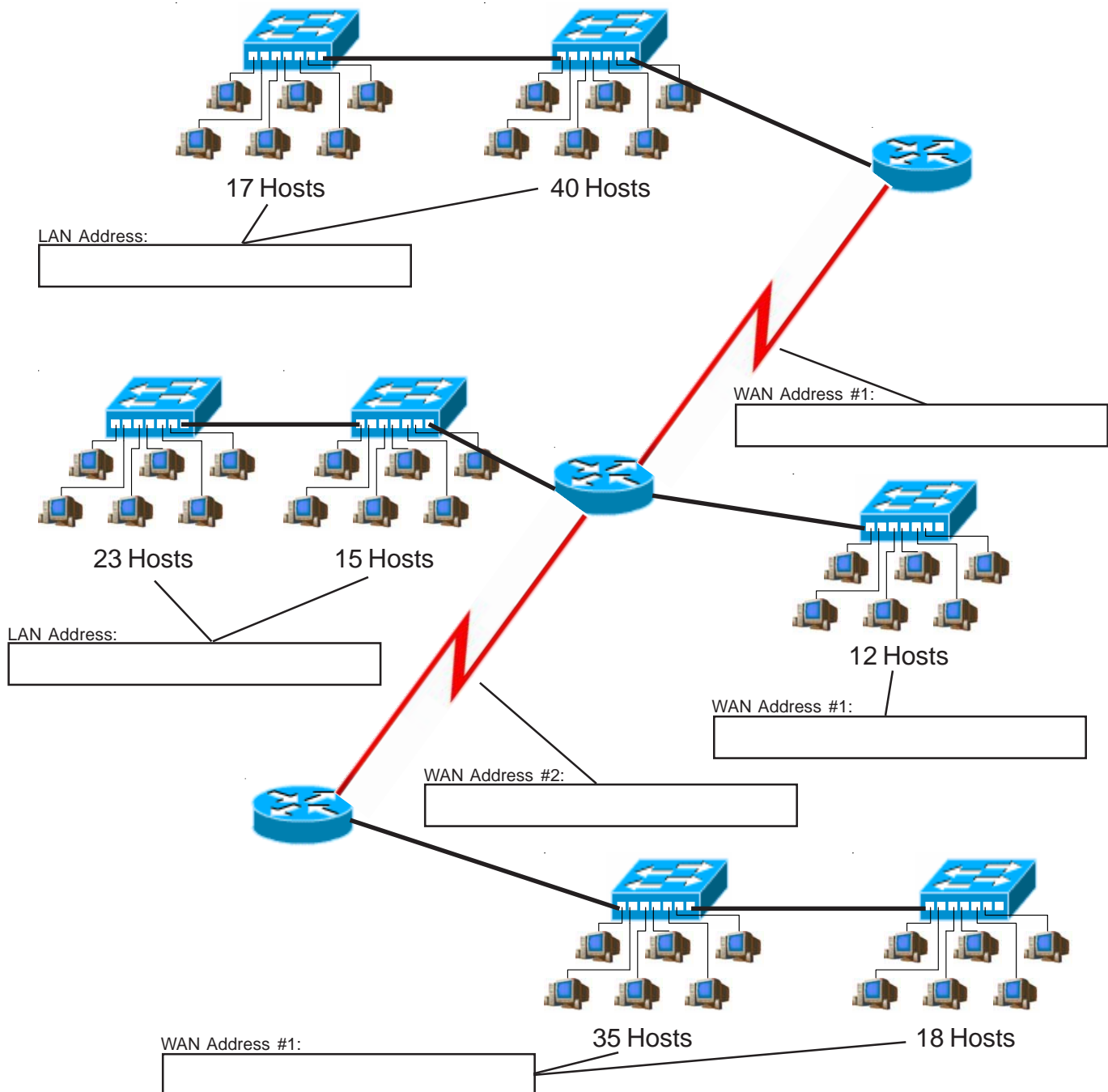
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

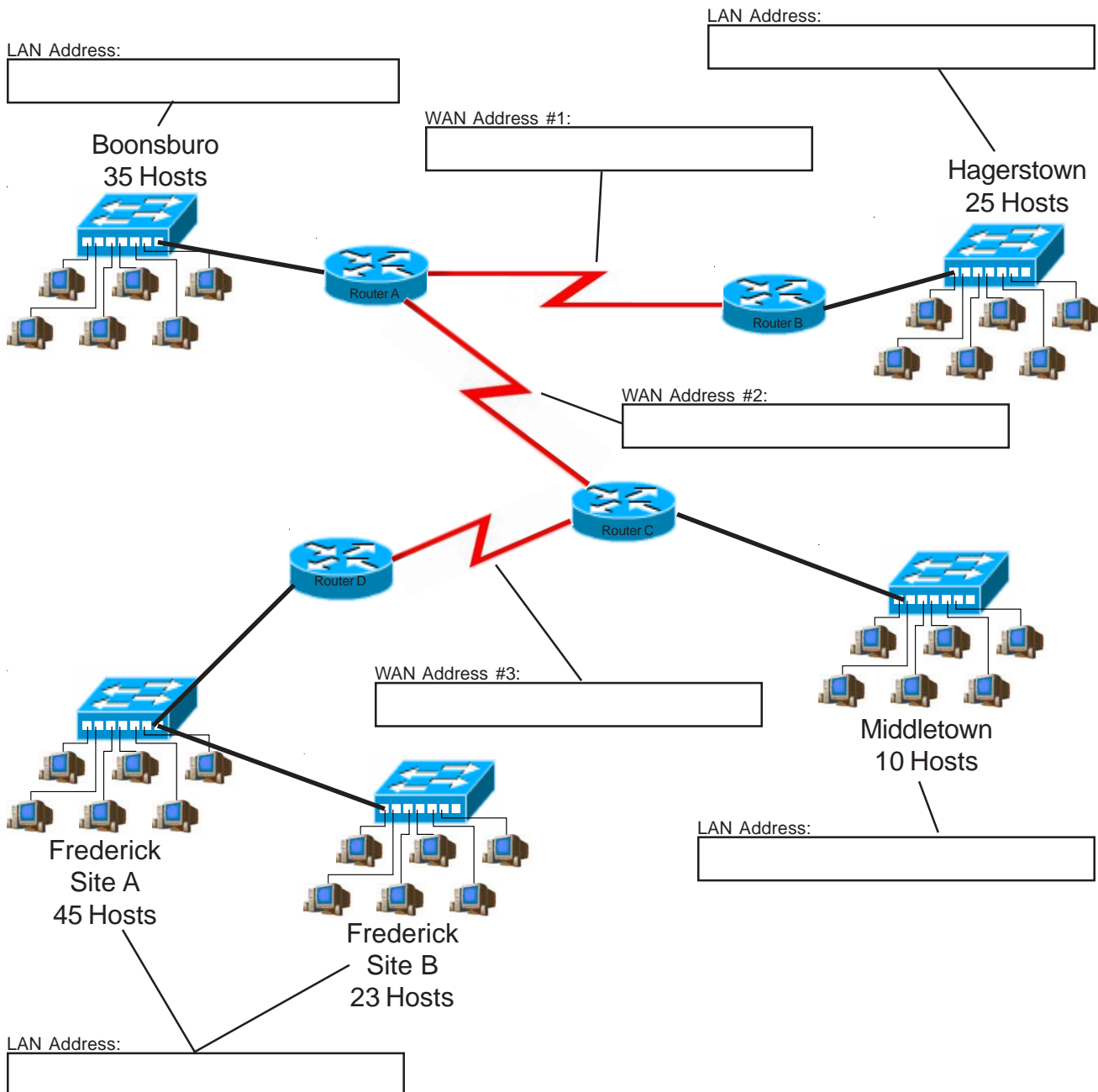
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

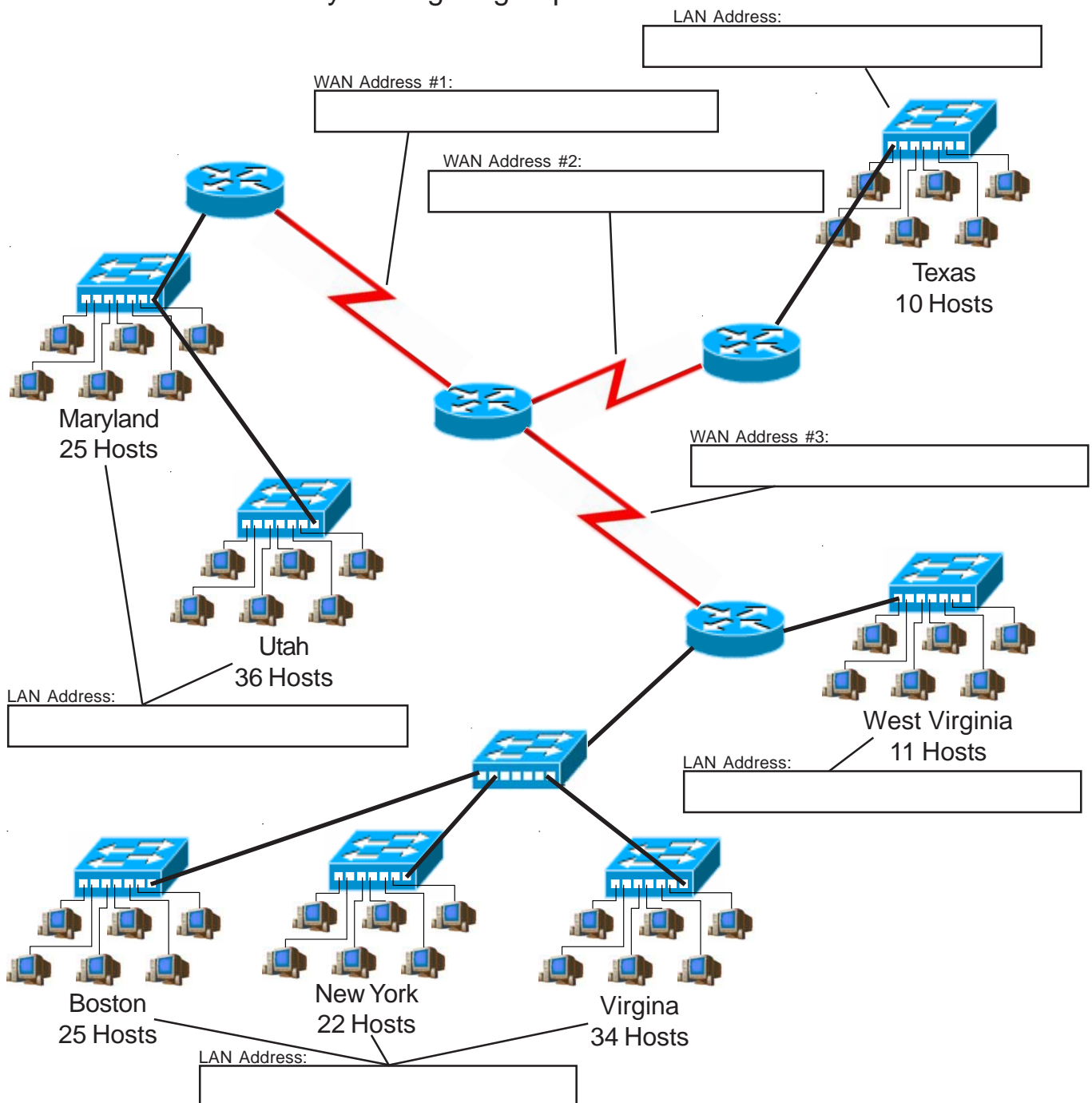
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31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

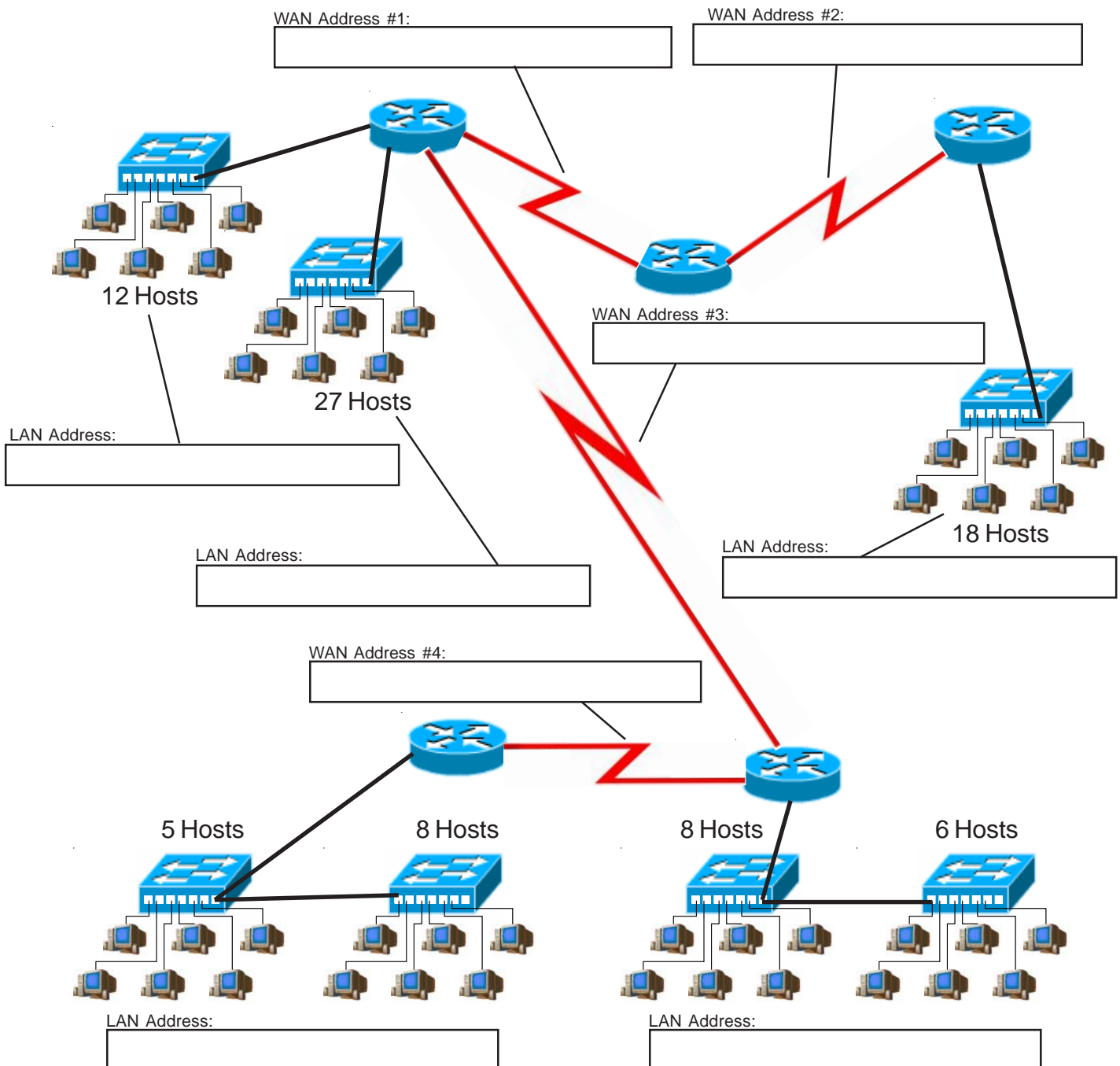
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
					4-7	4-7
				16-31	8-15	8-11
					12-15	12-15
		32-63	32-47	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	192-223	192-207	192-199	112-115	112-115
					116-119	116-119
				200-207	120-123	120-123
					124-127	124-127
		208-223	208-215	208-215	128-131	128-131
					132-135	132-135
			216-223	216-223	136-139	136-139
					140-143	140-143
		224-255	224-239	224-231	144-147	144-147
					148-151	148-151
				232-239	152-155	152-155
					156-159	156-159
			240-255	240-247	160-163	160-163
					164-167	164-167
				248-255	168-171	168-171
					172-175	172-175
		192-255	192-207	192-199	176-179	176-179
					180-183	180-183
				200-207	184-187	184-187
					188-191	188-191
			208-223	208-215	192-195	192-195
					196-199	196-199
				216-223	200-203	200-203
					204-207	204-207
		192-255	192-223	192-207	208-211	208-211
					212-215	212-215
				208-223	216-219	216-219
					220-223	220-223
			224-255	224-231	224-227	224-227
					228-231	228-231
				232-239	232-235	232-235
					236-239	236-239
			240-255	240-247	240-243	240-243
					244-247	244-247
				248-255	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)

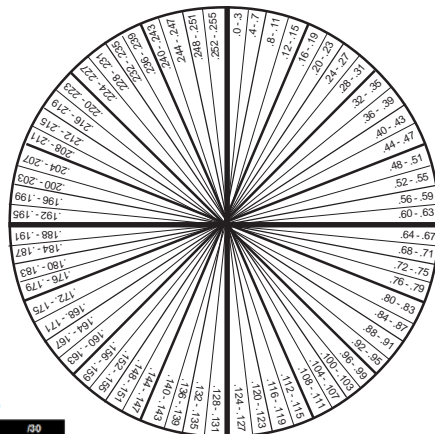
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

VLSM Addressing

Problem 27

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

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

VLSM Addressing

Problem 28

A shipping company needs to set up its network across several locations. The Denver office needs six computers. The Waco office needs 22 computers. The Fargo office will need five computers. The WAN links between all three locations need to be included in the solution. Using the IP address 192.168.10.0/24 divide the network using VLSM. Complete the information required below. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

VLSM Addressing

Problem 29

A new school is being built in the local school district. It will have three computer labs with 28 computers each. There will be 58 classrooms with 2 computers each that need to be on one sub-subnet. The office staff and administrators will need 7 computers. The guidance and attendance office will have 5 computers. The school has been given the address 223.145.75.0/24. Complete the information required below. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

VLSM Addressing

Problem 30

A local college is setting up a campus wide network. The technology wing will be on its own network address of 192.168.250.0/24. The office wing will include 15 computers. There are 2 labs of 20 computers each, 2 labs of 30 computers each and one lab of 35 computers. Complete the information required below. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

VLSM Addressing

Problem 31

You are setting up a network for a company in four locations. Location A has 8 computers. Location B has 122 computers. Location C has 4 computers. Location D has 55 computers. There is a WAN connection between all four locations. Complete the information required below using the class C address 192.168.10.0. Remember to work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

VLSM Addressing

Problem 32

A college dormitory is being remodeled. A new network is being installed. There are 50 dorm rooms with two drops each that will be on one sub-subnet. The offices will have 5 drops. The reception desk will have three drops. A small study hall will include 30 drops. Using the IP address 192.168.12.0/24 complete the information required below using VLSM. Work from largest to smallest.

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

VLSM Addressing

Problem 33

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

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Problem 33 - Detailed Map

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

VLSM Addressing

Problem 34

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

Subnet	Subnet	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Problem 34 - Detailed Map

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

10.0.0.0

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

D4	D5	D6	D7	D8	D9	D0
200-205	206-210	211-215	216-220	221-225	226-230	231-235
				0-5	5-7	7-11
				8-9	9-15	15-21
				16-21	21-23	23-27
				24-31	31-37	37-43
				38-47	47-58	58-70
				48-58	59-67	67-77
				68-83	83-93	93-107
				84-78	79-70	70-75
				86-85	86-87	87-90
				88-91	91-103	103-110
				92-127	128-131	132-137
				138-140	140-149	149-155
				156-159	160-169	169-175
				176-181	182-191	191-197
				192-223	224-231	232-237
				238-239	240-253	254-257
				258-275	276-283	284-290
				291-303	304-307	308-310
				311-313	314-315	316-317
				318-319	320-321	322-323
				324-325	326-327	328-329
				330-331	332-333	334-335
				336-337	338-339	340-341
				342-343	344-345	346-347
				348-349	350-351	352-353
				354-355	356-357	358-359
				360-361	362-363	364-365
				366-367	368-369	370-371
				372-373	374-375	376-377
				378-379	380-381	382-383
				384-385	386-387	388-389
				390-391	392-393	394-395
				396-397	398-399	400-401
				402-403	404-405	406-407
				408-409	410-411	412-413
				414-415	416-417	418-419
				420-421	422-423	424-425
				426-427	428-429	430-431
				432-433	434-435	436-437
				438-439	440-441	442-443
				444-445	446-447	448-449
				450-451	452-453	454-455
				456-457	458-459	460-461
				462-463	464-465	466-467
				468-469	470-471	472-473
				474-475	476-477	478-479
				480-481	482-483	484-485
				486-487	488-489	490-491
				492-493	494-495	496-497
				498-499	500-501	502-503
				504-505	506-507	508-509
				510-511	512-513	514-515
				516-517	518-519	520-521
				522-523	524-525	526-527
				528-529	530-531	532-533
				534-535	536-537	538-539
				540-541	542-543	544-545
				546-547	548-549	550-551
				552-553	554-555	556-557
				558-559	560-561	562-563
				564-565	566-567	568-569
				570-571	572-573	574-575
				576-577	578-579	580-581
				582-583	584-585	586-587
				588-589	590-591	592-593
				594-595	596-597	598-599
				600-601	602-603	604-605
				606-607	608-609	610-611
				612-613	614-615	616-617
</						

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)

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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	<i>15.208.0.0 to 15.208.31.255</i>	<i>/19</i>
Client #2	5,000	<i>15.208.32.0 to 15.208.63.255</i>	<i>/19</i>
Client #3	4,500	<i>15.208.64.0 to 15.208.95.255</i>	<i>/19</i>
Client #4	2,000	<i>15.208.96.0 to 15.208.103.255</i>	<i>/21</i>
Client #5	1,450	<i>15.208.104.0 to 15.208.111.255</i>	<i>/21</i>
Client #6	1,150	<i>15.208.112.0 to 15.208.119.255</i>	<i>/21</i>
Client #7	900	<i>15.208.120.0 to 15.208.123.255</i>	<i>/22</i>
Client #8	750	<i>15.208.124.0 to 15.208.127.255</i>	<i>/22</i>
Client #9	450	<i>15.208.128.0 to 15.208.129.255</i>	<i>/23</i>

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

/16 255.255.0.0 65,536 Hosts	/17 255.255.128.0 32,768 Hosts	/18 255.255.192.0 16,384 Hosts	/19 255.255.224.0 8,192 Hosts	/20 255.255.240.0 4,096 Hosts	/21 255.255.248.0 2,048 Hosts	/22 255.255.252.0 1,024 Hosts	/23 255.255.254.0 512 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1
					8-15	4-7	2-3
						8-11	4-5
						12-15	6-7
						16-19	8-9
						20-23	10-11
						24-27	12-13
						28-31	14-15
				16-31	16-23	32-35	16-17
					24-31	36-39	18-19
			32-63	32-47	32-39	40-43	20-21
					40-47	44-47	22-23
					48-55	48-51	24-25
					56-63	52-55	26-27
						56-59	28-29
						60-63	30-31
				64-79	64-71	64-67	32-33
					72-79	68-71	34-35
			64-127	80-95	80-87	84-87	36-37
					88-95	88-91	38-39
				96-111	96-103	96-99	40-41
					104-111	104-107	42-43
				112-127	112-119	112-115	44-45
					120-127	116-119	46-47
						120-123	48-49
						124-127	50-51
				128-143	128-135	128-131	52-53
					136-143	132-135	54-55
			128-191	144-159	144-151	144-147	56-57
					152-159	148-151	58-59
				160-175	160-167	160-163	60-61
					168-175	164-167	62-63
				176-191	176-183	172-175	64-65
					184-191	176-179	66-67
				192-207	192-199	192-195	68-69
					200-207	196-199	70-71
			192-255	208-223	208-215	208-203	72-73
					216-223	204-207	74-75
				224-239	224-231	224-227	76-77
					232-239	228-231	78-79
				240-255	240-247	232-235	80-81
					248-255	236-239	82-83
						240-243	84-85
						244-247	86-87
						248-251	88-89
						252-255	90-91
	128-255	128-191	128-159	128-143	128-135	128-131	92-93
							94-95
							96-97
							98-99
							100-101
							102-103
							104-105
							106-107
							108-109
							110-111
							112-113
							114-115
							116-117
							118-119
							120-121
							122-123
							124-125
							126-127
							128-129
							130-131
							132-133
							134-135
							136-137
							138-139
							140-141
							142-143
							144-145
							146-147
							148-149
							150-151
							152-153
							154-155
							156-157
							158-159
							160-161
							162-163
							164-165
							166-167
							168-169
							170-171
							172-173
							174-175
							176-177
							178-179
							180-181
							182-183
							184-185
							186-187
							188-189
							190-191
							192-193
							194-195
							196-197
							198-199
							200-201
							202-203
							204-205
							206-207
							208-209
							210-211
							212-213
							214-215
							216-217
							218-219
							220-221
							222-223
							224-225
							226-227
							228-229
							230-231
							232-233
							234-235
							236-237
							238-239
							240-241
							242-243
							244-245
							246-247
							248-249
							250-251
							252-253
							254-255

VLSM

with

Class A and B Addresses

Sample Problem 35

Part 3 of 3

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

ISP Addresses 15.208.124.**0**

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

Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

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

School System Address 172.32.0.0

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
North High	2,400		
South High	2,000		
North Middle	1,200		
South Middle	1,000		
Central Elem.	550		
Southern Elem.	475		
Eastern Elem.	450		
Central Office	400		
Western Elem.	300		

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	4-5
			32-63	32-47	24-31	24-27	6-7
						28-31	8-9
				40-47	32-39	32-35	10-11
						36-39	4-5
				48-63	40-43	40-43	6-7
						44-47	8-9
				56-63	48-55	48-51	10-11
						52-55	4-5
			64-127	64-79	56-59	56-59	6-7
					60-63	60-63	8-9
						64-67	10-11
						68-71	4-5
				80-95	72-79	72-75	6-7
						76-79	8-9
			96-127	96-111	80-87	80-83	10-11
						84-87	4-5
				104-111	88-95	88-91	6-7
						92-95	8-9
				112-127	96-99	96-99	10-11
						100-103	4-5
	128-255	128-191	128-159	128-143	104-111	104-107	6-7
						108-111	8-9
				144-159	112-119	112-115	10-11
						116-119	4-5
			160-191	160-175	120-123	120-123	6-7
						124-127	8-9
				176-191	128-135	128-131	10-11
						132-135	4-5
			192-255	192-207	136-143	136-139	6-7
						140-143	8-9
				208-223	144-151	144-147	10-11
						148-151	4-5
				224-239	152-155	152-155	6-7
						156-159	8-9
			240-255	240-247	160-163	160-163	10-11
						164-167	4-5
				248-255	168-175	168-171	6-7
						172-175	8-9
					176-183	176-179	10-11
						180-183	4-5
					184-191	184-187	6-7
						188-191	8-9
					192-199	192-195	10-11
						196-199	4-5
					200-207	200-203	6-7
						204-207	8-9
					208-215	208-211	10-11
						212-215	4-5
					216-223	216-219	6-7
						220-223	8-9
					224-231	224-227	10-11
						228-231	4-5
					232-239	232-235	6-7
						236-239	8-9
					240-247	240-243	10-11
						244-247	4-5
					248-251	248-251	6-7
						252-255	8-9
					252-255	252-255	10-11
							4-5

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		
Printers	45		
Staff	40		
Network Devices	25		
Administrative	12		

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		
Network Devices	250		
Printers	200		
Staff	150		
Administrative	50		

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		
New York	1,540,000		
St. Petersburg	1,075,000		
London	975,000		
Ekaterinoburg	525,000		
Munchen	450,000		
Napoli	150,000		
Birmingham	130,000		
Rotterdam	95,000		

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
						8-11	4-5
						12-15	6-7
			16-31	16-23		16-19	8-9
						20-23	10-11
					24-31	24-27	12-13
						28-31	14-15
			32-63	32-39		32-35	16-17
						36-39	18-19
				40-47		40-43	20-21
						44-47	22-23
				48-63	48-55	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	88-91	44-45
						92-95	46-47
			96-127	96-103	96-99	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	68-69
						140-143	70-71
			144-159	144-151		144-147	72-73
						148-151	74-75
				152-159	152-155	152-155	76-77
						156-159	78-79
			160-191	160-175	160-163	160-163	80-81
						164-167	82-83
				168-175	168-171	168-171	84-85
						172-175	86-87
			176-191	176-183	176-179	176-179	88-89
						180-183	90-91
				184-191	184-187	184-187	92-93
						188-191	94-95
		192-255	192-223	192-199	192-199	192-195	96-97
						196-199	98-99
				200-207	200-203	200-203	100-101
						204-207	102-103
			208-223	208-215	208-211	208-211	104-105
						212-215	106-107
				216-223	216-219	216-219	108-109
						220-223	110-111
			224-255	224-231	224-227	224-227	112-113
						228-231	114-115
				232-239	232-235	232-235	116-117
						236-239	118-119
				240-247	240-243	240-243	120-121
						244-247	122-123
						248-251	124-125
					248-255	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

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		
Office #2	3,780		
Office #3	2,750		
Office #4	2,000		
Office #5	1,000		
Office #6	845		
Office #7	500		
Office #8	450		
Office #9	300		

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

VLSM

with

Class A and B Addresses

Problem 37

Part 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		
2nd Floor	75		
5th Floor	50		
8th Floor	45		
4th Floor	30		
Basement	14		
7th Floor	12		
3rd Floor	6		
6th Floor	4		

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

VLSM

with

Class A and B Addresses

Problem 38

Part 1 of 4

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

Addresses 75.0.0.0

Customer Name	Number of Addresses	Address Range	CIDR
United States	6.5 million		
China	4 million		
Japan	1 million		
Germany	500,000		
Russia	455,000		
Australia	450,000		
Brazil	125,000		
Canda	90,000		
Denmark	88,000		

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

VLSM

with

Class A and B Addresses

Sample Problem 38

Part 2 of 4

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

Addresses Range: 75.0.0.0 to 75.127.255.255

Customer Name	Number of Addresses	Address Range	CIDR
Client #1	1,950,000		
Client #2	1,000,000		
Client #3	950,000		
Client #4	700,000		
Client #5	550,000		
Client #6	500,000		
Client #7	450,000		

Class A Addresses

VLSM Chart 8-15 Bits (2nd octet)

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

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		
Office #2	45,000		
Office #3	30,000		
Office #4	24,000		
Office #5	15,000		
Office #6	10,000		
Office #7	8,000		
Office #8	2,000		
Office #9	1,000		

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

/16	/17	/18	/19	/20	/21	/22	/23					
255.255.0.0 65,536 Hosts	255.255.128.0 32,768 Hosts	255.255.192.0 16,384 Hosts	255.255.224.0 8,192 Hosts	255.255.240.0 4,096 Hosts	255.255.248.0 2,048 Hosts	255.255.252.0 1,024 Hosts	255.255.254.0 512 Hosts					
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0-1					
						4-7	2-3					
					8-15	8-11	4-5					
						12-15	6-7					
						16-19	8-9					
						20-23	10-11					
				16-31		24-27	12-13					
						28-31	14-15					
					32-63	32-47	32-35	16-17				
							36-39	18-19				
							40-43	20-21				
							44-47	22-23				
			48-51	24-25								
			52-55	26-27								
			48-63	56-59		28-29						
				60-63		30-31						
				64-127		64-95	64-79	64-71	32-33			
								72-79	34-35			
								80-95	80-87	36-37		
									88-95	38-39		
			96-111		96-103				40-41			
					104-111				42-43			
					112-127		112-119		44-45			
							120-127		46-47			
		128-255					128-191	128-143	128-135	48-49		
									136-143	50-51		
			144-159						144-151	52-53		
									152-159	54-55		
					160-191	160-167			56-57			
						168-175			58-59			
						176-191			176-183	60-61		
									184-191	62-63		
			192-255						192-223	192-207	192-199	64-65
											200-207	66-67
					208-223						208-215	68-69
											216-223	70-71
		224-239				224-231		72-73				
						232-239		74-75				
						240-255		240-247		76-77		
								248-255		78-79		
				192-255	192-223			192-207		192-199	80-81	
										200-207	82-83	
		208-223								208-215	84-85	
										216-223	86-87	
			224-239			224-231			88-89			
						232-239			90-91			
						240-255			240-247	92-93		
									248-255	94-95		
	192-255	192-223					192-207		192-199	96-97		
									200-207	98-99		
			208-223						208-215	100-101		
									216-223	102-103		
				224-239		224-231		104-105				
						232-239		106-107				
						240-255		240-247	108-109			
								248-255	110-111			
			192-255					192-223	192-207	192-199	112-113	
										200-207	114-115	
				208-223						208-215	116-117	
										216-223	118-119	
	224-239					224-231	120-121					
						232-239	122-123					
						240-255	240-247			124-125		
							248-255			126-127		
				192-255	192-223		192-207			192-199	128-129	
										200-207	130-131	
	208-223									208-215	132-133	
										216-223	134-135	
			224-239			224-231			136-137			
						232-239			138-139			
						240-255			240-247	140-141		
									248-255	142-143		
	192-255	192-223							192-207	192-199	144-145	
										200-207	146-147	
			208-223							208-215	148-149	
										216-223	150-151	
				224-239		224-231	152-153					
						232-239	154-155					
						240-255	240-247			156-157		
							248-255			158-159		
			192-255				192-223	192-207		192-199	160-161	
										200-207	162-163	
				208-223						208-215	164-165	
										216-223	166-167	
	224-239					224-231			168-169			
						232-239			170-171			
						240-255			240-247	172-173		
									248-255	174-175		
				192-255	192-223				192-207	192-199	176-177	
										200-207	178-179	
	208-223									208-215	180-181	
										216-223	182-183	
			224-239			224-231		184-185				
						232-239		186-187				
						240-255		240-247		188-189		
								248-255		190-191		
	192-255	192-223						192-207		192-199	192-193	
										200-207	194-195	
			208-223							208-215	196-197	
										216-223	198-199	
				224-239		224-231			200-201			
						232-239			202-203			
						240-255			240-247	204-205		
									248-255	206-207		
			192-255				192-223		192-207	192-199	208-209	
										200-207	210-211	
				208-223						208-215	212-213	
										216-223	214-215	
	224-239					224-231		216-217				
						232-239		218-219				
						240-255		240-247		220-221		
								248-255		222-223		
				192-255	192-223			192-207		192-199	224-225	
										200-207	226-227	
	208-223									208-215	228-229	
										216-223	230-231	
			224-239			224-231			232-233			
						232-239			234-235			
						240-255			240-247	236-237		
									248-255	238-239		
	192-255	192-223							192-207	192-199	240-241	
										200-207	242-243	
			208-223							208-215	244-245	
										216-223	246-247	
				224-239		224-231		248-249				
						232-239		250-251				
						240-255		240-247		252-253		
								248-255		254-255		

VLSM

with

Class A and B Addresses

Sample Problem 38

Part 4 of 4

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

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

ISP Addresses 75.107.128.0 to 75.107.159.255

Customer Name	Number of Addresses	Address Range	CIDR
Branch #1	4,000		
Branch #2	2,000		
Branch #3	1,000		
Branch #4	500		
Branch #5	450		

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

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

Reference Charts and Support Materials

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

[illegible]

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

16 16-20 16.0-20.0	17 21-25 21.0-25.0	18 26-30 26.0-30.0	19 31-35 31.0-35.0	20 36-40 36.0-40.0	21 41-45 41.0-45.0	22 46-50 46.0-50.0	23 51-55 51.0-55.0
					3-15	6-15	7-15
				9-91	12-21	15-21	18-21
			9-91		15-21	18-21	21-21
					24-31	30-31	36-31
					32-47	36-50	42-50
					48-47	51-50	54-50
					48-55	51-55	54-55
					56-65	59-72	62-72
					64-71	67-71	70-71
					72-76	75-77	78-77
					80-87	83-87	86-87
					88-95	90-95	93-95
					96-111	100-108	104-110
						104-111	108-115
						112-119	116-123
						120-127	124-131
						128-135	132-139
						136-143	140-147
						144-151	148-155
						152-159	156-163
						160-167	164-171
						168-175	172-179
						176-183	180-187
						184-191	188-195
						192-199	196-203
						200-207	204-211
						208-215	212-219
						216-223	220-227
						224-231	228-235
						232-239	236-243
						240-247	244-251
						248-255	252-259

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

[illegible]

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

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

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

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