

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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for taking the time to check this workbook for errors.

Workbooks included in the series:

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

Classful vs. Classless Subnetting

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

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

What is VLSM

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

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

Benefits of VLSM

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

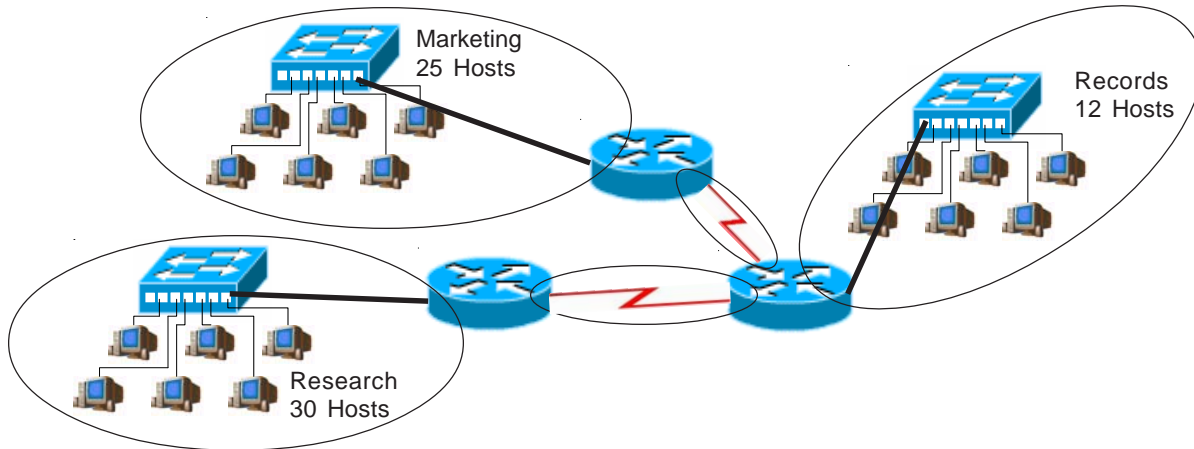
This workbook explores three different methods to figure out sub-subnets: the box method, the circle method, and a VLSM chart.

Classful Subnetting Example

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

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

IP Address: 192.168.1.0



The Box Method for visualizing subnets

Classful Subnet Ranges

192.168.1.0	to	192.168.1.31	/27
192.168.1.32	to	192.168.1.63	/27
192.168.1.64	to	192.168.1.95	/27
192.168.1.96	to	192.168.1.127	/27
192.168.1.128	to	192.168.1.159	/27
192.168.1.160	to	192.168.1.191	/27
192.168.1.192	to	192.168.1.223	/27
192.168.1.224	to	192.168.1.255	/27
/27			
255.255.255.224			
32 Hosts			
8 Subnets			

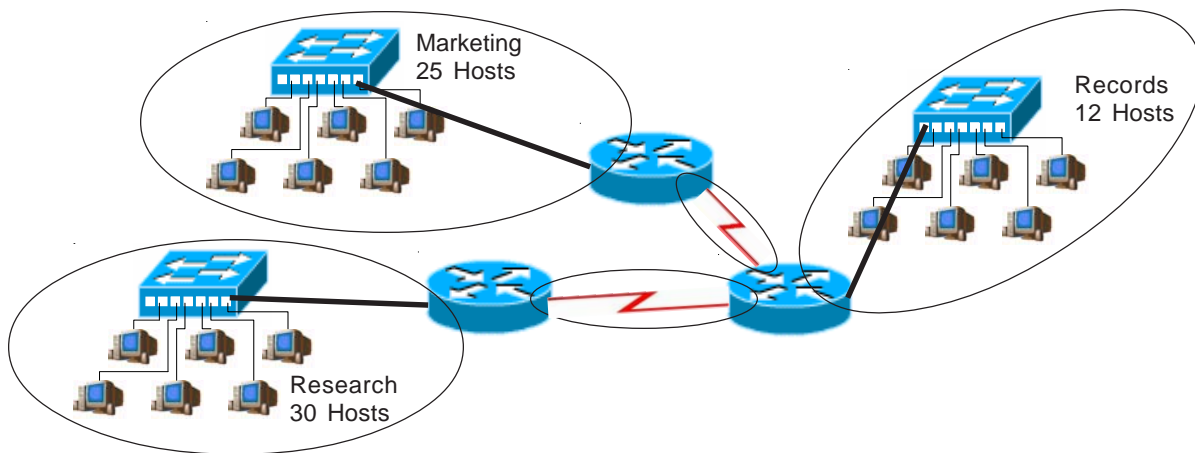
0 31	32 63	128 159	160 191
64 95	96 127	192 223	224 255

Classless Subnetting Example

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

In this example you need 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

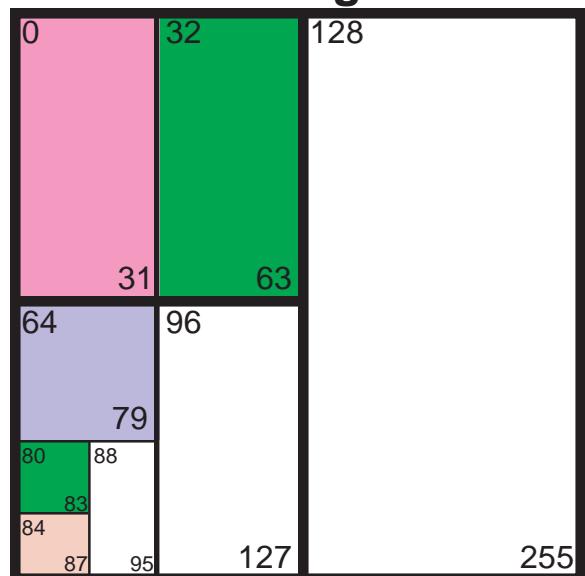


By adjusting the subnet masks you can cut your address usage by almost half in this example. This type of subnetting requires a network protocol which will support it such as: RIP version 2, EIGRP, OSPF, or BGP.

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

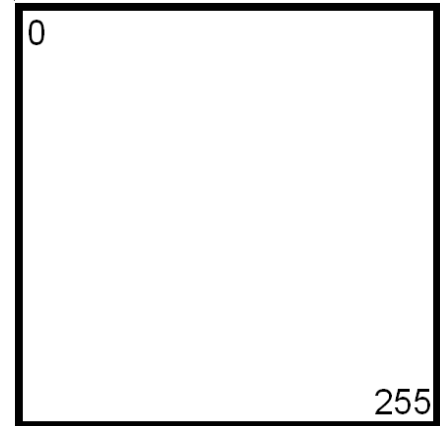


Visualizing Subnets Using The Box Method

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.

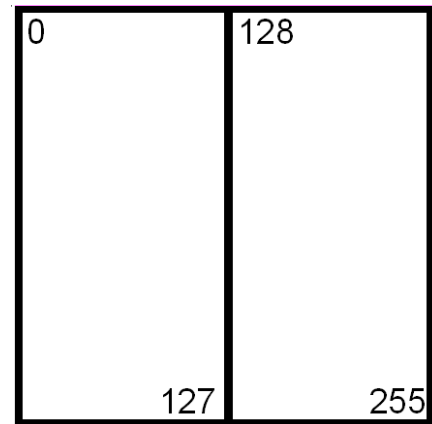
Start with a square. The whole square is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



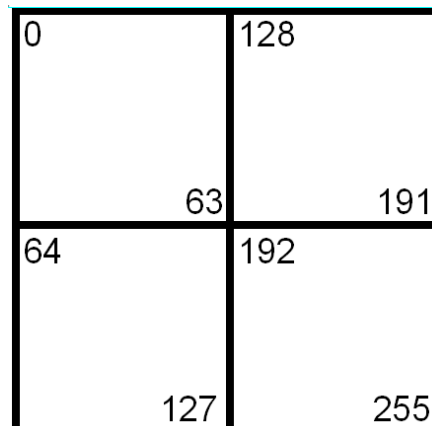
Split the box in half and you get two subnets with 128 addresses.

/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

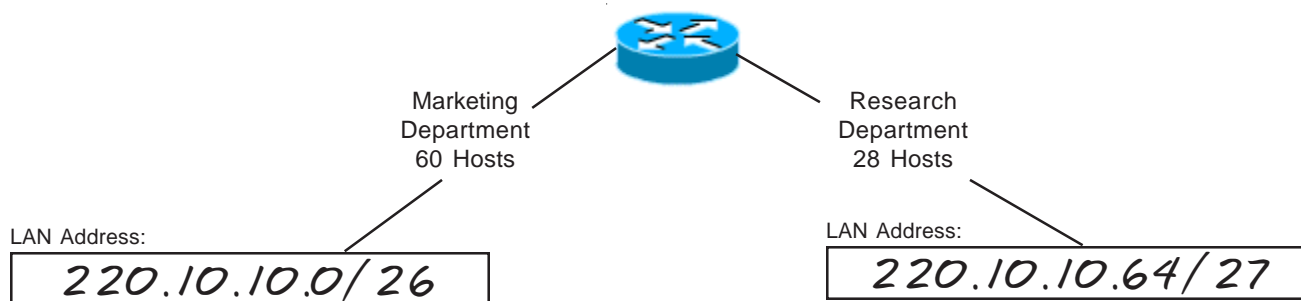
VLSM Addressing

Box Method

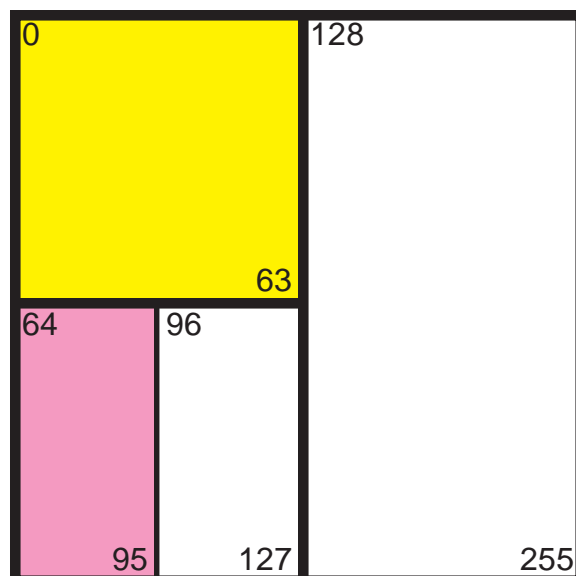
(Sample)

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.



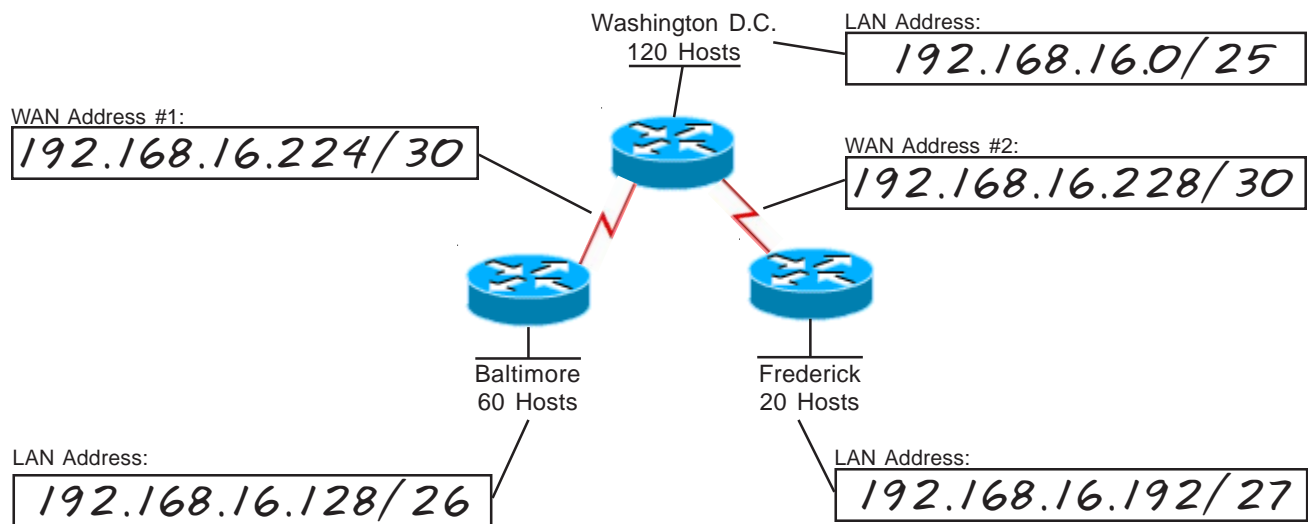
VLSM Addressing

Box Method

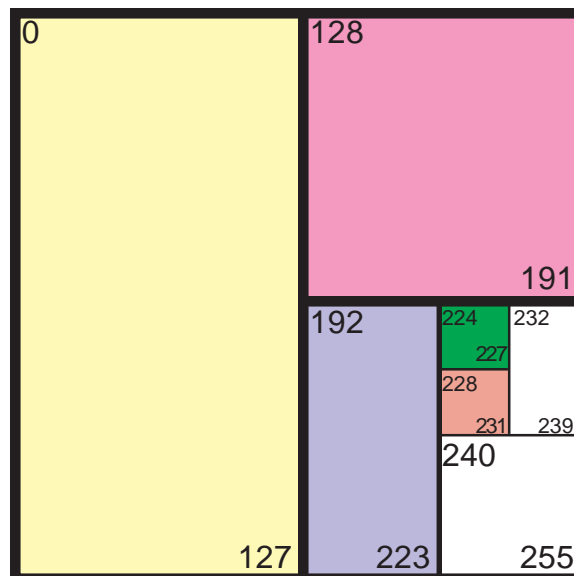
(Sample)

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.

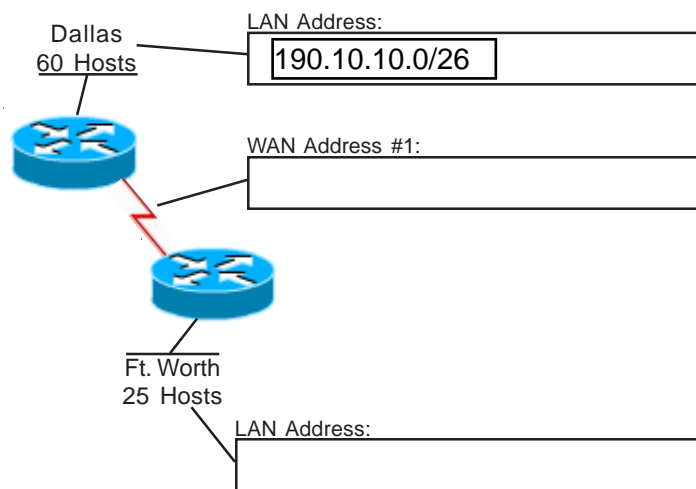


VLSM Addressing

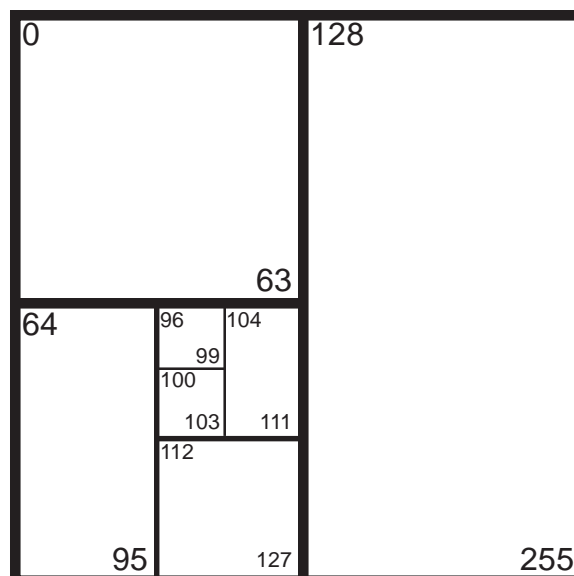
Box Method

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 190.10.10.0. Remember to start with your largest groups first.



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

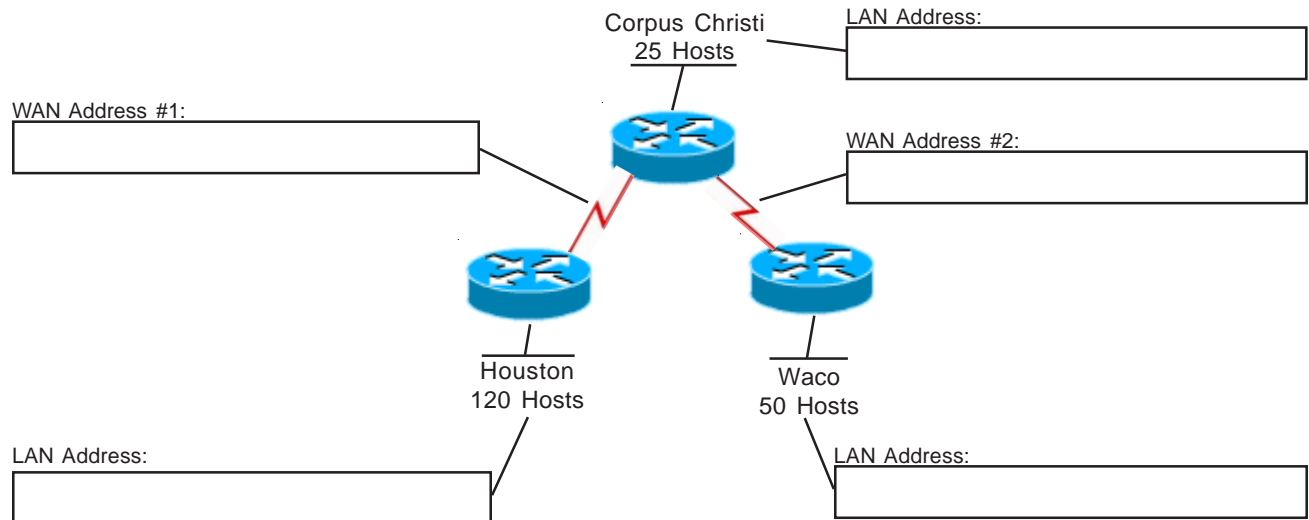


VLSM Addressing

Box Method

Problem 4

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



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

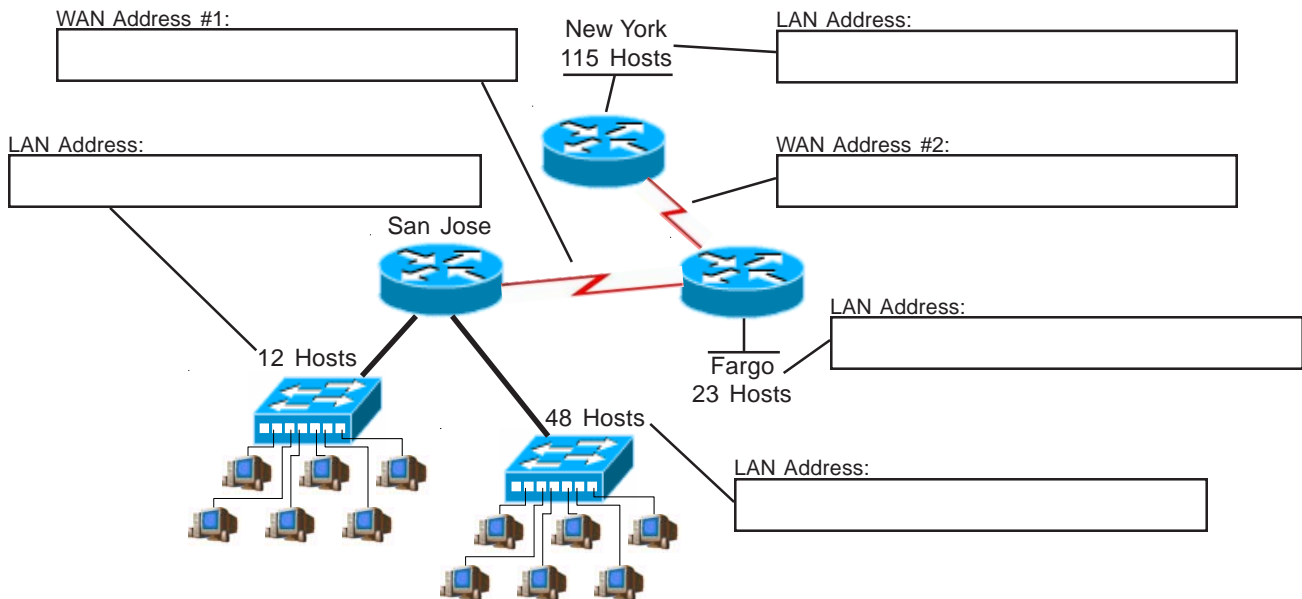
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	163
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	167
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103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

VLSM Addressing

Box Method

Problem 5

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



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

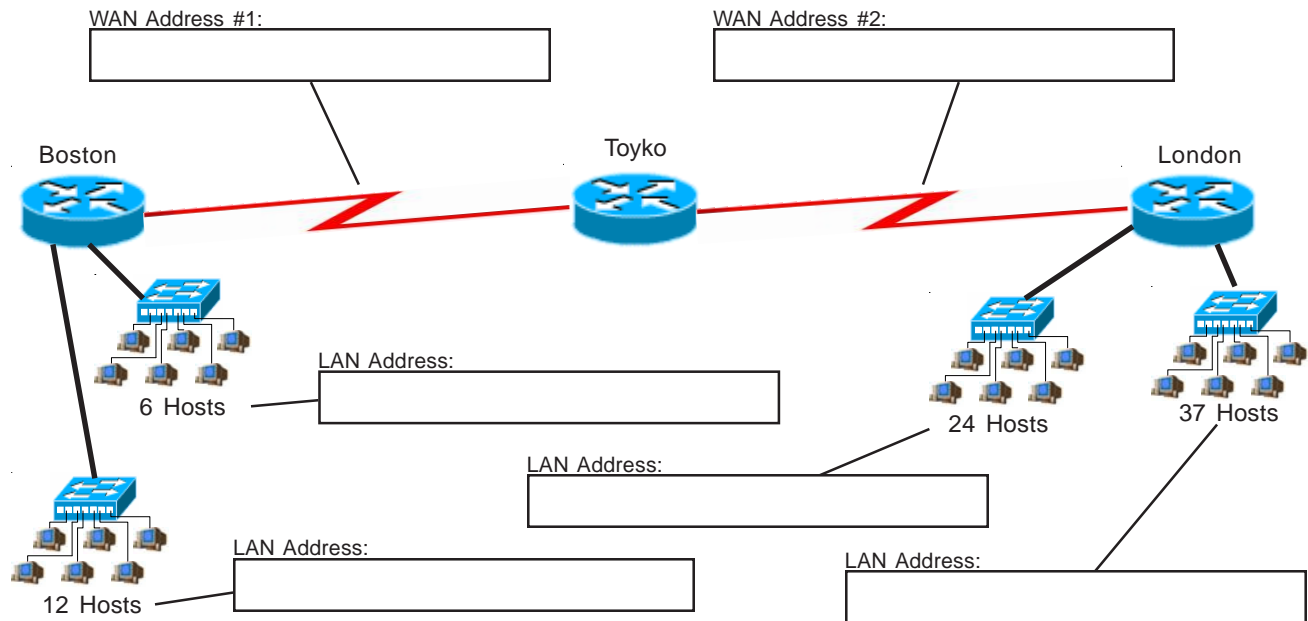
0	8	32	40	128	136	160	168
	3	11	35	43	131	139	171
4	12	36	44	132	140	164	172
	7	15	39	47	135	143	167
16	24	48	56	144	152	176	184
	19	27	51	59	147	155	179
20	28	52	60	148	156	180	188
	23	31	55	63	151	159	183
64	72	96	104	192	200	224	232
	67	75	99	107	195	203	227
68	76	100	108	196	204	228	236
	71	79	103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

VLSM Addressing

Box Method

Problem 6

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



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

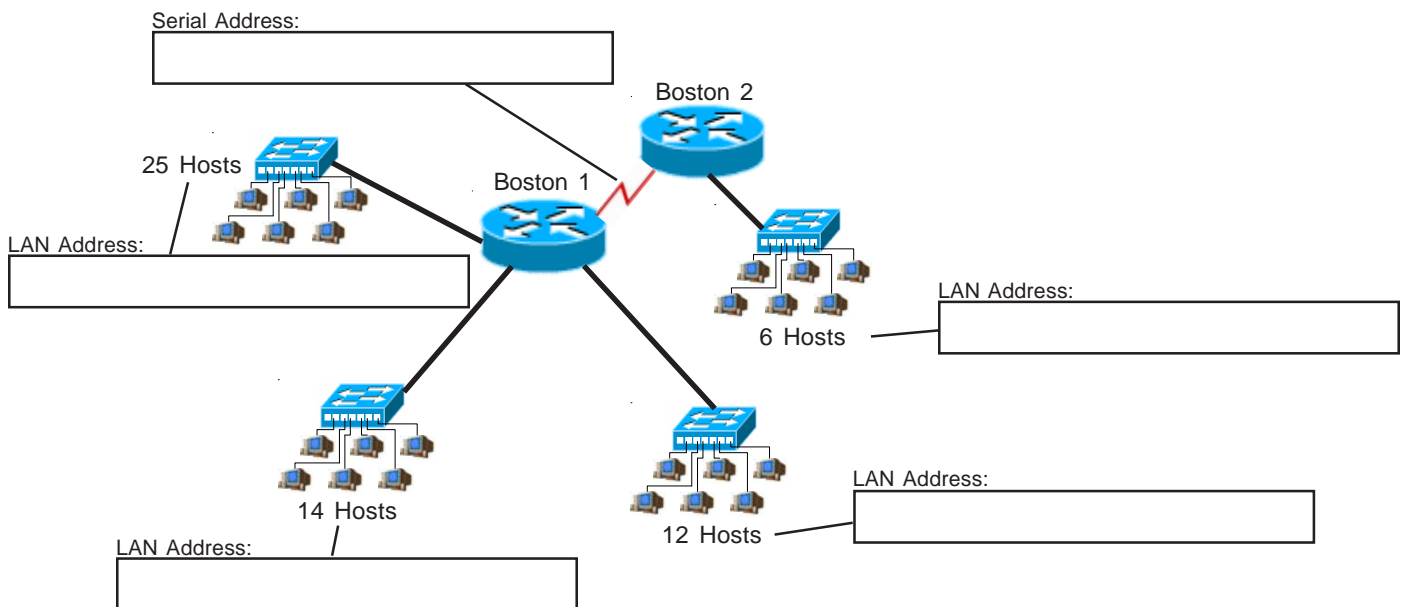
0	32	128	160
31	63	159	191
64	96	192	224
95	127	223	255

VLSM Addressing

Box Method

Problem 7

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



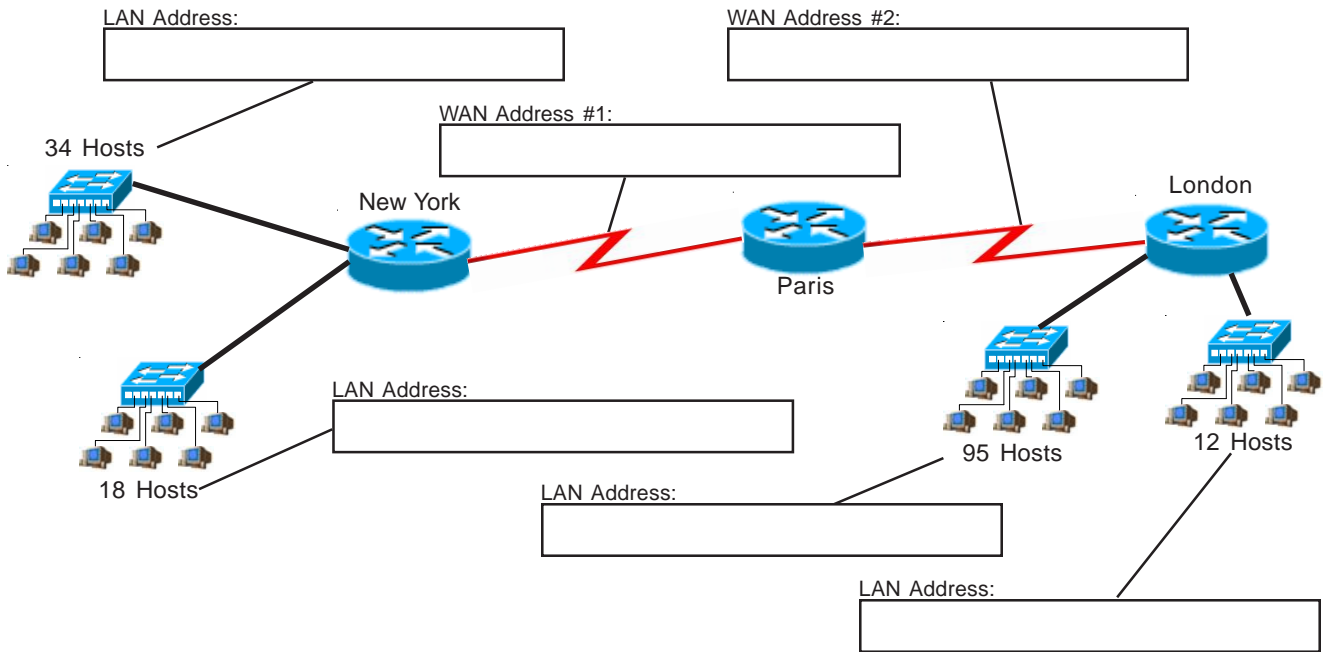
Draw the necessary lines and color in the used squares with different shades to highlight each subnet.

0	128
63	191
64	192
127	255

Box Method

Problem 8

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



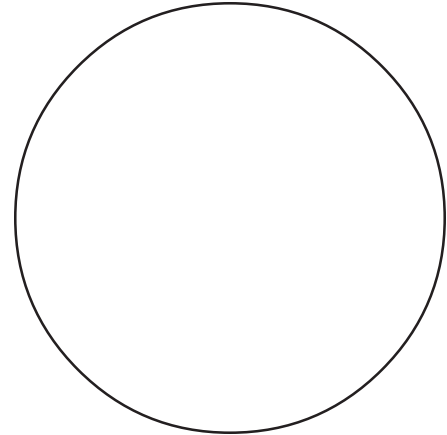
Draw the necessary lines and color in the used squares with different shades to highlight each subnet.

Visualizing Subnets Using The Circle Method

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

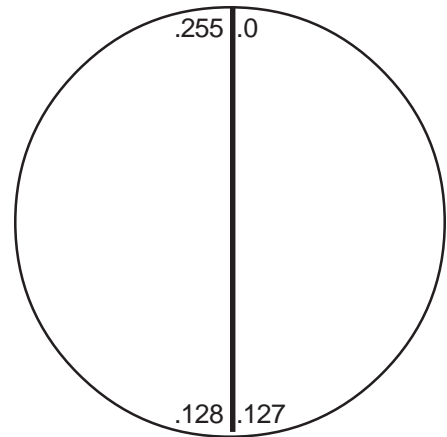
Start with a circle. The whole circle is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



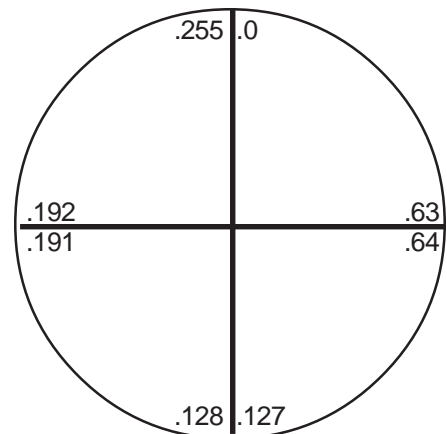
Split the circle in half and you get two subnets with 128 addresses.

/25
255.255.255.128
128 Hosts
2 Subnets



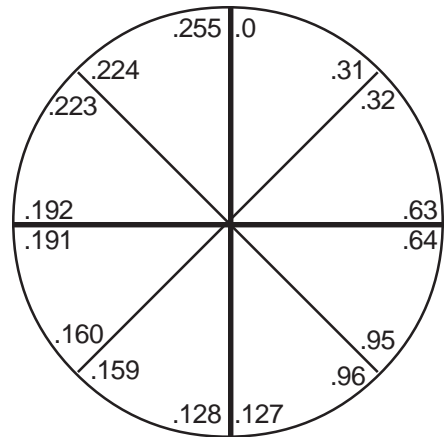
Divide the circle into quarters and you get four subnets with 64 addresses.

/26
255.255.255.192
64 Hosts
4 Subnets



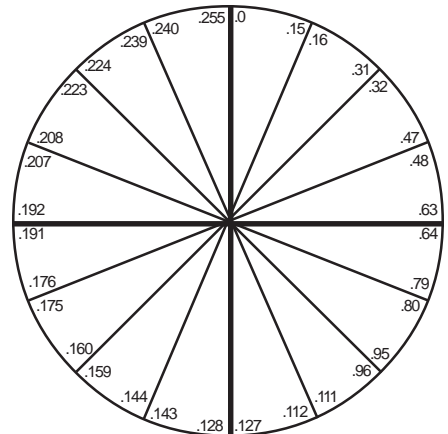
Split each quarter and you get eight subnets with 32 addresses.

/27
255.255.255.224
32 Hosts
8 Subnets



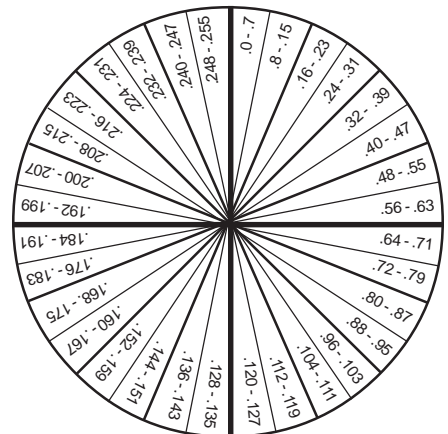
Split the boxes in half again and you get sixteen subnets with sixteen addresses.

/28
255.255.255.240
16 Hosts
16 Subnets



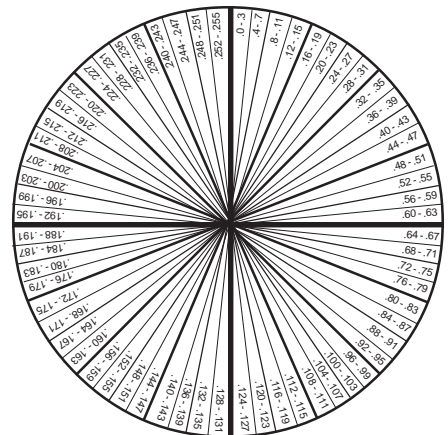
The next split gives you thirty two subnets with eight addresses.

/29
255.255.255.248
8 Hosts
32 Subnets



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

/30
255.255.255.252
4 Hosts
64 Subnets



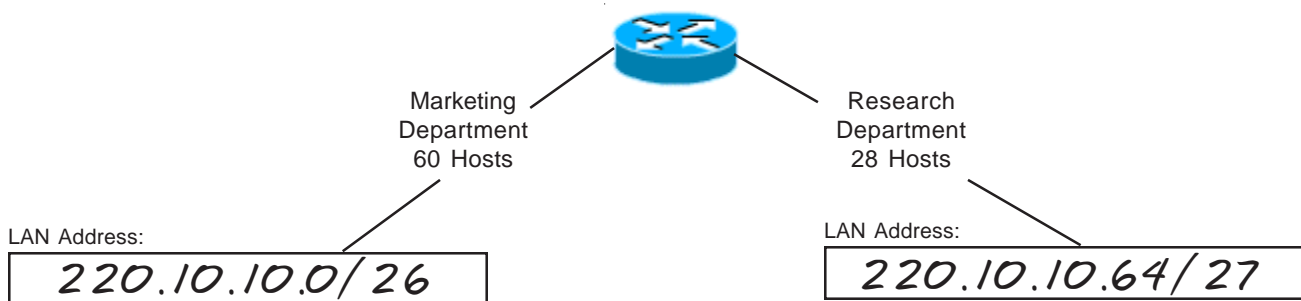
VLSM Addressing

Circle Method

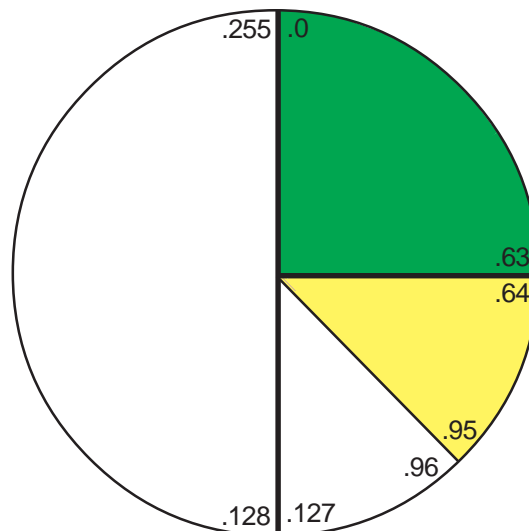
(Sample)

Problem 9

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



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



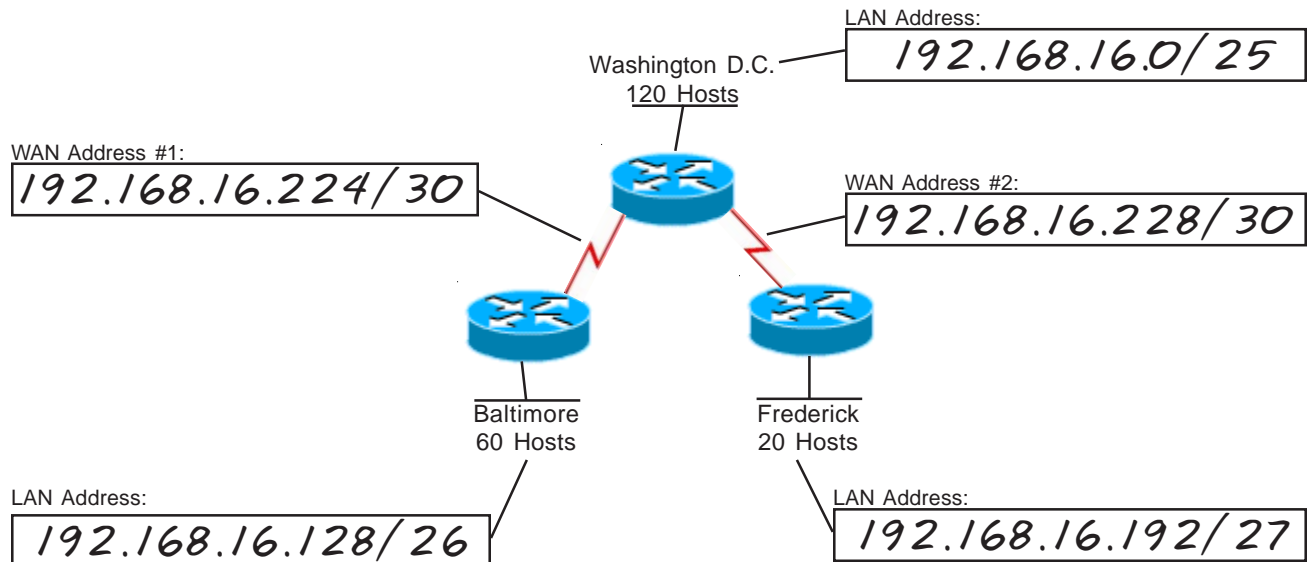
VLSM Addressing

Circle Method

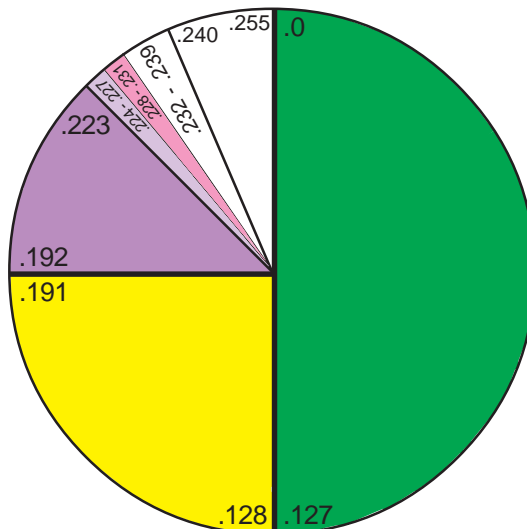
(Sample)

Problem 10

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



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



VLSM Addressing

Circle Method

Problem 11

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

LAN Address:

Marketing
Department
100 Hosts

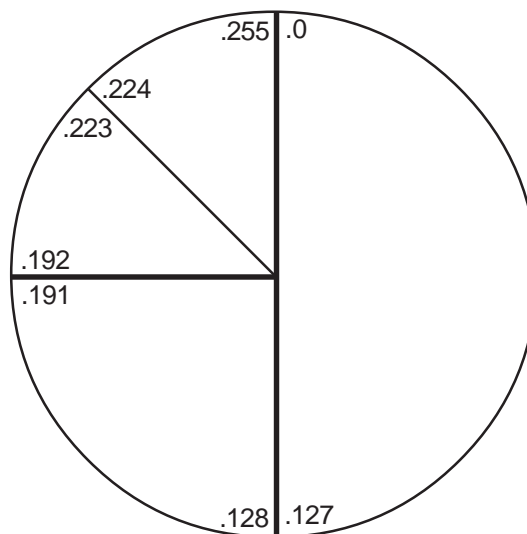
Marketing
Department
50 Hosts

Department
25 Hosts

LAN Address:

LAN Address:

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

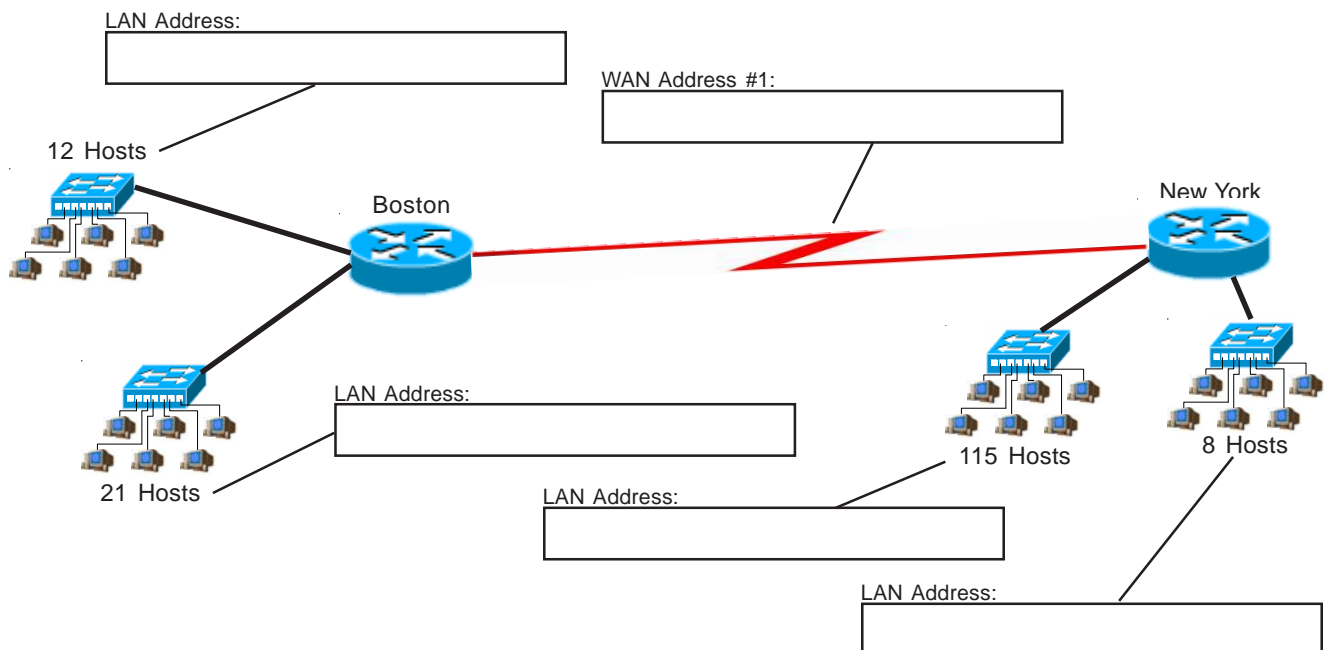


VLSM Addressing

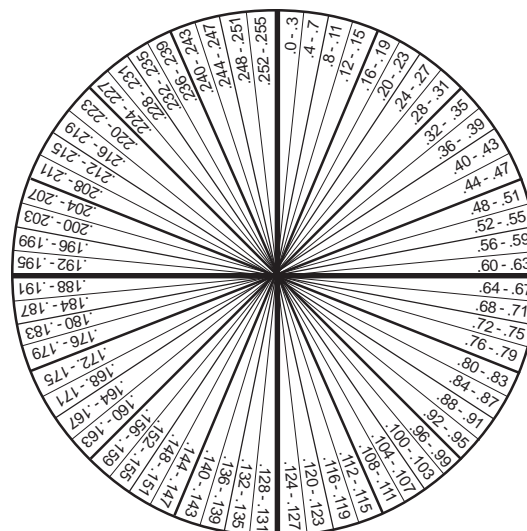
Circle Method

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.

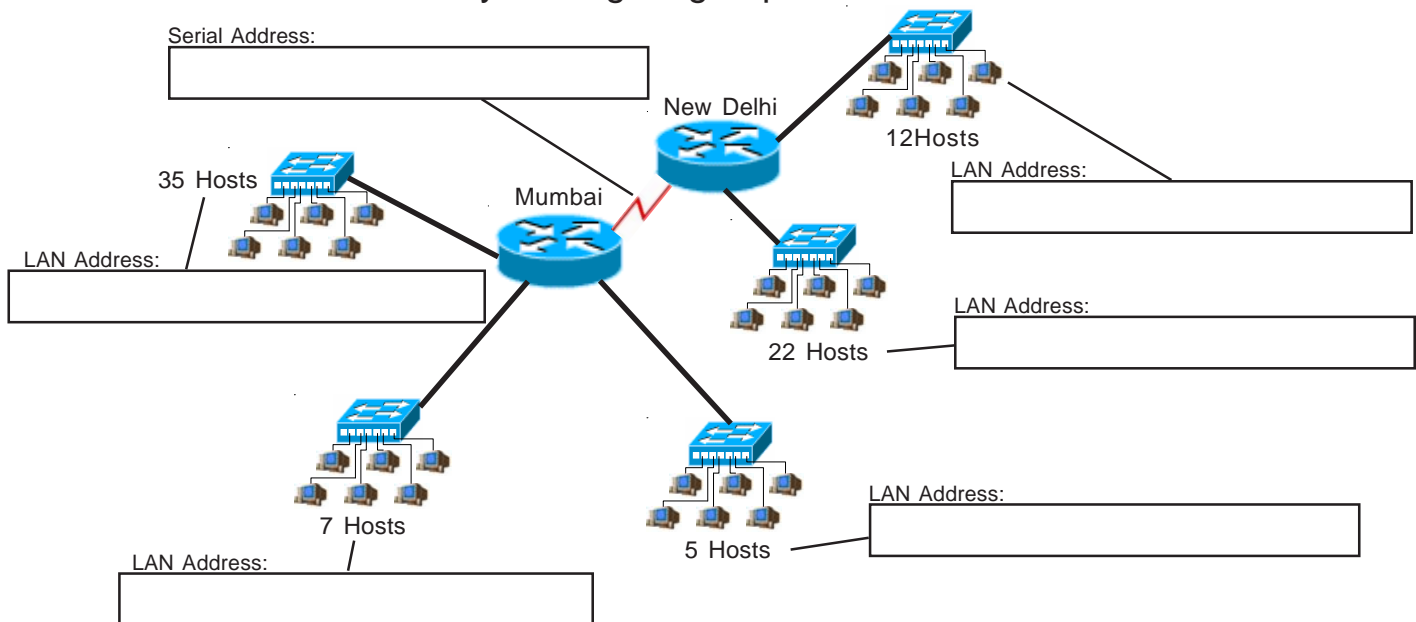


VLSM Addressing

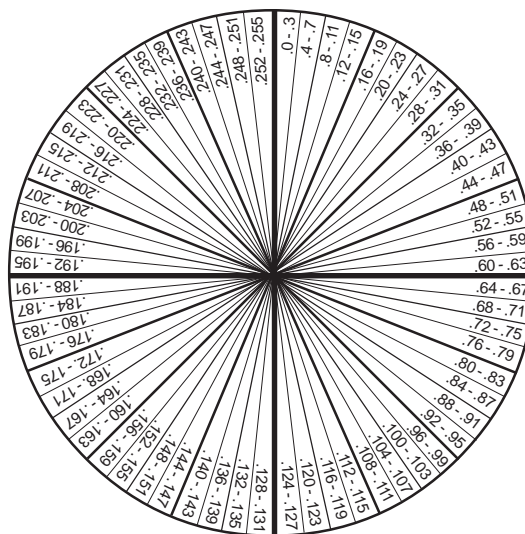
Circle Method

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.

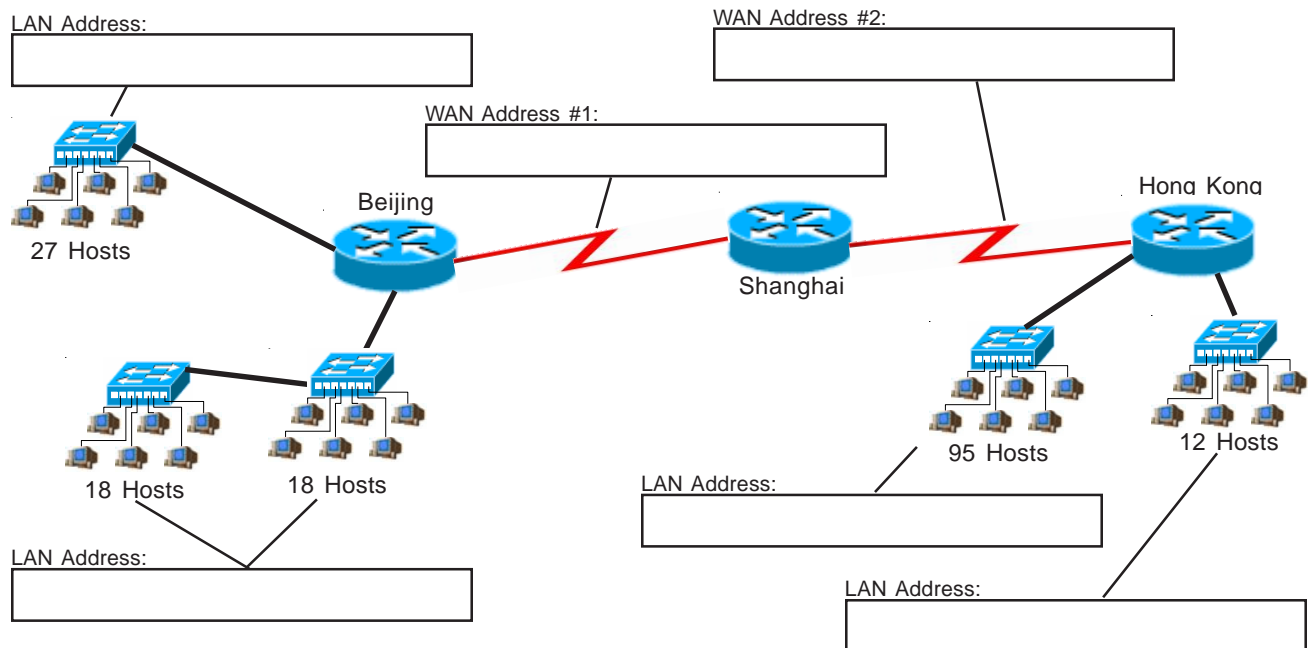


VLSM Addressing

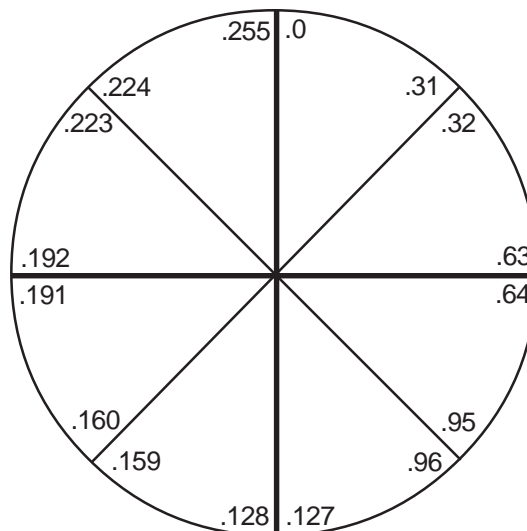
Circle Method

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.

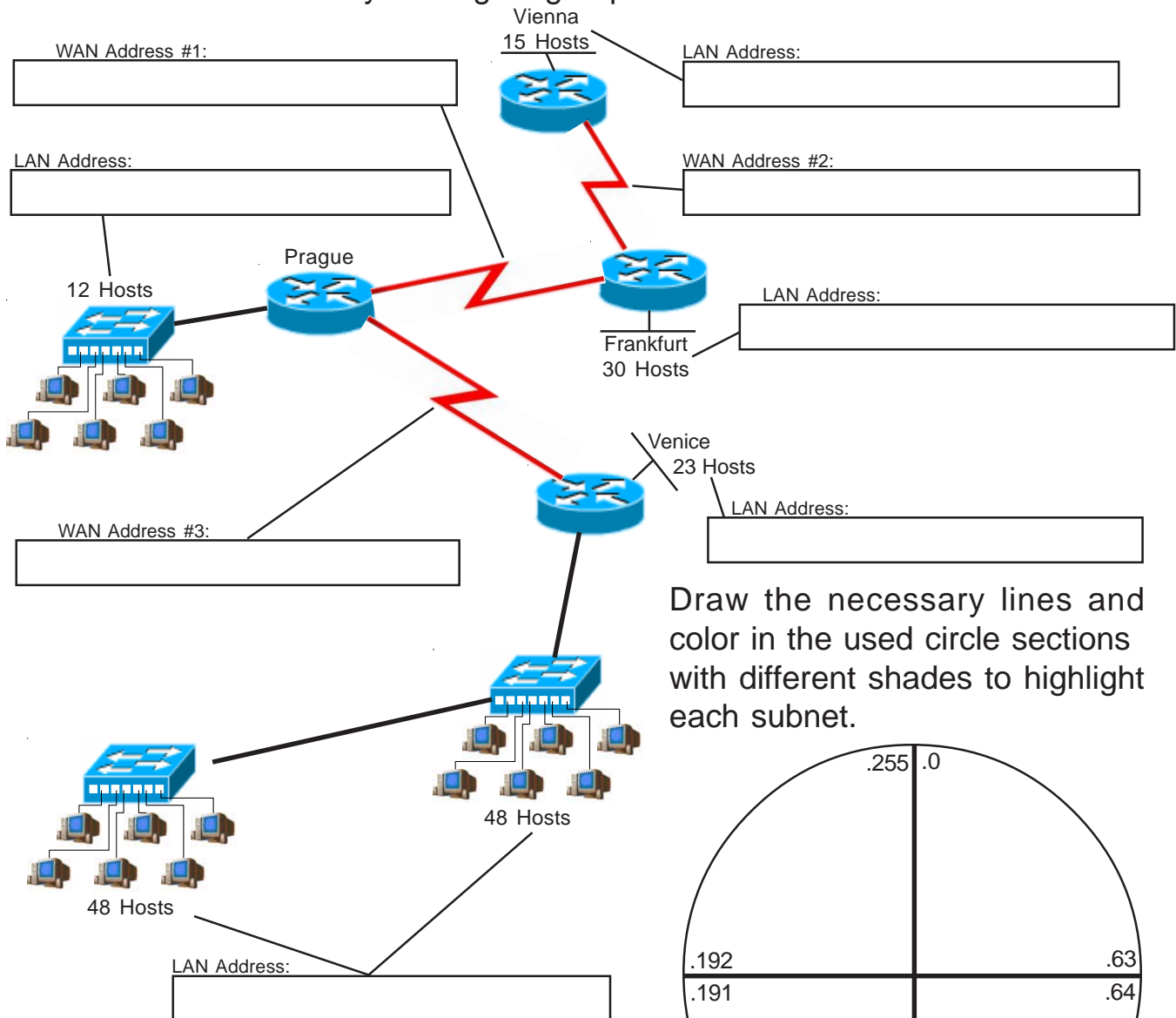


VLSM Addressing

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.

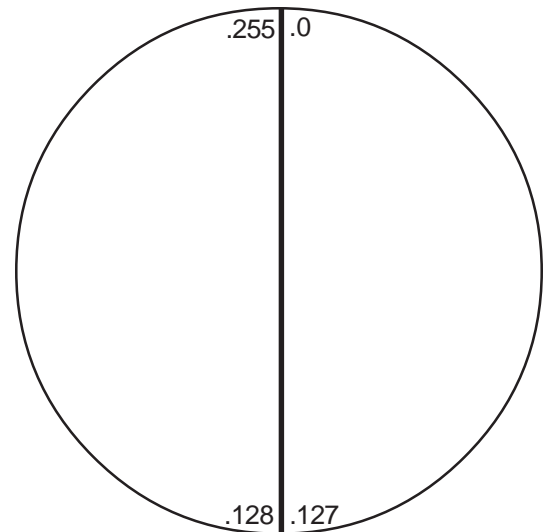
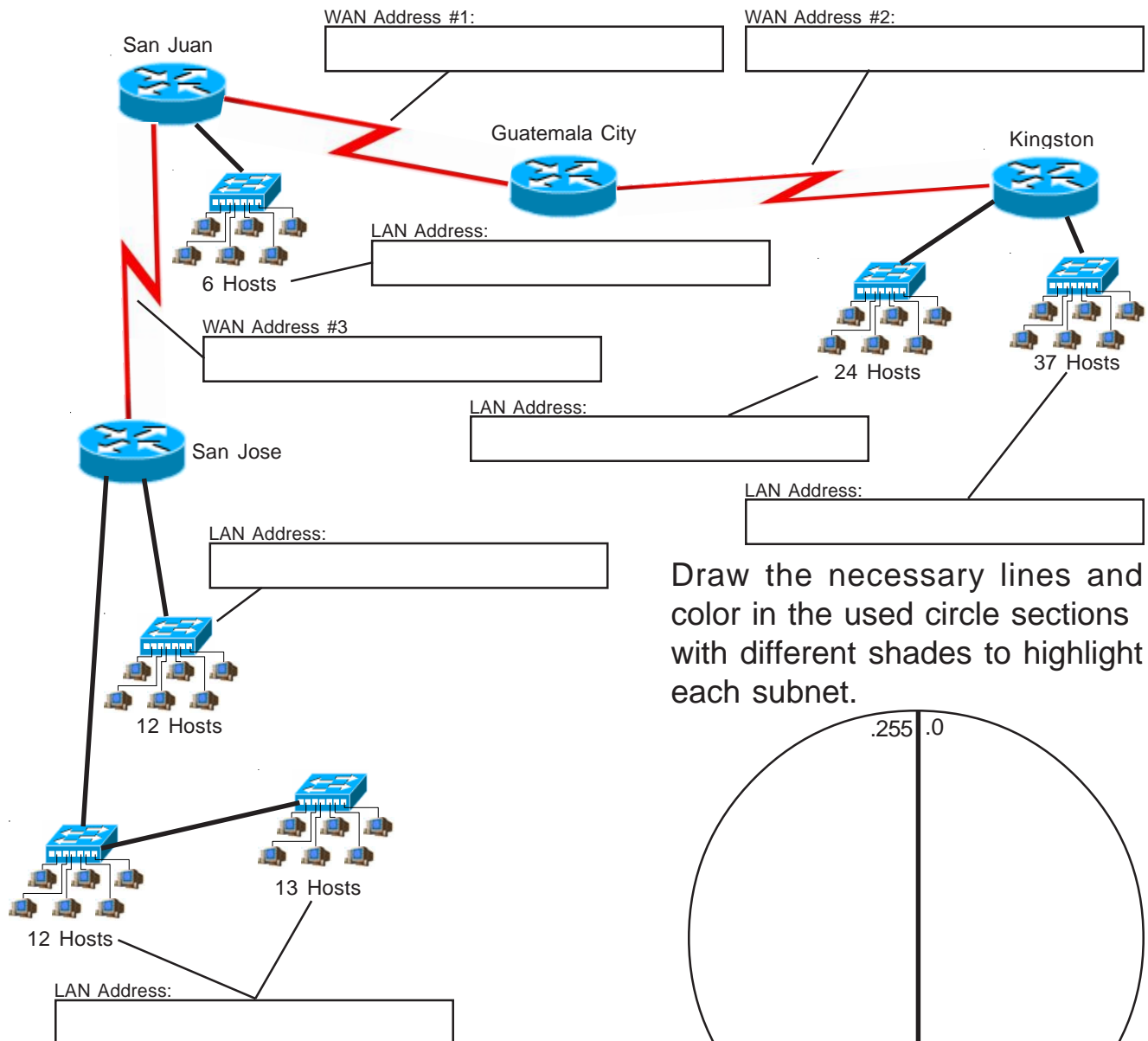


VLSM Addressing

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.

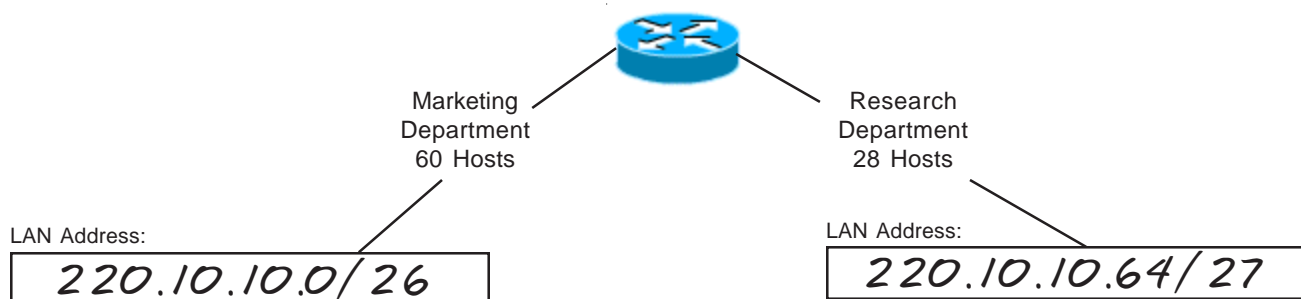
VLSM Addressing

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

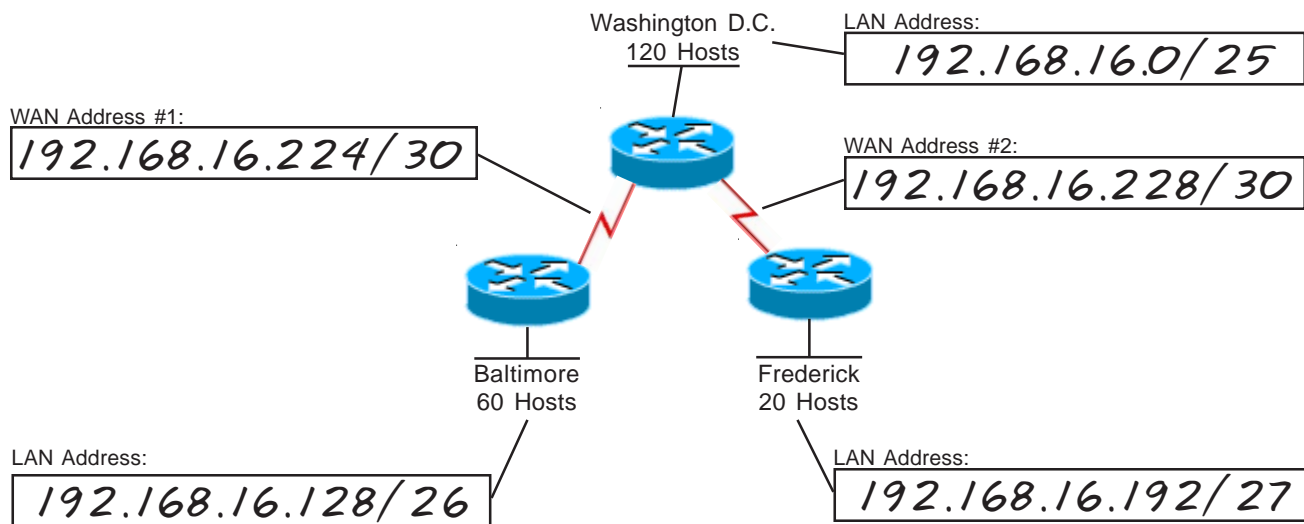
VLSM Addressing

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)

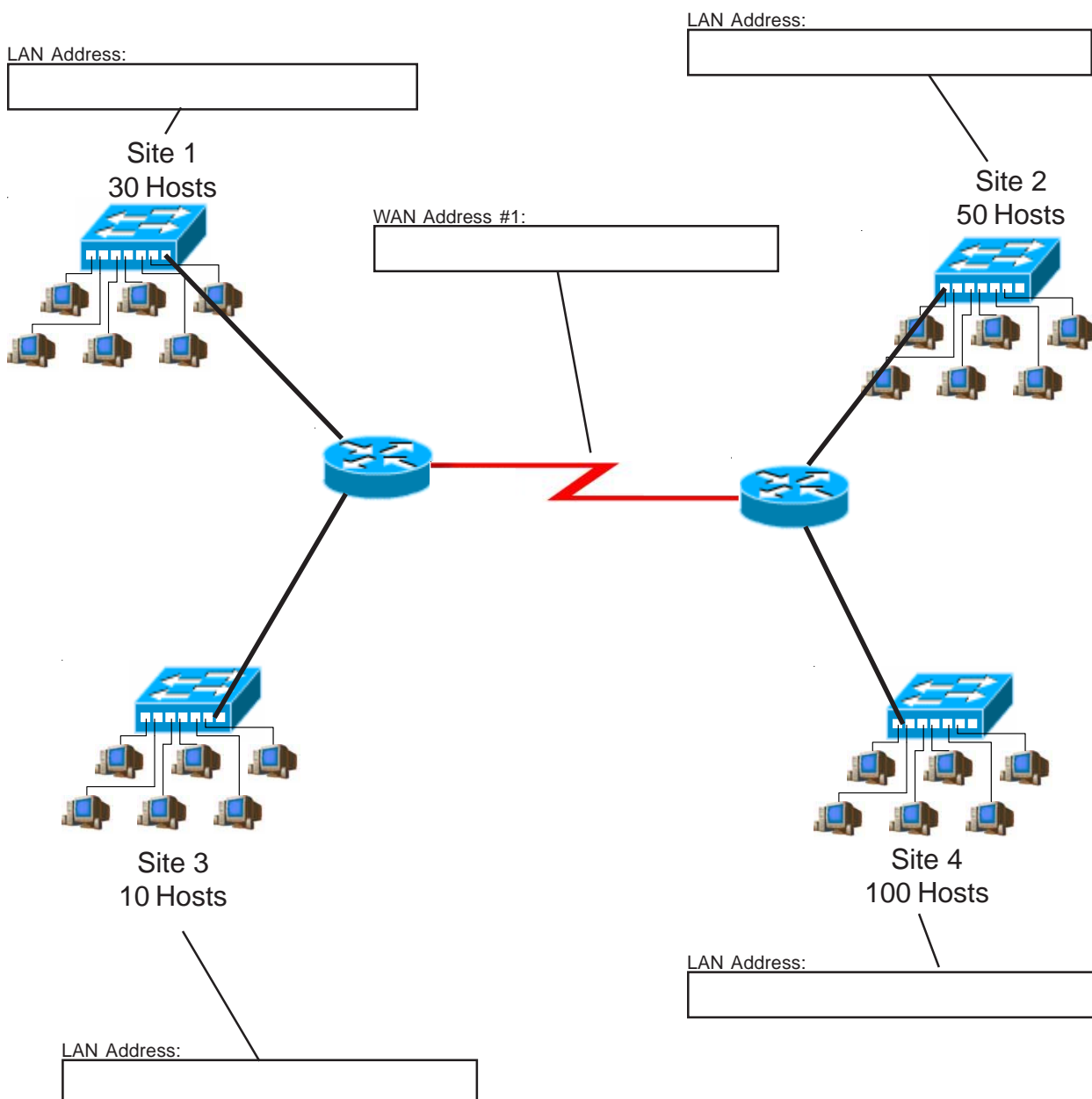
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

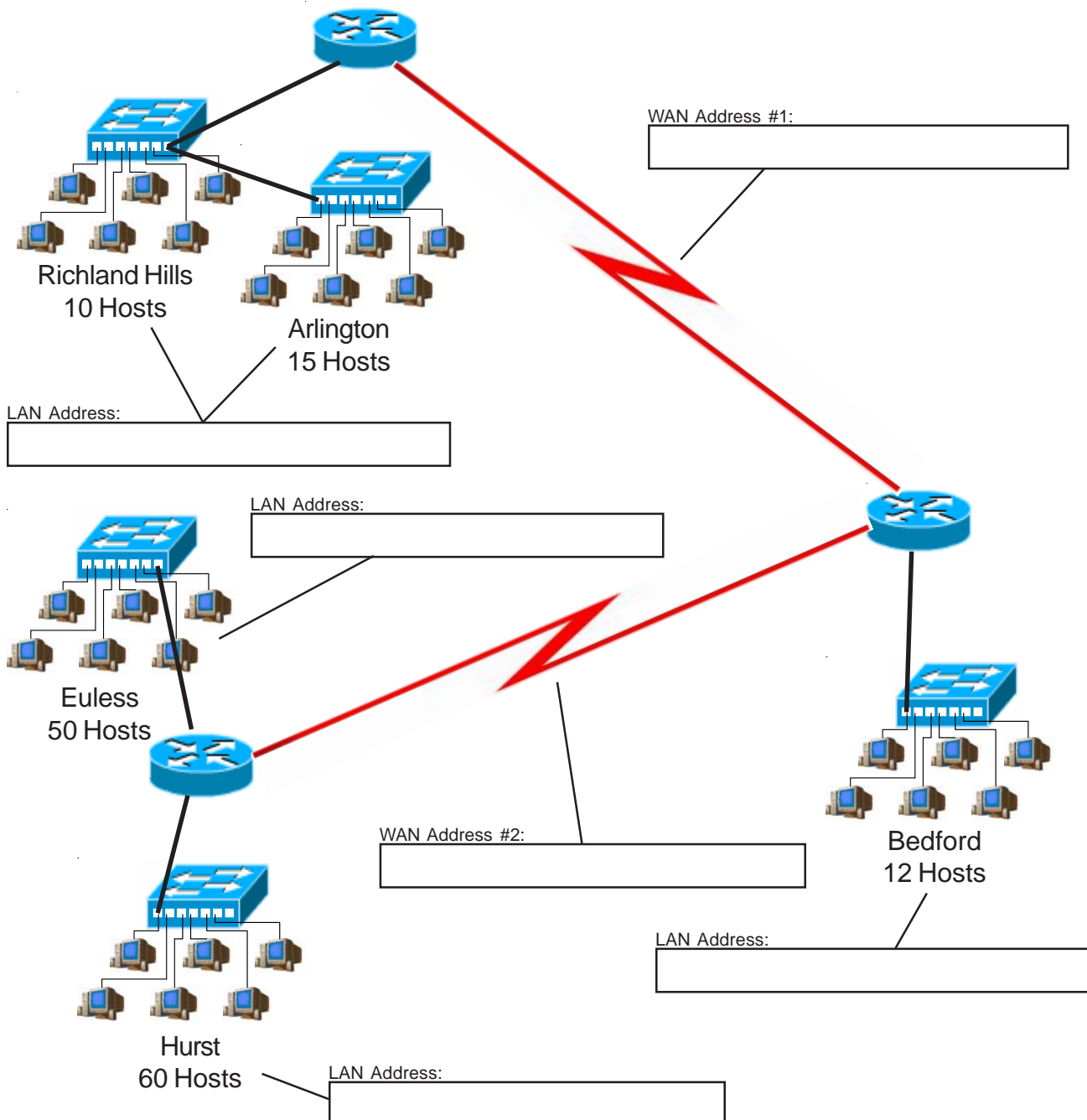
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
					4-7	4-7
				16-31	8-15	8-11
					12-15	12-15
			32-63	32-47	16-23	16-19
					20-23	20-23
					24-31	24-27
					28-31	28-31
				48-63	32-39	32-35
					36-39	36-39
					40-47	40-43
					44-47	44-47
		64-127	64-95	64-79	48-55	48-51
					52-55	52-55
					56-59	56-59
					60-63	60-63
				80-95	64-71	64-67
					68-71	68-71
					72-75	72-75
					76-79	76-79
			96-127	96-111	80-83	80-83
					84-87	84-87
					88-91	88-91
					92-95	92-95
				112-127	96-99	96-99
					100-103	100-103
					104-107	104-107
					108-111	108-111
	128-255	128-191	128-159	128-143	112-115	112-115
					116-119	116-119
				144-159	120-123	120-123
					124-127	124-127
			160-191	160-175	128-131	128-131
					132-135	132-135
				176-191	136-139	136-139
					140-143	140-143
		192-255	192-223	192-207	144-147	144-147
					148-151	148-151
				208-223	152-155	152-155
					156-159	156-159
			224-255	224-239	160-163	160-163
					164-167	164-167
				240-255	168-171	168-171
					172-175	172-175
				248-255	176-179	176-179
					180-183	180-183
				252-255	184-187	184-187
					188-191	188-191
				256-259	192-195	192-195
					196-199	196-199
				260-263	200-203	200-203
					204-207	204-207
				264-267	208-211	208-211
					212-215	212-215
				268-271	216-219	216-219
					220-223	220-223
				272-275	224-227	224-227
					228-231	228-231
				276-279	232-235	232-235
					236-239	236-239
				280-283	240-243	240-243
					244-247	244-247
				284-287	248-251	248-251
					252-255	252-255

VLSM Addressing

VLSM Chart Method

Problem 20

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

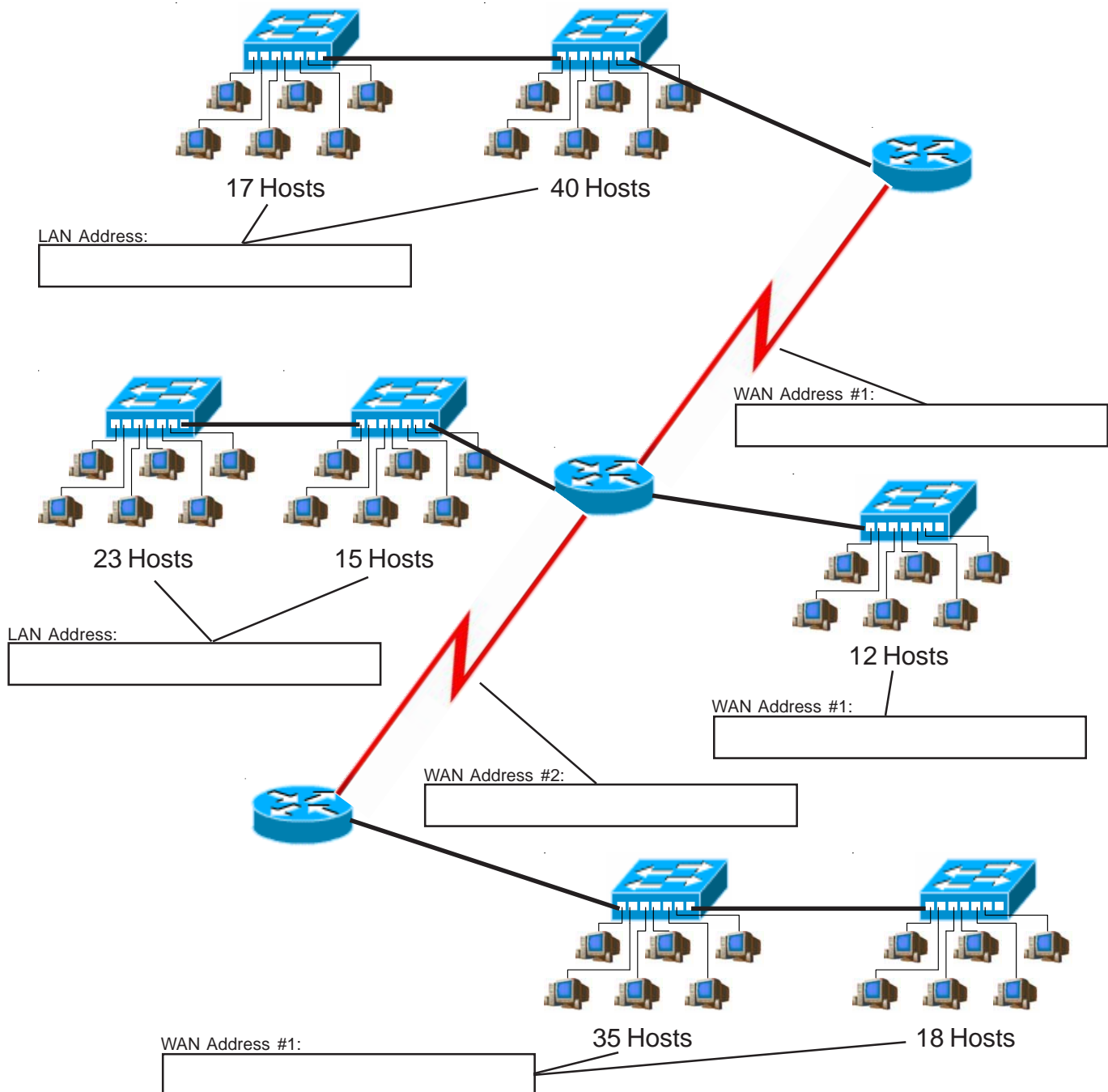
/24	/25	/26	/27	/28	/29	/30			
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts			
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3			
					4-7	4-7			
				16-31	8-15	8-11			
					12-15	12-15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

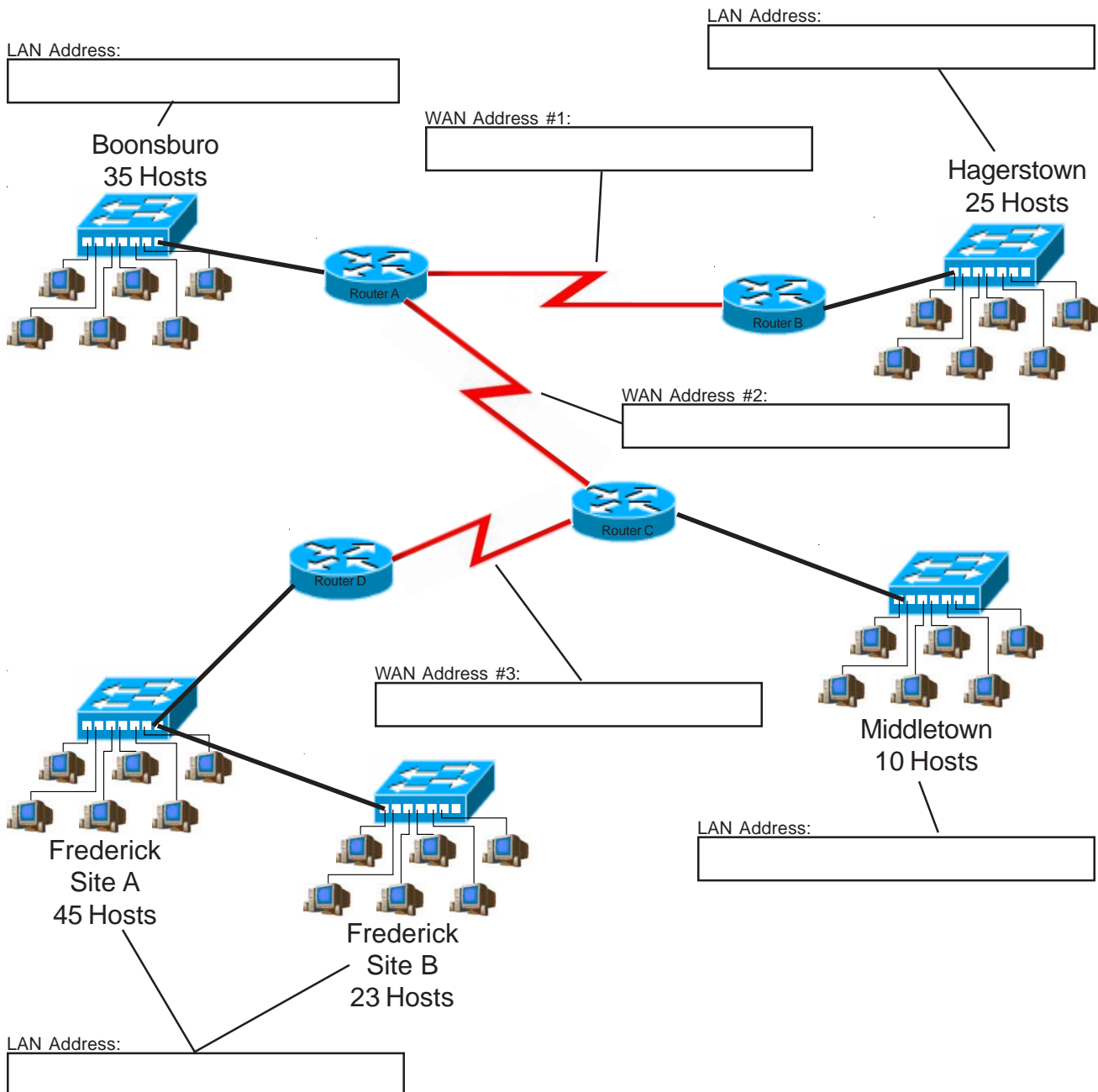
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3 4-7
					8-15	8-11 12-15
				16-31	16-23	16-19 20-23
					24-31	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 22

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

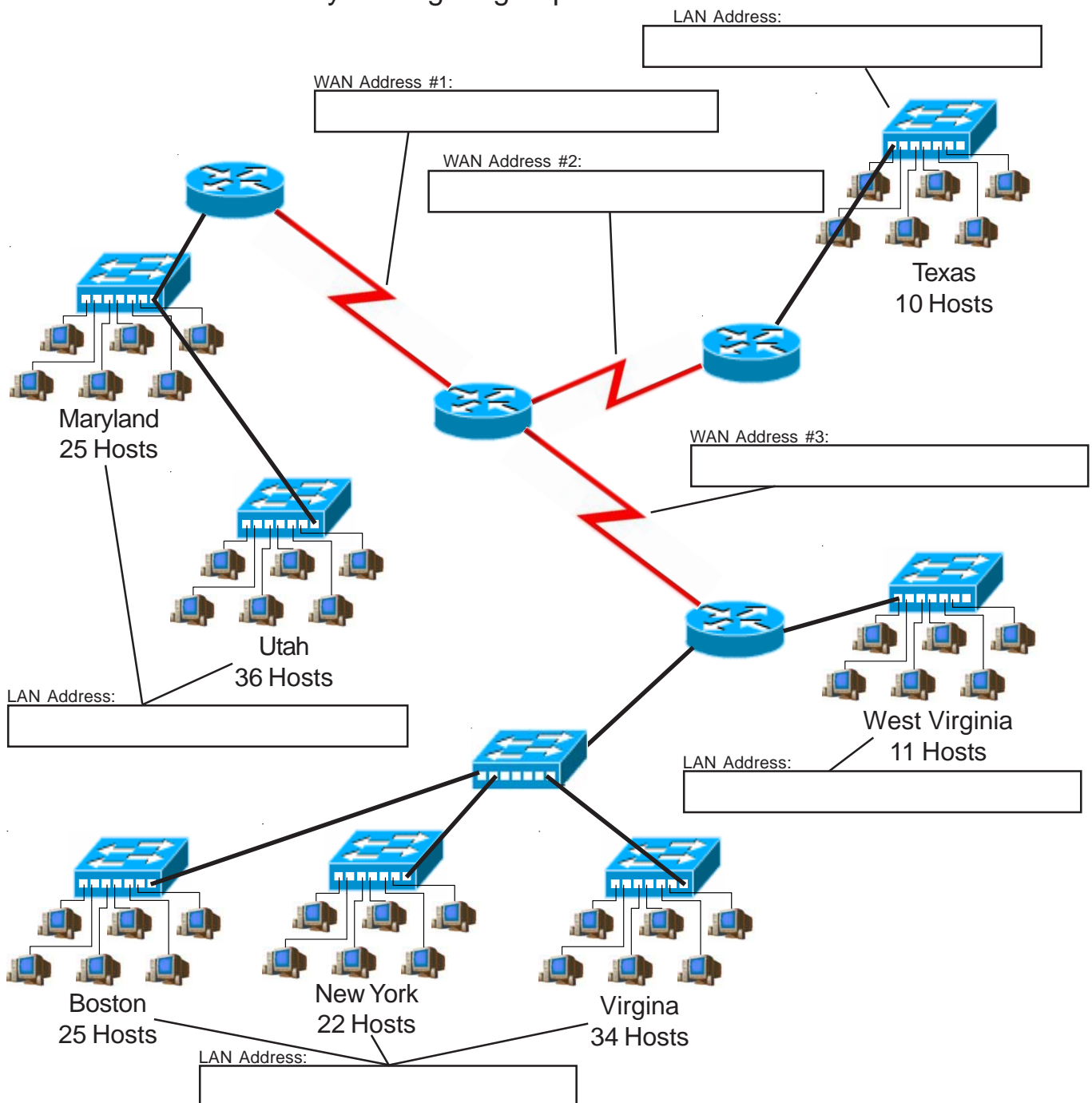
/24	/25	/26	/27	/28	/29	/30
255.255.255.0 256 Hosts	255.255.255.128 128 Hosts	255.255.255.192 64 Hosts	255.255.255.224 32 Hosts	255.255.255.240 16 Hosts	255.255.255.248 8 Hosts	255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						36-39
					40-47	40-43
						44-47
				48-63	48-55	48-51
						52-55
					56-63	56-59
						60-63
		64-127	64-95	64-79	64-71	64-67
						68-71
					72-79	72-75
						76-79
				80-95	80-87	80-83
						84-87
					88-95	88-91
						92-95
			96-127	96-103	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)

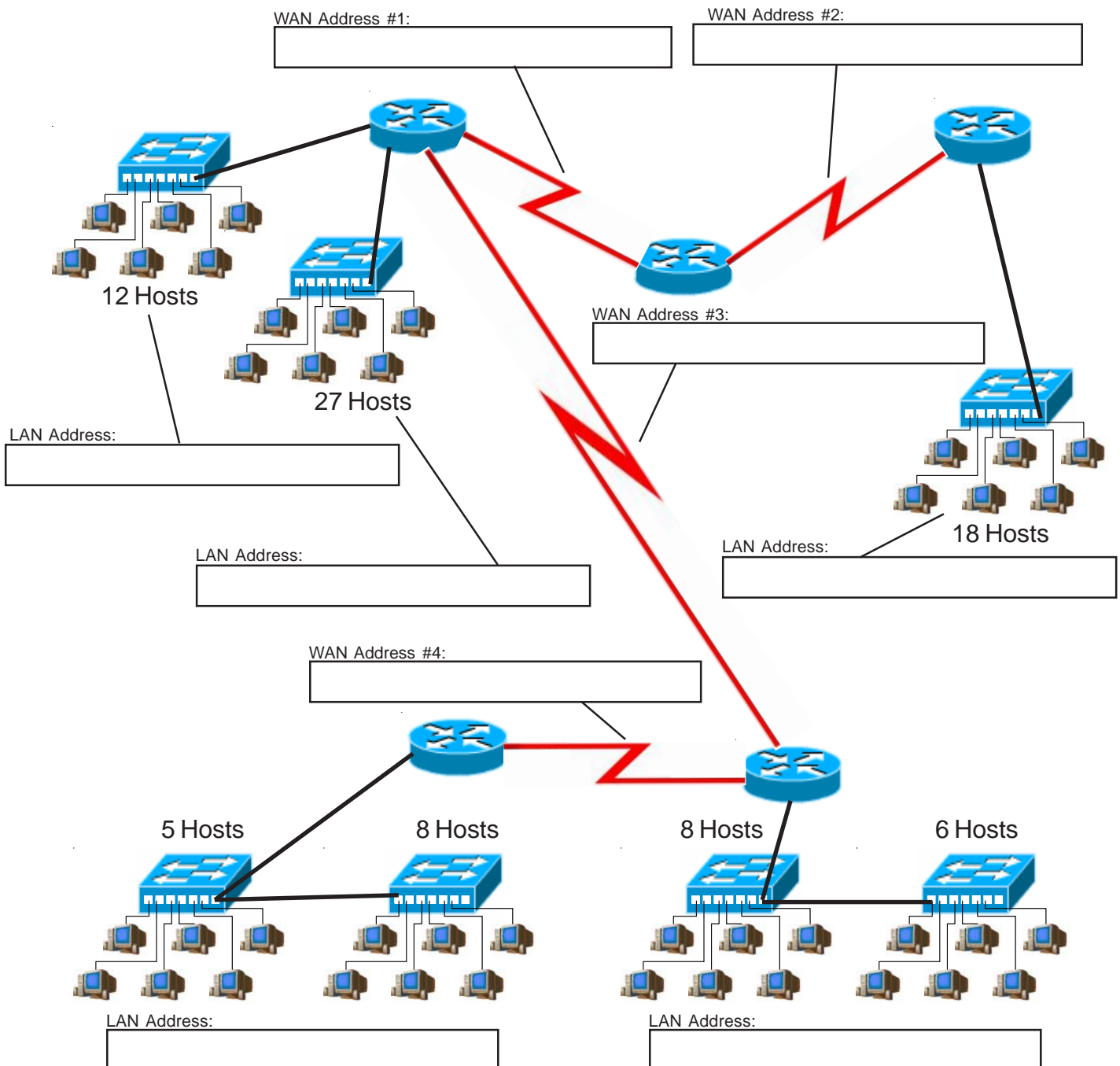
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
					4-7	4-7
				16-31	8-15	8-11
					12-15	12-15
		32-63	32-47	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
		192-255	208-223	208-215	128-131	128-131
					132-135	132-135
				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
			240-255	240-247	176-179	176-179
					180-183	180-183
				248-255	184-187	184-187
					188-191	188-191
			240-255	240-247	192-195	192-195
					196-199	196-199
				248-255	200-203	200-203
					204-207	204-207
			240-255	240-247	208-211	208-211
					212-215	212-215
				248-255	216-219	216-219
					220-223	220-223
			240-255	240-247	224-227	224-227
					228-231	228-231
				248-255	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)

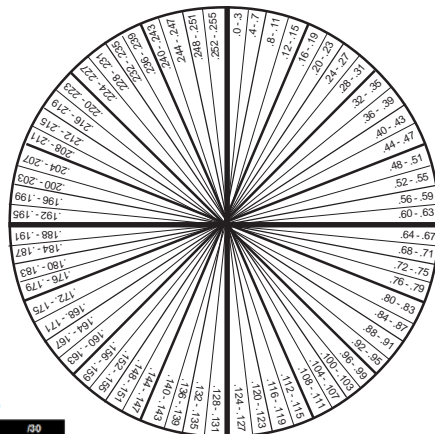
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
					4-7	4-7
				16-31	8-15	8-11
					12-15	12-15
		32-63	32-47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

Practical VLSM

Problems

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

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



VLSM Chart 24-30 Bits (4th octet)

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

VLSM Addressing

(Sample)

Problem 25

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

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

VLSM Addressing

(Sample)

Problem 26

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

Subnet	Subnet Address	Subnet Mask (/X)	First Usable Host	Last Usable Host	Broadcast Address
1	220.55.80.0	/ 27	220.55.80.1	220.55.80.30	220.55.80.31
2	220.55.80.32	/ 27	220.55.80.	220.55.80.62	220.55.80.63
3	220.55.80.64	/ 28	220.55.80.65	220.55.80.78	220.55.80.79
4	220.55.80.80	/ 30	220.55.80.81	220.55.80.82	220.55.80.83
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

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)

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

VLSM

with

Class A and B Addresses

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

Sample Problem 35

Part 1 of 3

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

ISP Addresses 15.**0**.0.0

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

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	6-7			
						16-31	16-19	8-9		
							20-23	10-11		
				24-31			24-27	12-13		
							28-31	14-15		
					32-63		32-47	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		
				56-63			56-59	28-29		
							60-63	30-31		
						64-127	64-95	64-79	64-71	32-33
									68-71	34-35
			72-79						72-75	36-37
									76-79	38-39
				80-95	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	
					112-119		112-115	56-57		
							116-119	58-59		
			120-127				120-123	60-61		
							124-127	62-63		
				128-255			128-191	128-143	128-131	64-65
									132-135	66-67
					136-143				136-139	68-69
									140-143	70-71
		144-151	144-147						72-73	
			148-151						74-75	
			152-159					152-155	76-77	
								156-159	78-79	
					160-191	160-175		160-163	80-81	
								164-167	82-83	
		168-175						168-171	84-85	
								172-175	86-87	
			176-183				176-179	88-89		
							180-183	90-91		
						192-255	192-223	192-207	192-199	92-93
									200-207	94-95
		208-215							96-97	
		208-223						216-219	98-99	
			220-223					100-101		
			224-255					224-239	224-231	102-103
					232-235		104-105			
					240-247		240-243		106-107	
							244-247		108-109	
		248-255					248-251		110-111	
				252-255			112-113			

VLSM

with

Class A and B Addresses

Sample Problem 35

Part 2 of 3

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

ISP Addresses 15.208.0.0

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

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

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

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)

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

VLSM

with

Class A and B Addresses

Problem 36

Part 1 of 3

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

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

School System Address 172.32.0.0

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
North High	2,400		
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	/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				
				16-31	16-23	16-19	8-9				
					24-31	20-23	10-11				
			32-63	32-47	32-39	32-35	12-13				
						40-43	14-15				
					40-47	44-47	16-17				
						48-51	18-19				
					48-55	52-55	20-21				
						56-63	60-63	22-23			
		64-95		64-71	64-71	64-67	24-25				
						68-71	26-27				
					72-79	72-75	28-29				
				76-79		30-31					
				80-95		80-87	80-83	80-81	32-33		
					84-87			34-35			
		88-95	88-91		36-37						
			92-95		38-39						
			96-111		96-103	96-99	96-97	40-41			
		100-103					42-43				
		104-111		104-107		44-45					
				108-111	46-47						
				112-127	112-119	112-115	116-117	48-49			
		116-119					50-51				
		120-127	120-123			52-53					
			124-127		54-55						
			128-255		128-191	128-159	128-143	128-135	56-57		
		136-143						58-59			
		144-159		144-147				60-61			
				148-151			62-63				
				152-159			152-155	64-65			
		156-159					66-67				
		160-191				160-175	160-167	160-163	68-69		
				164-167				70-71			
				168-175			168-171	72-73			
						172-175	74-75				
						176-191	176-183	176-179	180-183	76-77	
				184-187					78-79		
		184-191		184-187				80-81			
				188-191			82-83				
				192-255			192-223	192-207	192-199	84-85	
		200-207							86-87		
		208-223				208-215			88-89		
						216-223			90-91		
						224-239			224-231	224-227	92-93
										228-231	94-95
								232-235		96-97	
								240-255	240-247	240-243	98-99
		244-247								100-101	
		248-255								248-251	102-103
					252-255	104-105					
					224-255	224-239			224-231	228-231	106-107
		232-235					108-109				
		240-247					240-243	110-111			
							248-255	248-251	112-113		
								252-255	114-115		
		240-255						240-247	240-243	244-247	116-117
						248-251	118-119				
	248-255					252-255	120-121				
						244-247	244-243		248-249	122-123	
									252-253	124-125	
	252-255								254-255	126-127	

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

VLSM

with

Class A and B Addresses

Problem 37

Part 3 of 3

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

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

Office #7
Address Range 110.128.**80.0** to 110.128.**81.255**

Customer Name	Number of Addresses	Address Range	CIDR
1st Floor	125		
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	4-7
				16-31	8-15	8-11
					12-15	12-15
			32-63	32-47	16-23	16-19
					20-23	20-23
					24-31	24-27
					28-31	28-31
				48-63	32-39	32-35
					36-39	36-39
					40-47	40-43
					44-47	44-47
		64-127	64-95	64-79	48-55	48-51
					52-55	52-55
					56-59	56-59
					60-63	60-63
				80-95	64-71	64-67
					68-71	68-71
					72-75	72-75
					76-79	76-79
			96-127	96-111	80-83	80-83
					84-87	84-87
					88-91	88-91
					92-95	92-95
				112-127	96-99	96-99
					100-103	100-103
					104-107	104-107
					108-111	108-111
	128-255	128-191	128-159	128-143	112-119	112-115
					116-119	116-119
				144-159	120-127	120-123
					124-127	124-127
			160-191	160-175	128-131	128-131
					132-135	132-135
				176-191	136-139	136-139
					140-143	140-143
		192-255	192-223	192-207	144-147	144-147
					148-151	148-151
				208-223	152-155	152-155
					156-159	156-159
			224-255	224-239	160-163	160-163
					164-167	164-167
				240-255	168-171	168-171
					172-175	172-175
				248-255	176-179	176-179
					180-183	180-183
				252-255	184-187	184-187
					188-191	188-191
				256-259	192-195	192-195
					196-199	196-199
				260-263	200-203	200-203
					204-207	204-207
				264-267	208-211	208-211
					212-215	212-215
				268-271	216-219	216-219
					220-223	220-223
				272-275	224-227	224-227
					228-231	228-231
				276-279	232-235	232-235
					236-239	236-239
				280-283	240-243	240-243
					244-247	244-247
				284-287	248-251	248-251
					252-255	252-255

VLSM

with

Class A and B Addresses

Problem 38

Part 1 of 4

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

Addresses 75.0.0.0

Customer Name	Number of Addresses	Address Range	CIDR
United States	6.5 million		
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)

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

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

VLSM

with

Class A and B Addresses

Sample Problem 38

Part 3 of 4

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

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

ISP Addresses 75.104.0.0 to 75.111.255.255

Customer Name	Number of Addresses	Address Range	CIDR
Office #1	60,000		
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)

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

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)

[illegible]

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

[illegible]

Class A Addresses

VLSM Chart 8-15 Bits (2nd octet)

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

Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

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

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

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

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