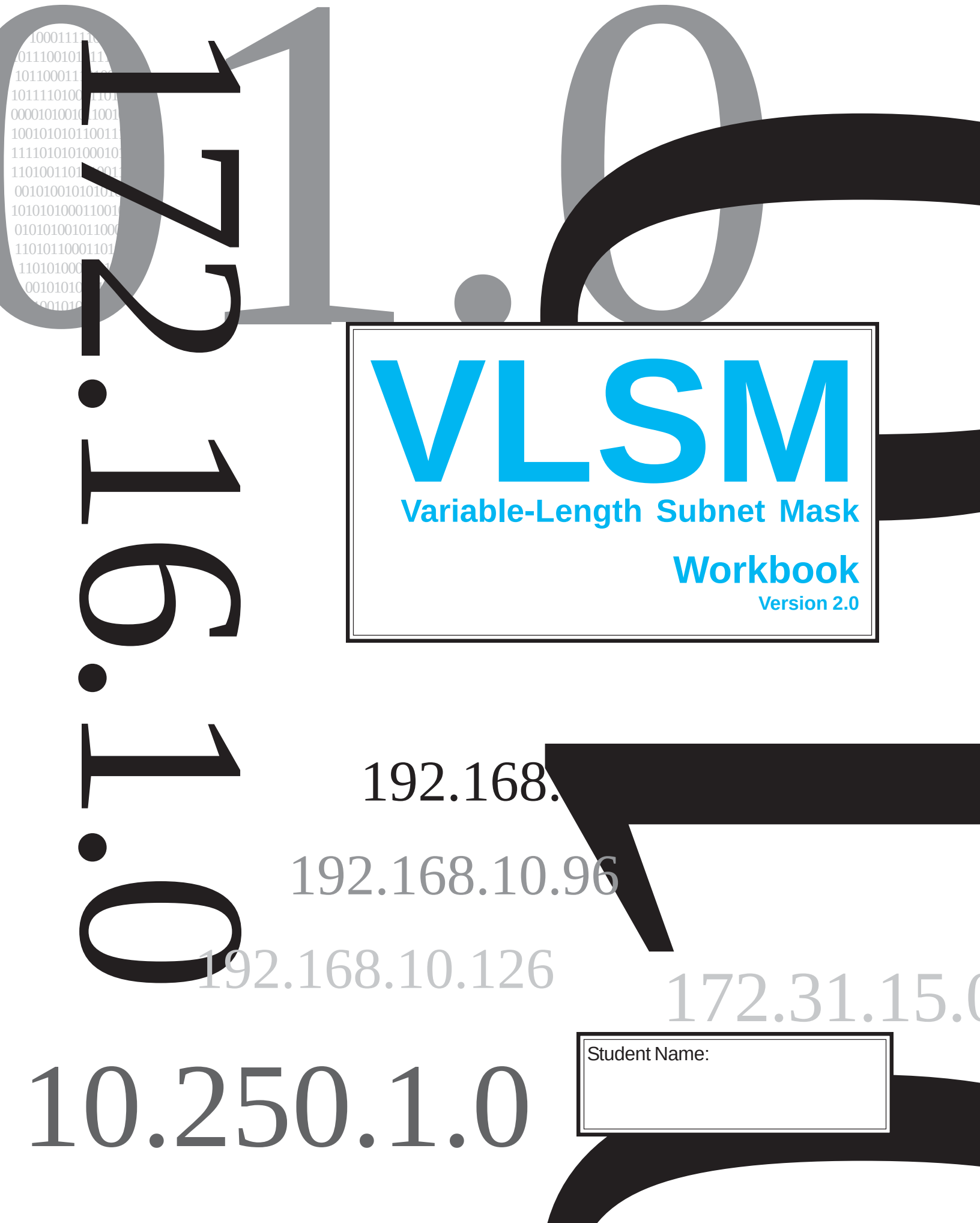

VLSM

Variable-Length Subnet Mask

Workbook

Version 2.0

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

Workbooks included in the series:

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

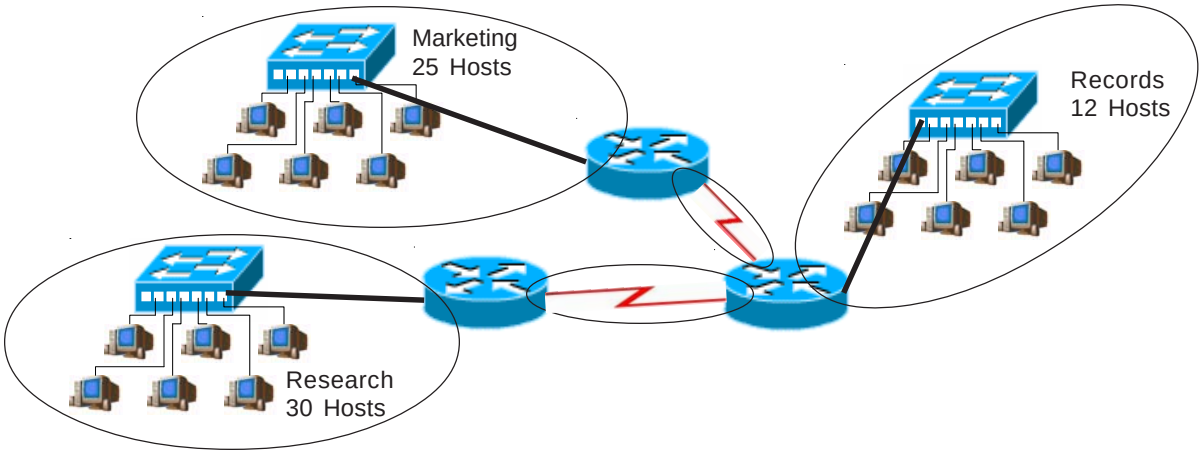
This workbook explores three different methods to figure out sub-subnets: the box method, the circle method, and a VLSM chart.

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

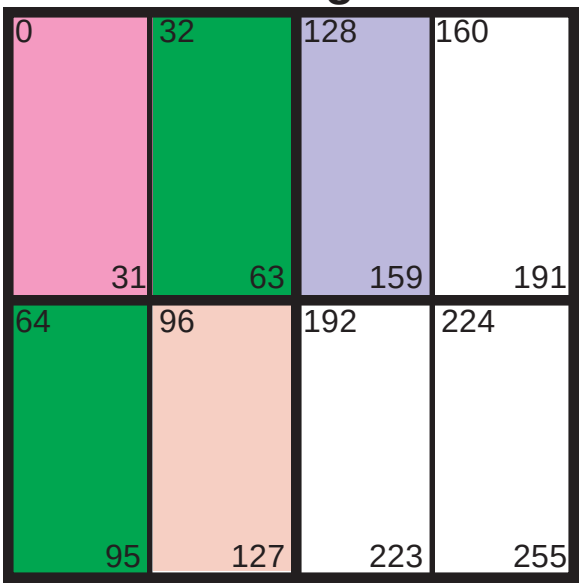


Classful Subnet Ranges

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

The Box Method for visualizing subnets

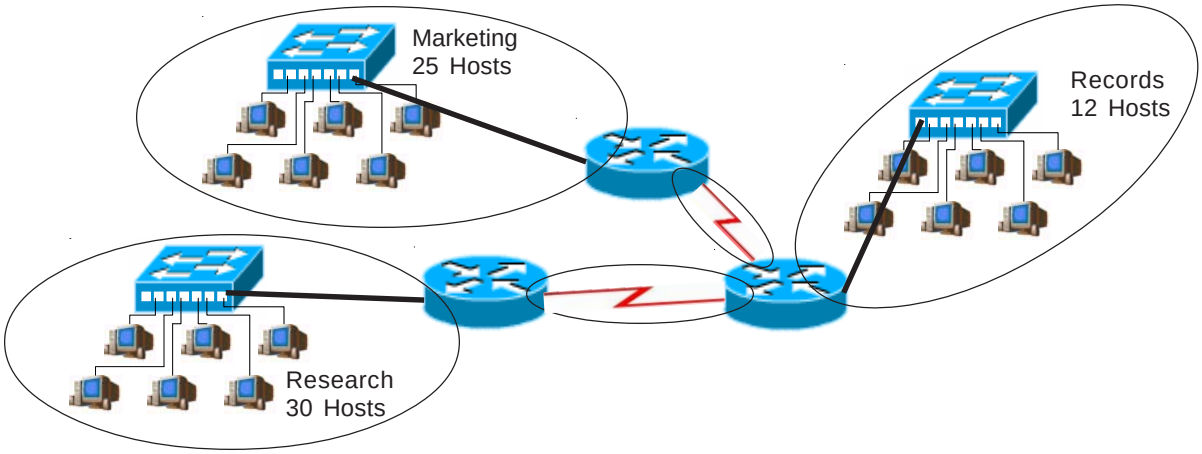


Classless Subnetting Example

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

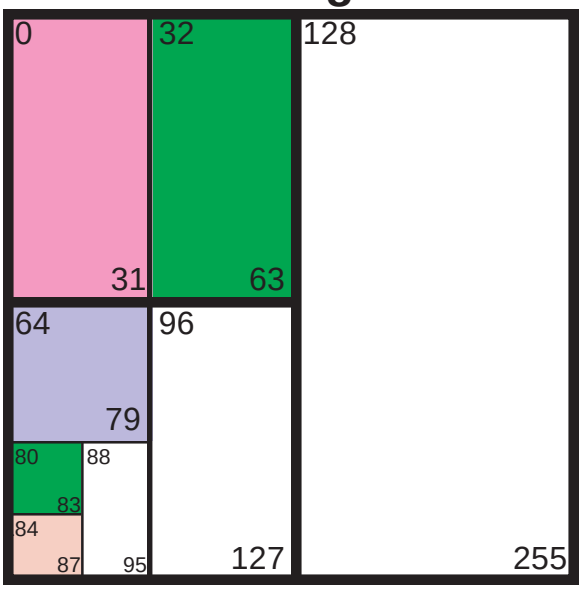


By adjusting the subnet masks you can cut your address usage by almost half in this example. This type of subnetting requires a network protocol which will support it such as: RIP version 2, EIGRP, OSPF, or BGP.

Classless Subnet Ranges

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

The Box Method for visualizing subnets

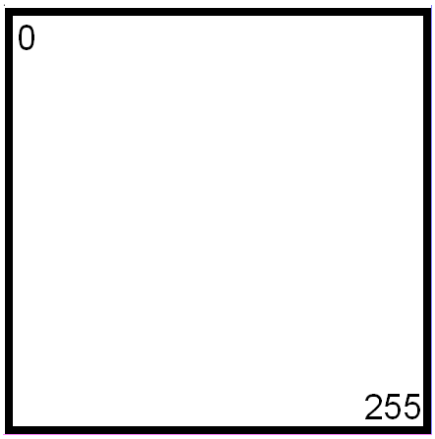


Visualizing Subnets Using The Box Method

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.

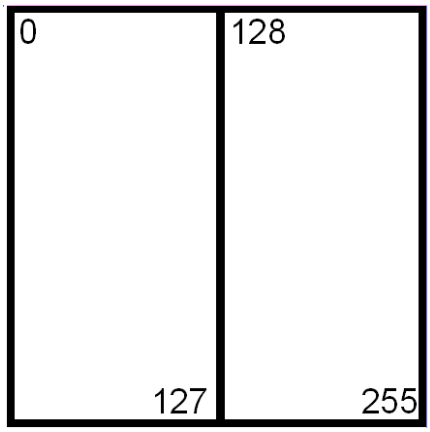
Start with a square. The whole square is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



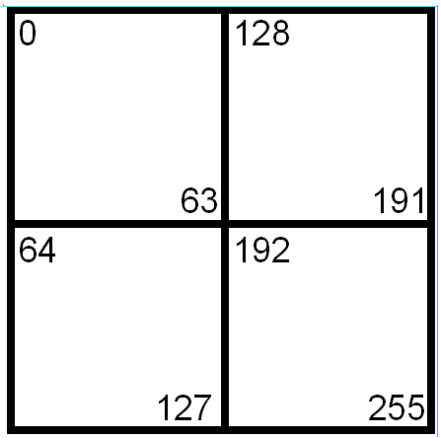
Split the box in half and you get two subnets with 128 addresses.

/25
255.255.255.128
128 Hosts
2 Subnets



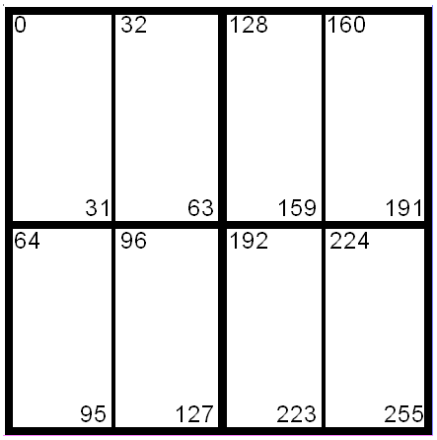
Divide the box into quarters and you get four subnets with 64 addresses.

/26
255.255.255.192
64 Hosts
4 Subnets



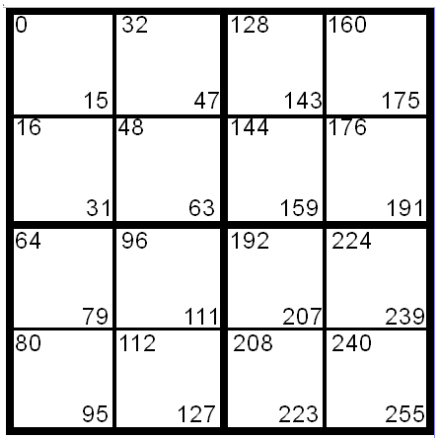
Split each individual square and you get eight subnets with 32 addresses.

/27
255.255.255.224
32 Hosts
8 Subnets



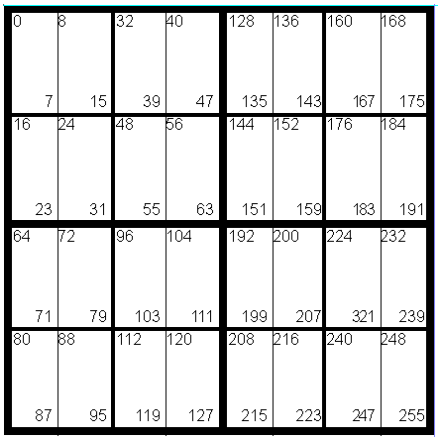
Split the boxes in half again and you get sixteen subnets with sixteen addresses.

/28
255.255.255.240
16 Hosts
16 Subnets



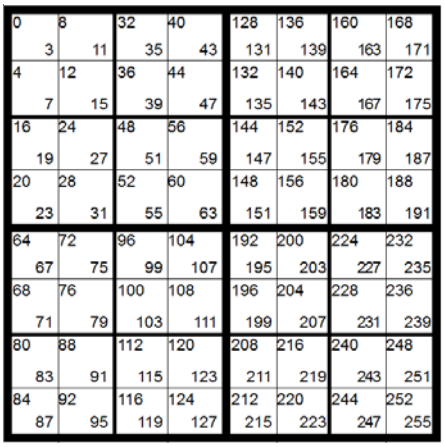
The next split gives you thirty two subnets with eight addresses.

/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



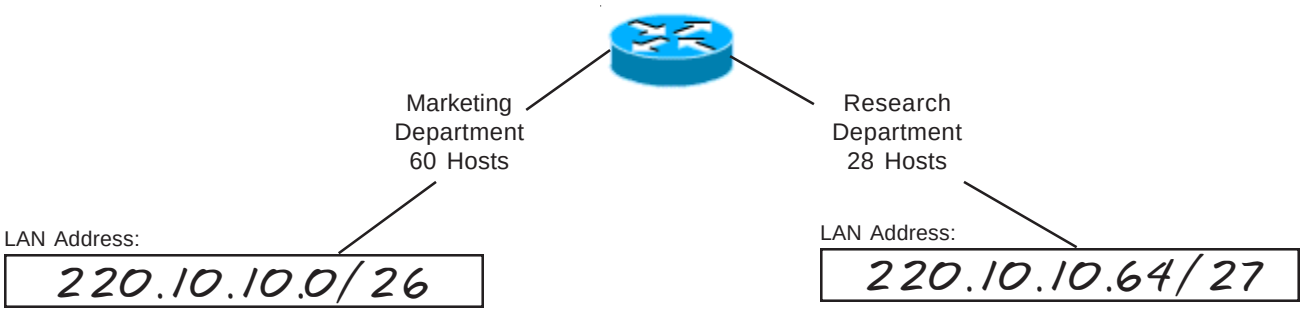
VLSM Addressing

Box Method

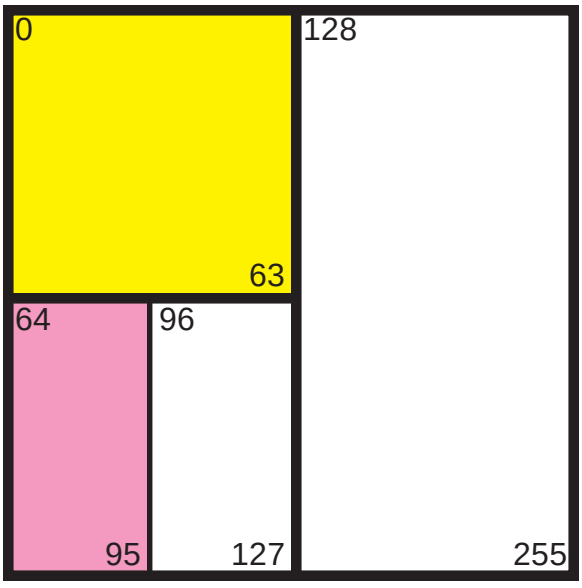
(Sample)

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.



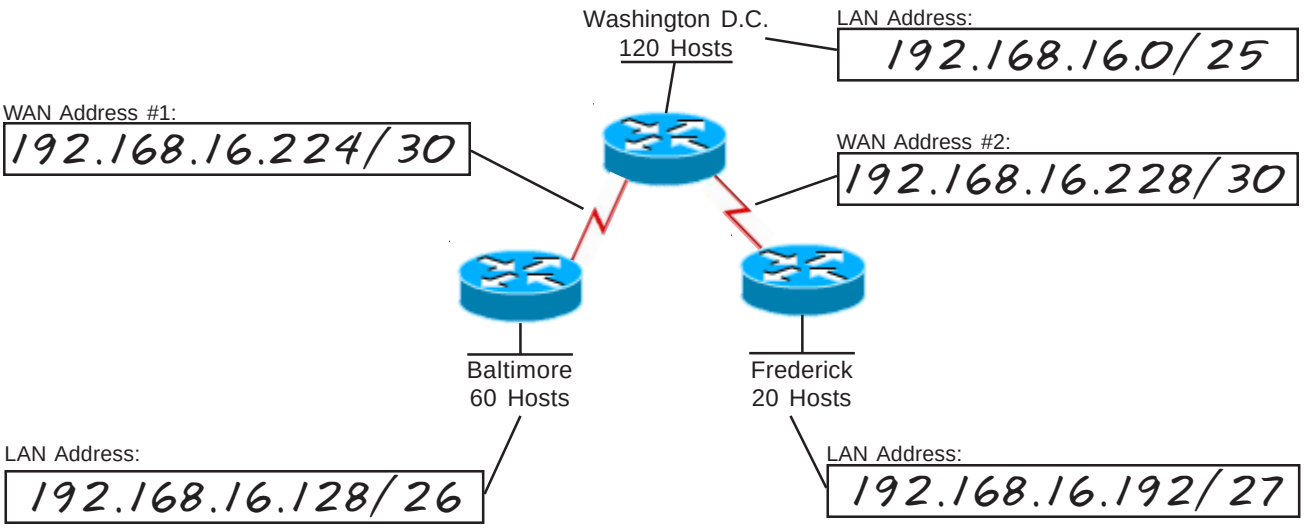
VLSM Addressing

Box Method

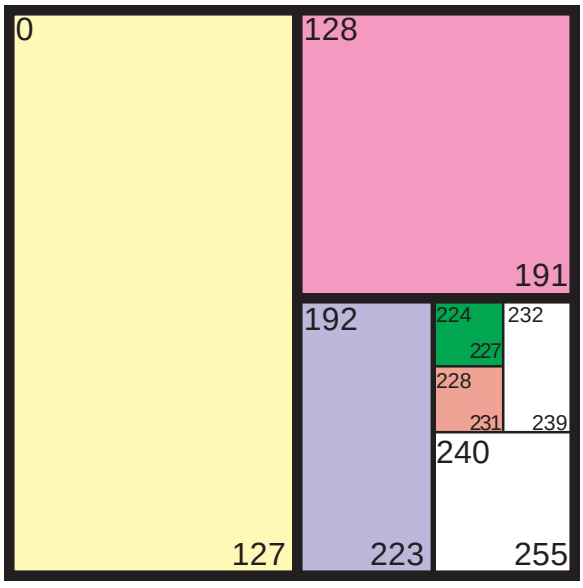
(Sample)

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.

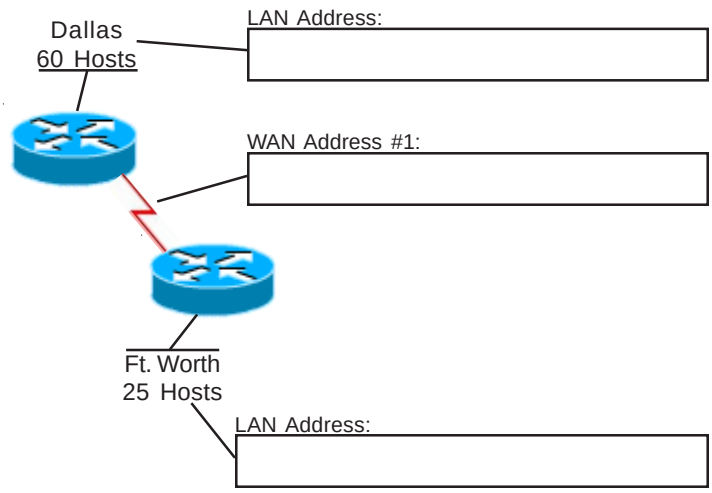


VLSM Addressing

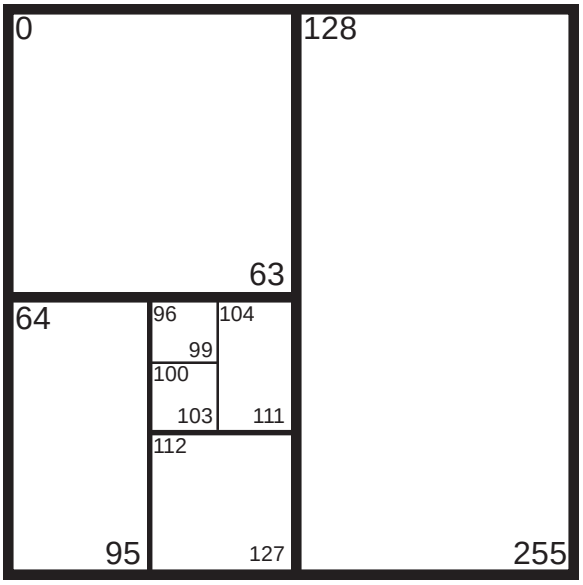
Box Method

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.

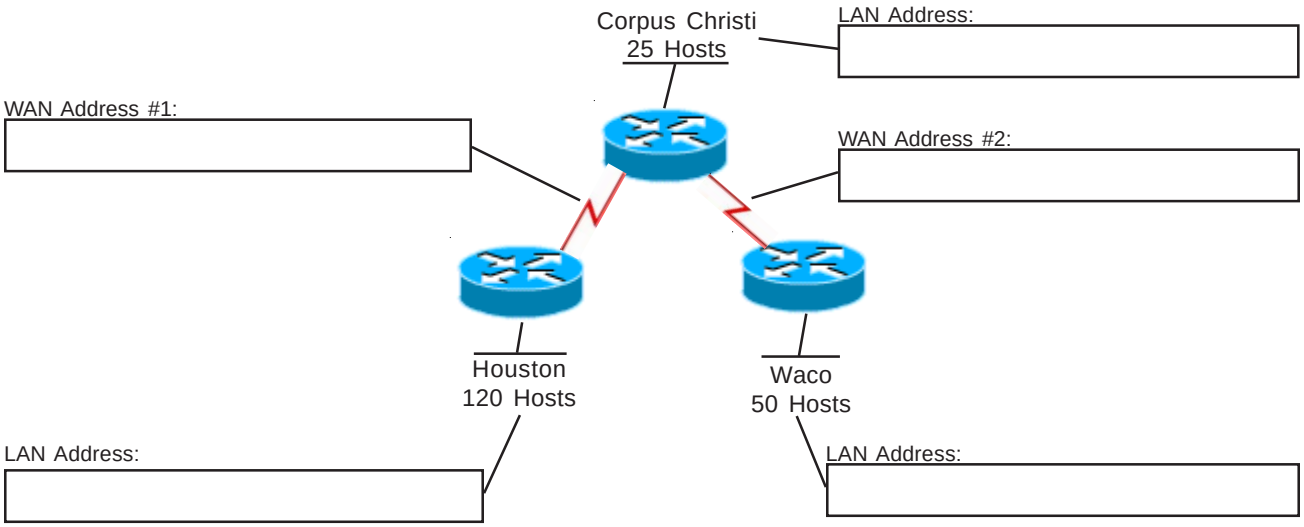


VLSM Addressing

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.

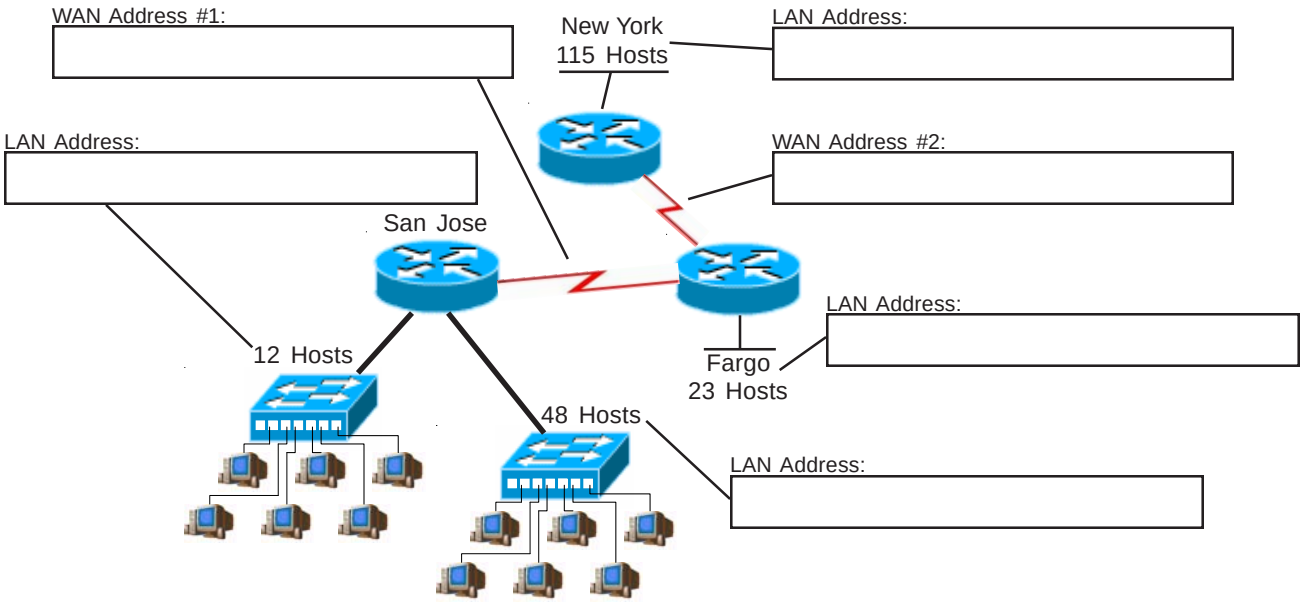
0 3	8 11	32 35	40 43	128 131	136 139	160 163	168 171
4 7	12 15	36 39	44 47	132 135	140 143	164 167	172 175
16 19	24 27	48 51	56 59	144 147	152 155	176 179	184 187
20 23	28 31	52 55	60 63	148 151	156 159	180 183	188 191
64 67	72 75	96 99	104 107	192 195	200 203	224 227	232 235
68 71	76 79	100 103	108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

VLSM Addressing

Box Method

Problem 5

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



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

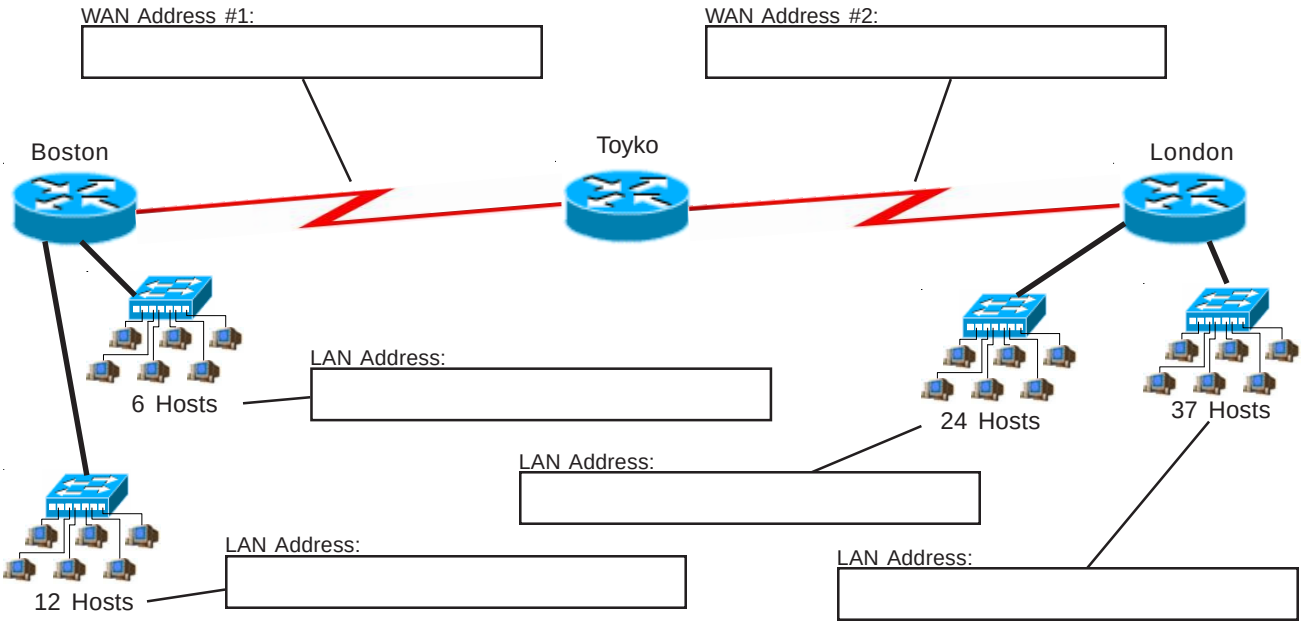
0 3	8 11	32 35	40 43	128 131	136 139	160 163	168 171
4 7	12 15	36 39	44 47	132 135	140 143	164 167	172 175
16 19	24 27	48 51	56 59	144 147	152 155	176 179	184 187
20 23	28 31	52 55	60 63	148 151	156 159	180 183	188 191
64 67	72 75	96 99	104 107	192 195	200 203	224 227	232 235
68 71	76 79	100 103	108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

VLSM Addressing

Box Method

Problem 6

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



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

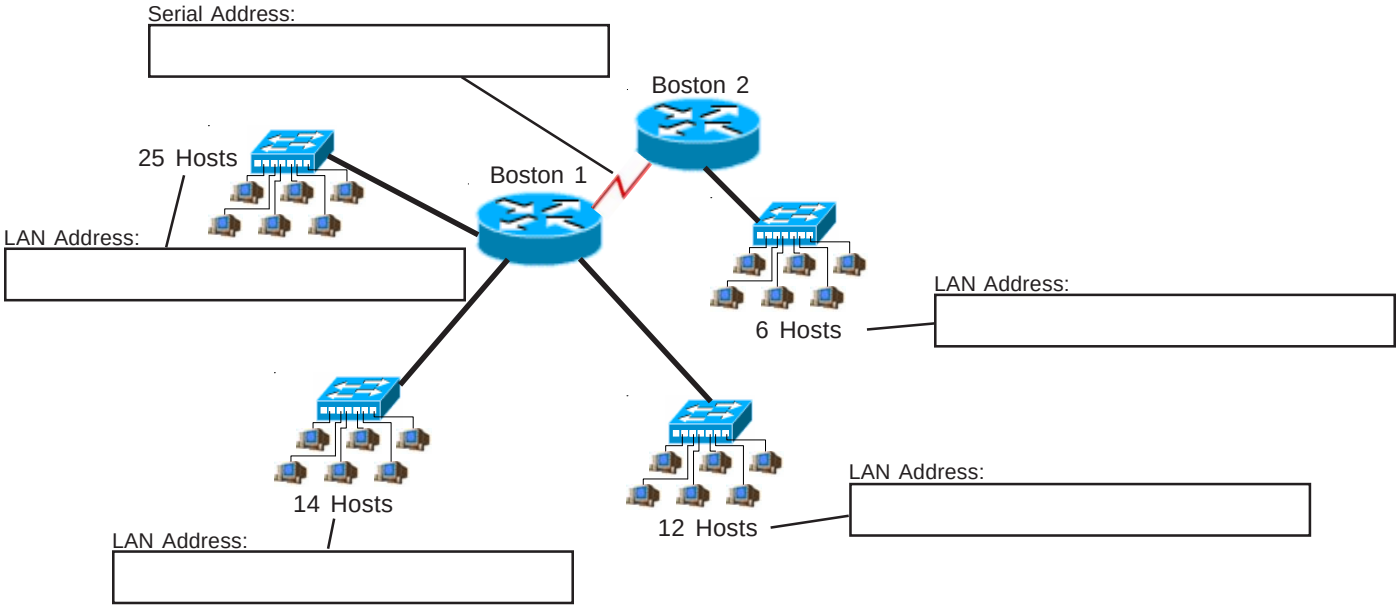
0 31	32 63	128 159	160 191
64 95	96 127	192 223	224 255

VLSM Addressing

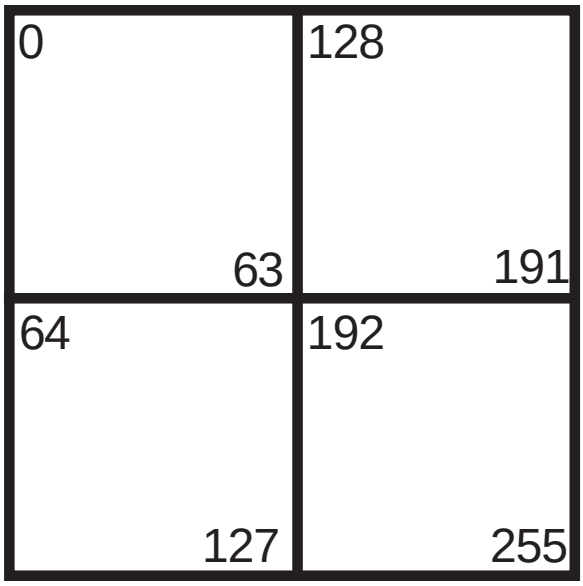
Box Method

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.

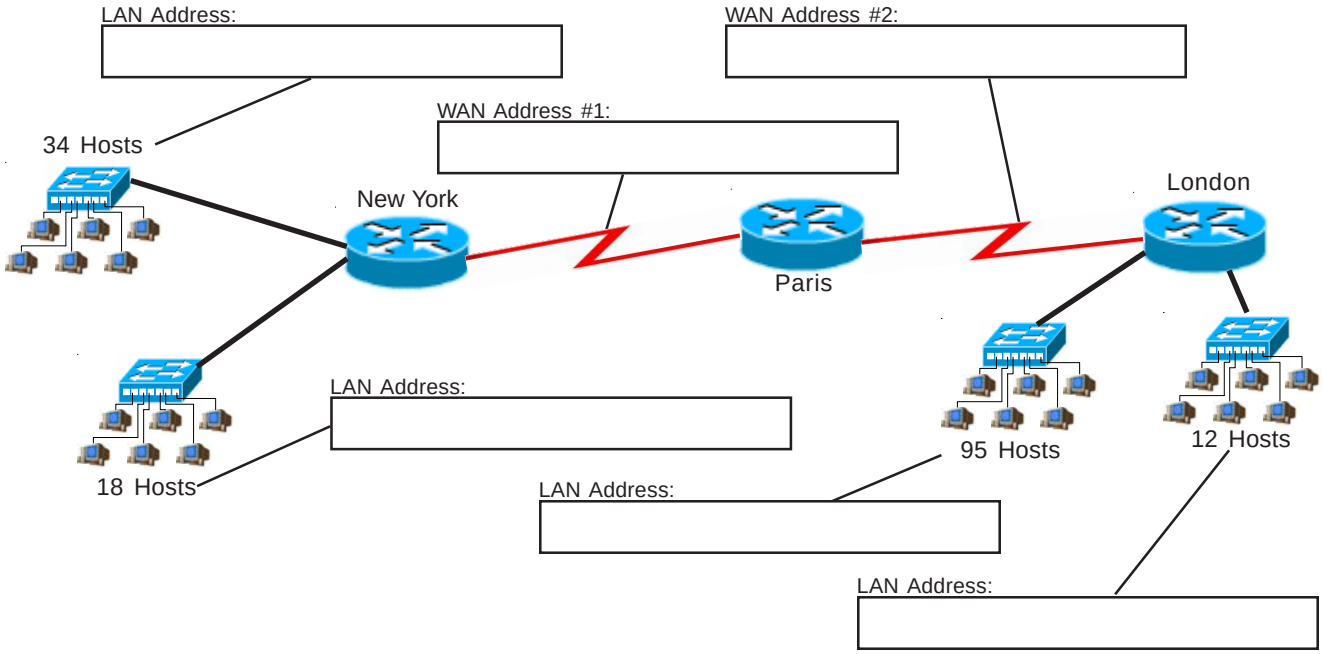


VLSM Addressing

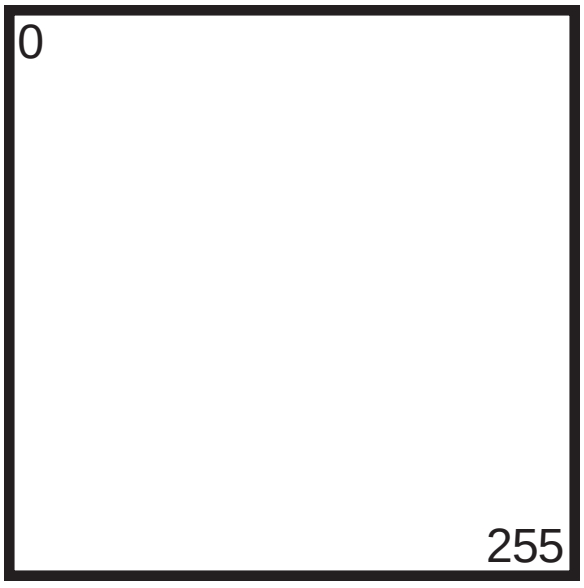
Box Method

Problem 8

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



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

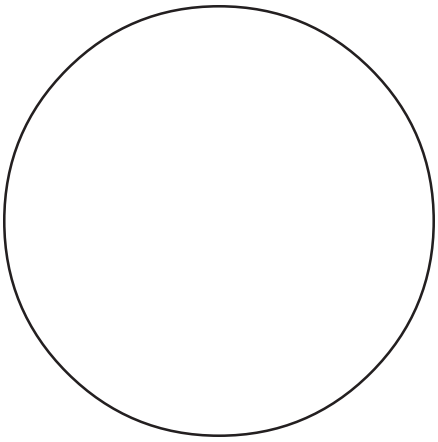


Visualizing Subnets Using The Circle Method

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

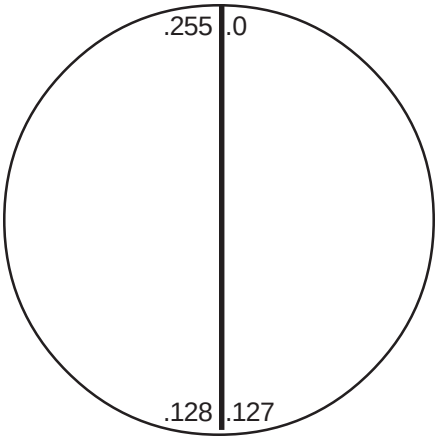
Start with a circle. The whole circle is a single subnet comprised of 256 addresses.

/24
255.255.255.0
256 Hosts
1 Subnet



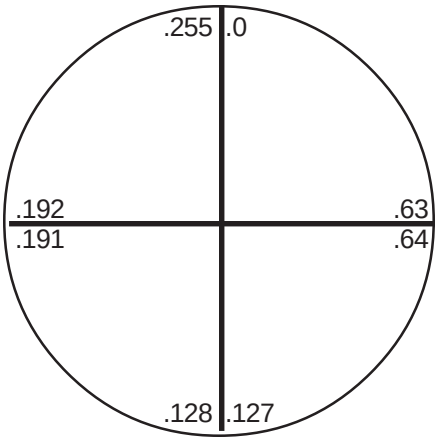
Split the circle in half and you get two subnets with 128 addresses.

/25
255.255.255.128
128 Hosts
2 Subnets

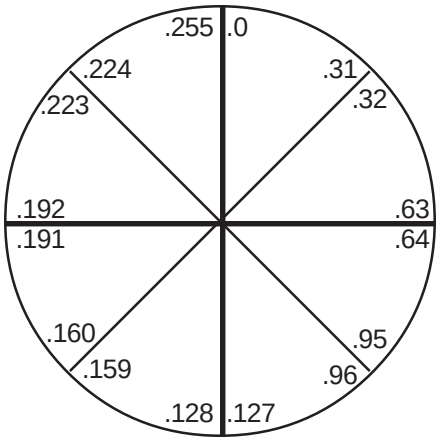


Divide the circle into quarters and you get four subnets with 64 addresses.

/26
255.255.255.192
64 Hosts
4 Subnets

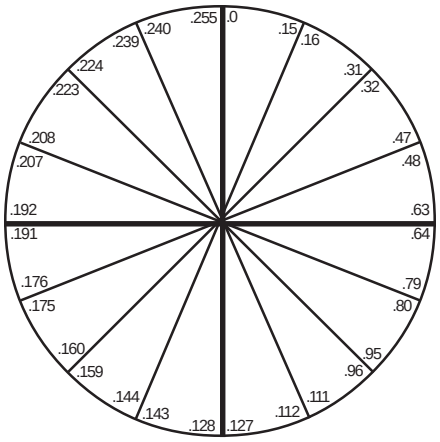


Split each quarter and you get eight subnets with 32 addresses.



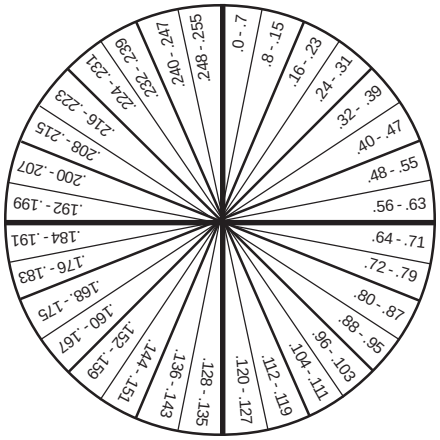
/27
255.255.255.224
32 Hosts
8 Subnets

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



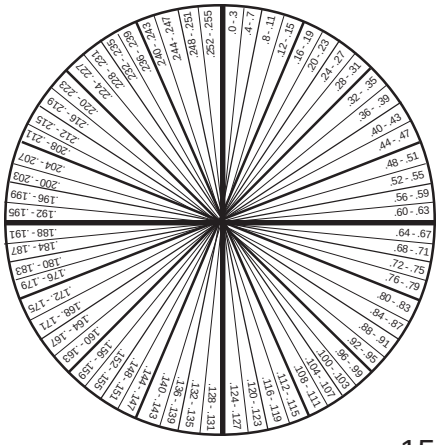
/28
255.255.255.240
16 Hosts
16 Subnets

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



/29
255.255.255.248
8 Hosts
32 Subnets

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



/30
255.255.255.252
4 Hosts
64 Subnets

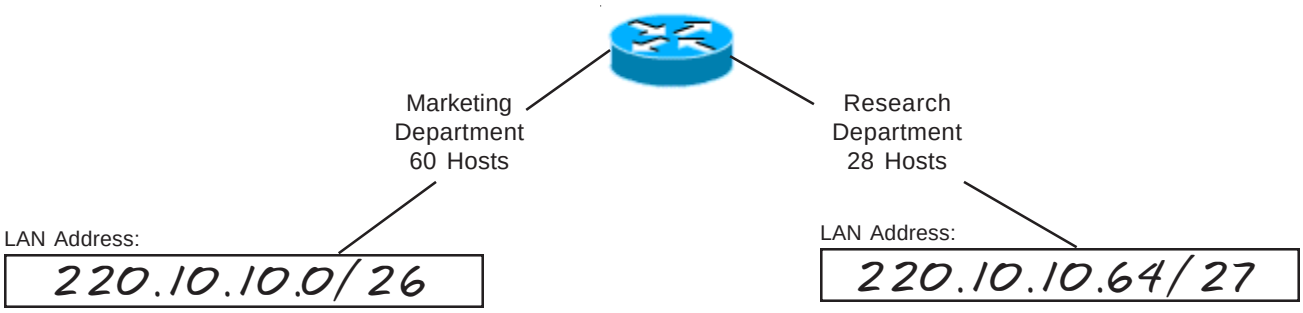
VLSM Addressing

Circle Method

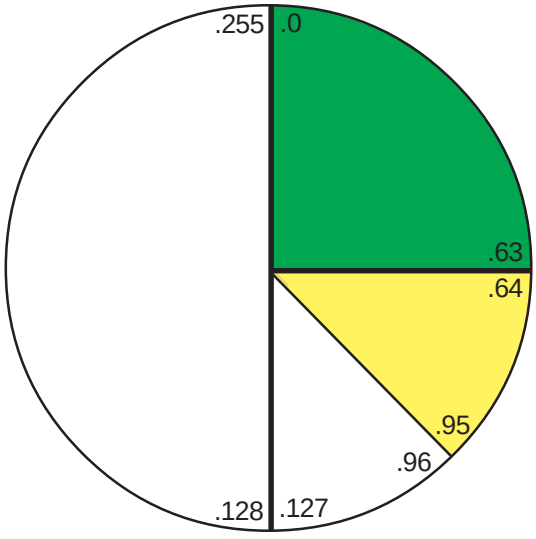
(Sample)

Problem 9

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



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



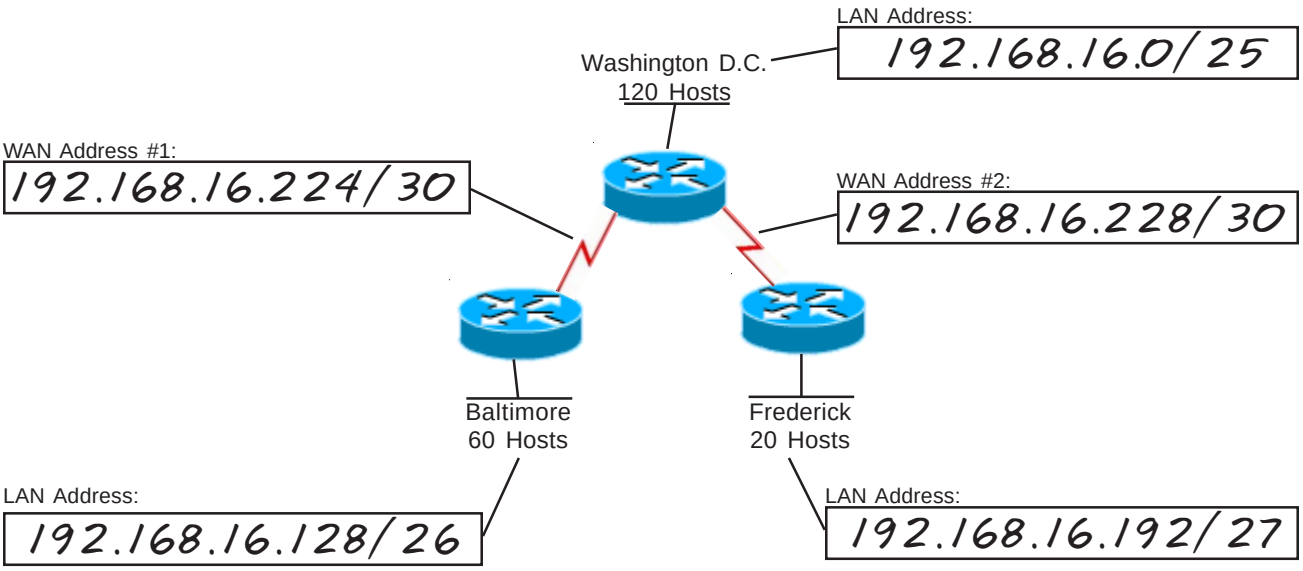
VLSM Addressing

Circle Method

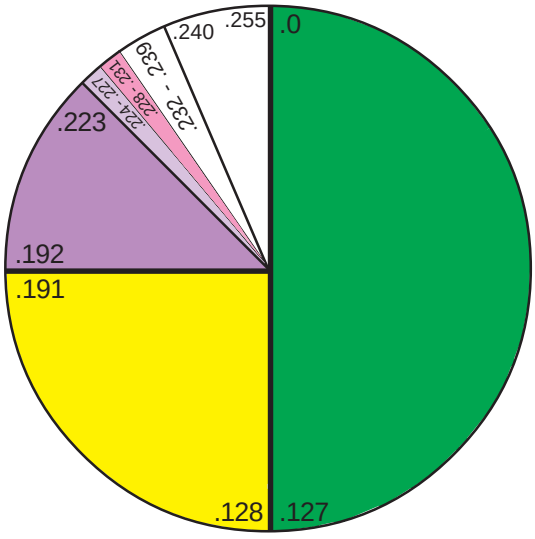
(Sample)

Problem 10

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



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

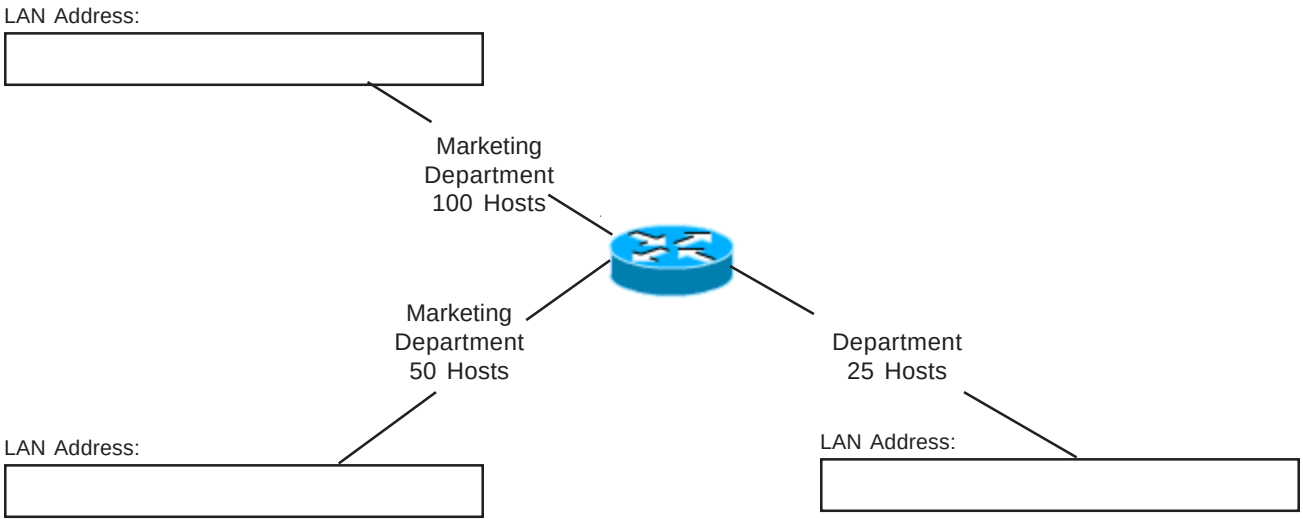


VLSM Addressing

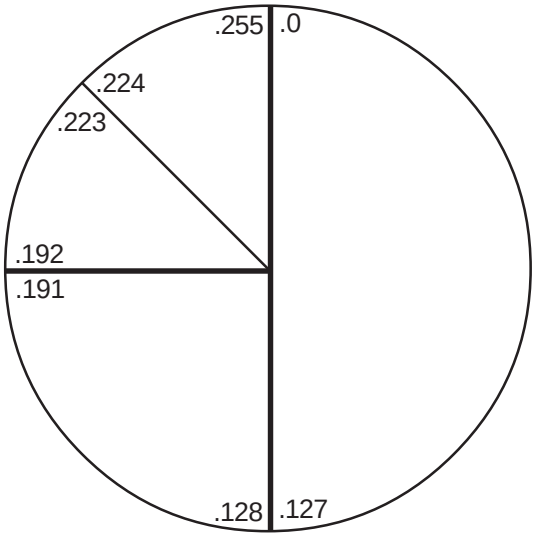
Circle Method

Problem 11

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



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

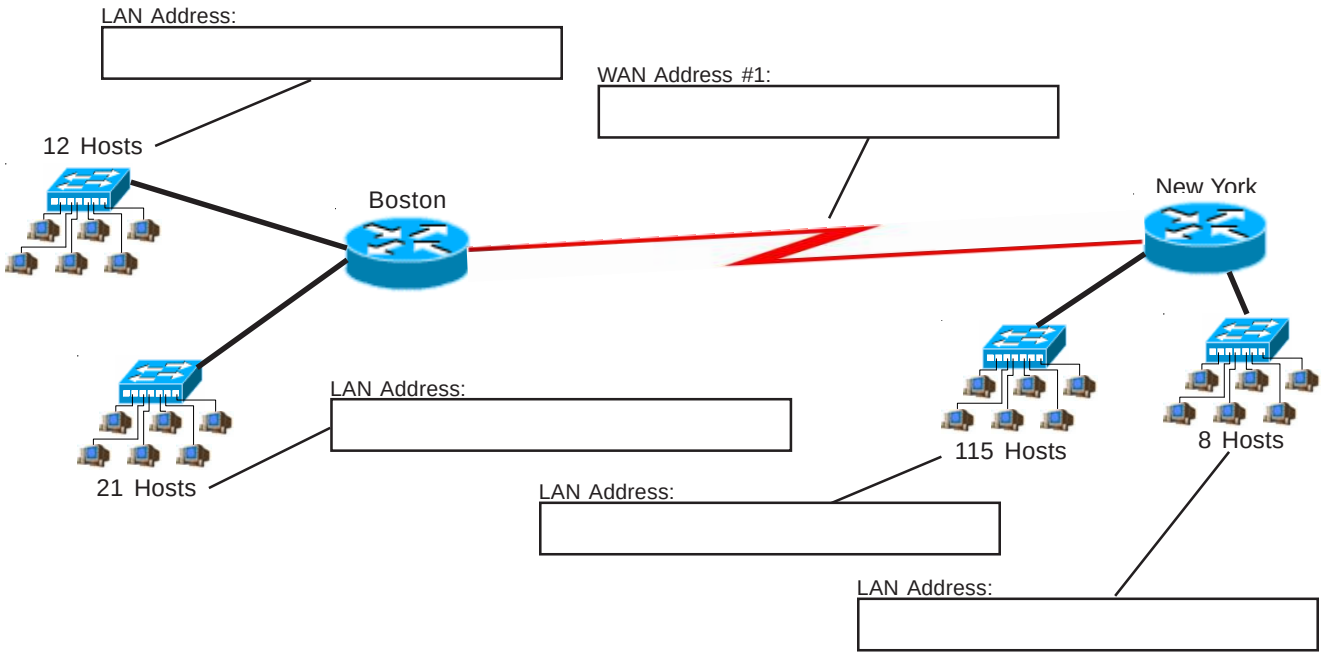


VLSM Addressing

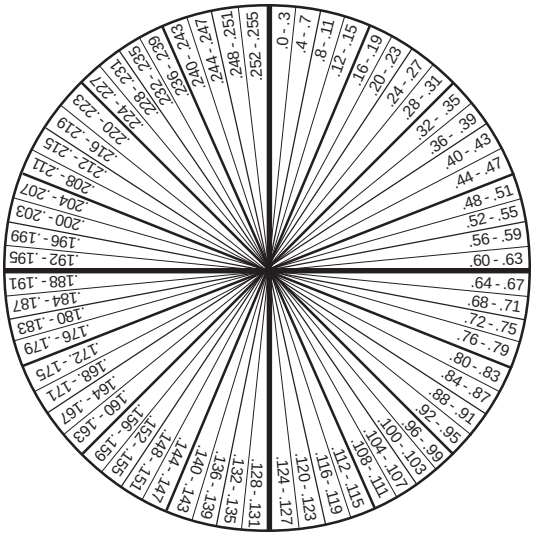
Circle Method

Problem 12

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



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

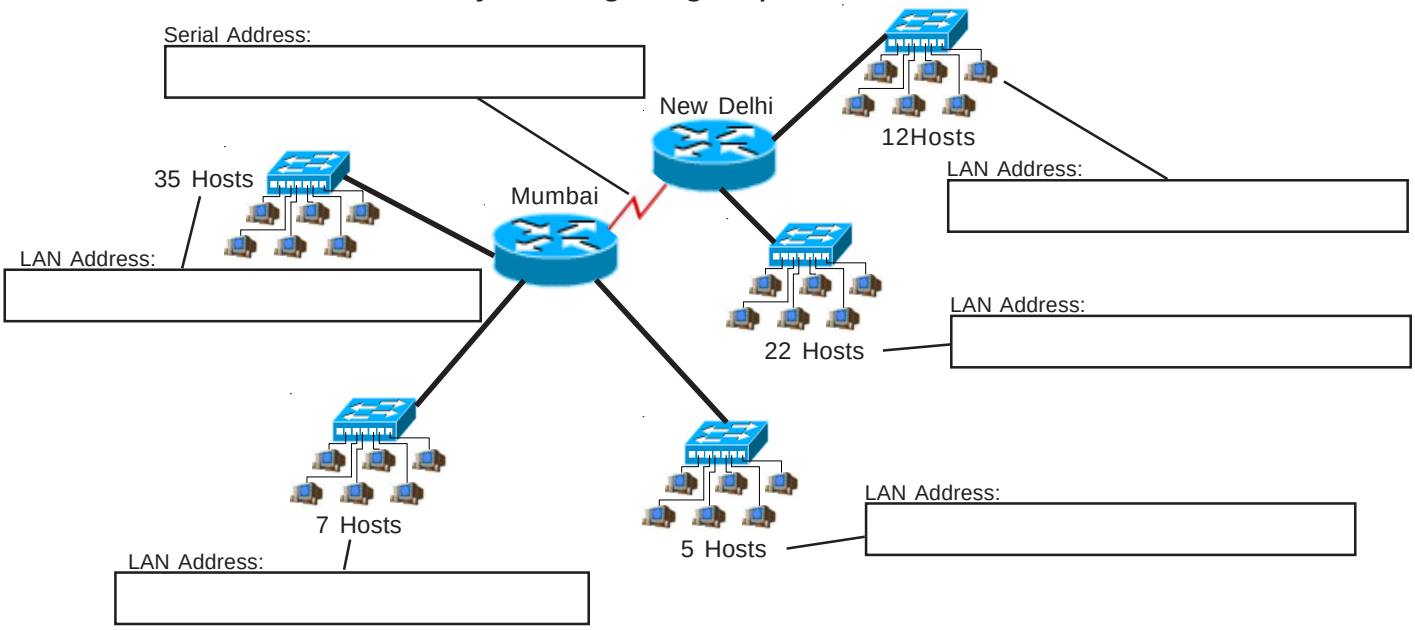


VLSM Addressing

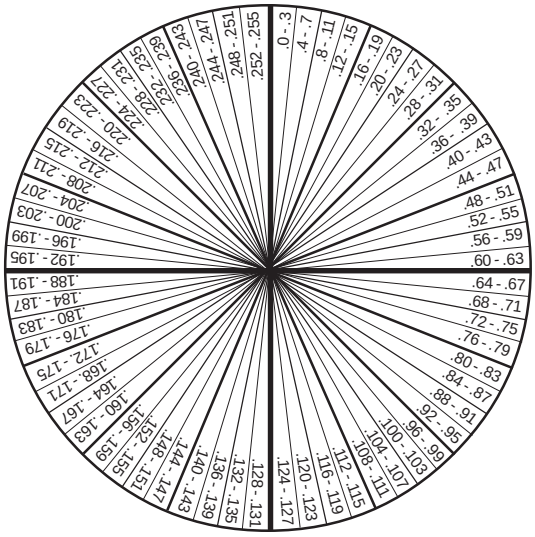
Circle Method

Problem 13

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



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

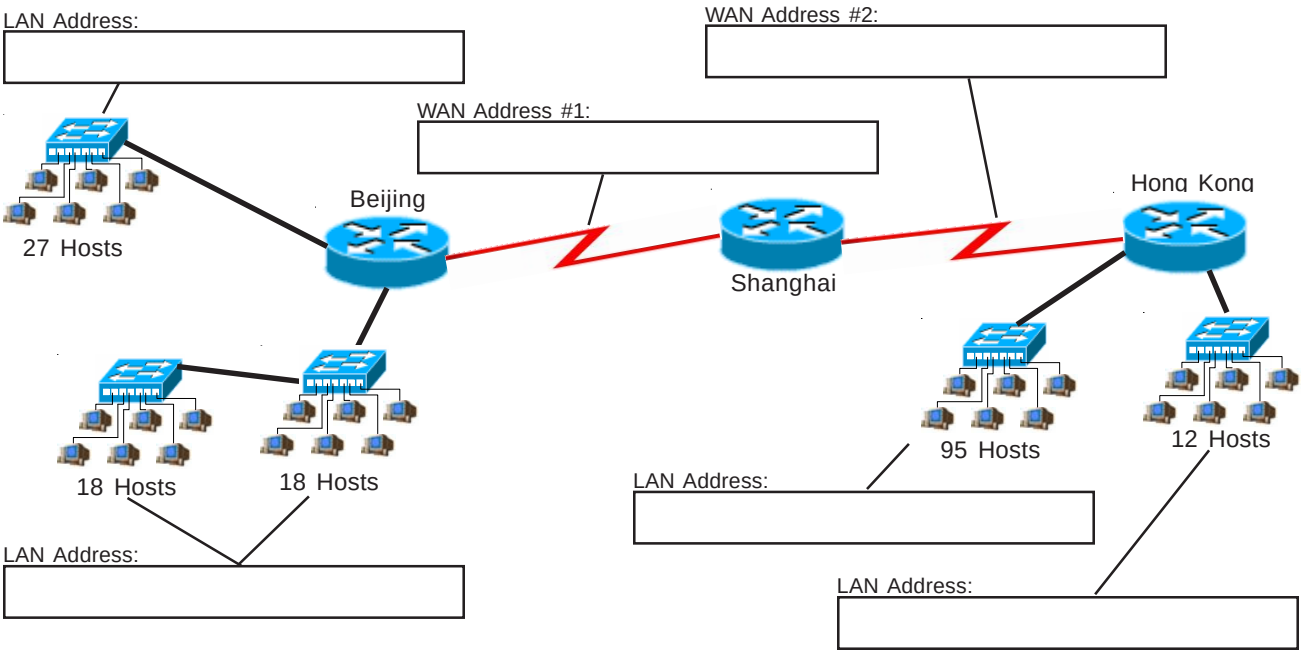


VLSM Addressing

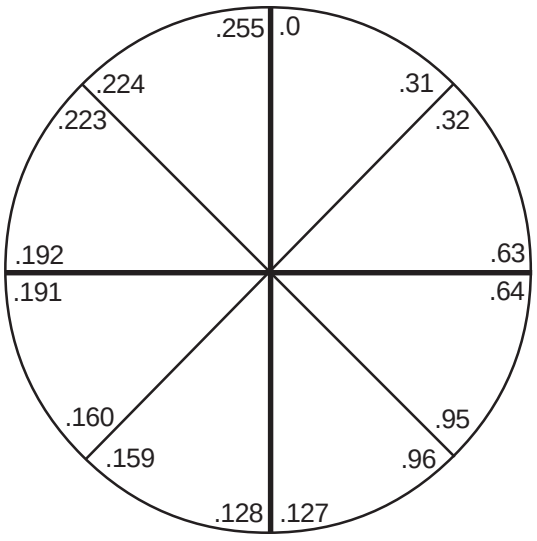
Circle Method

Problem 14

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



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

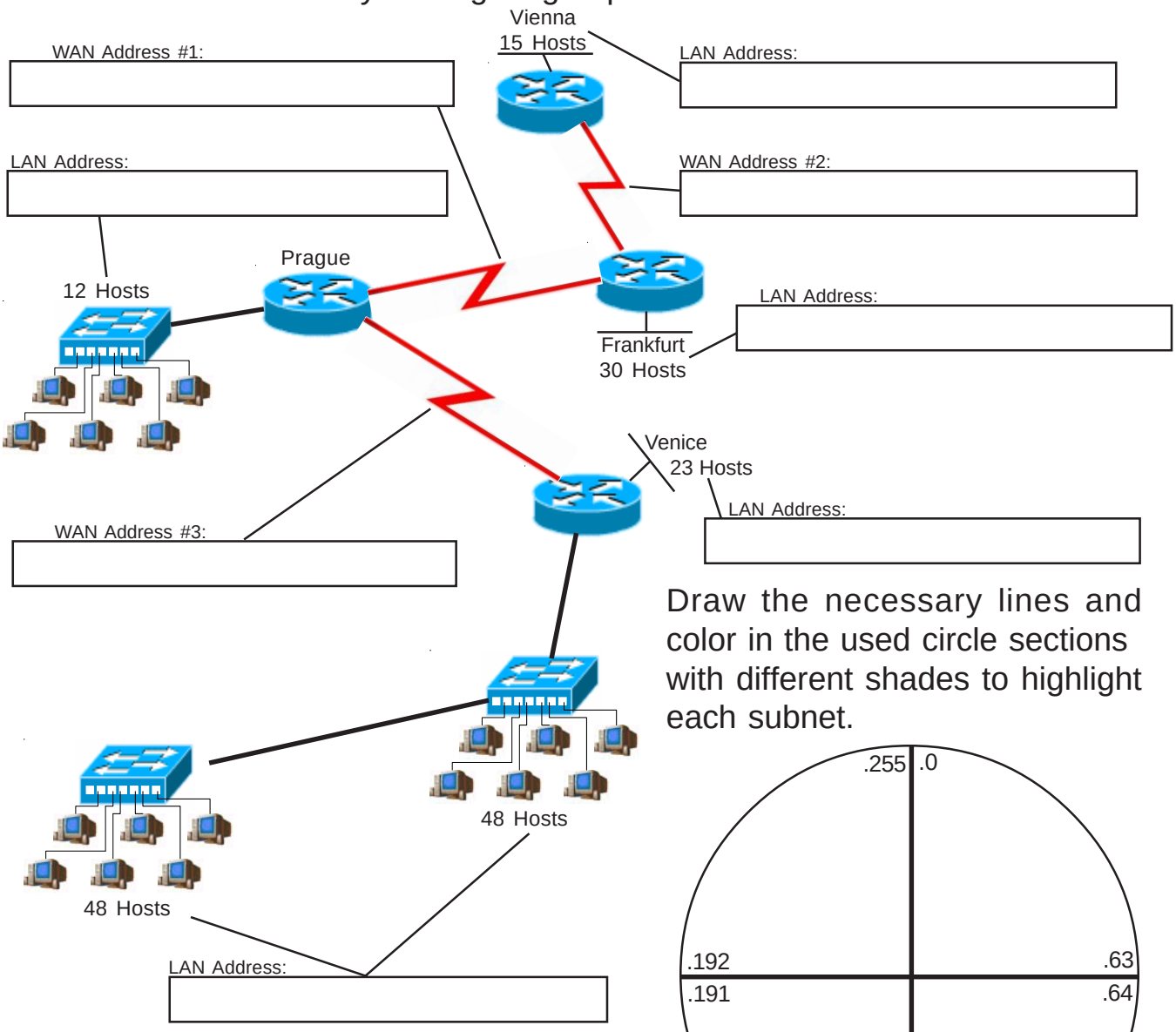


VLSM Addressing

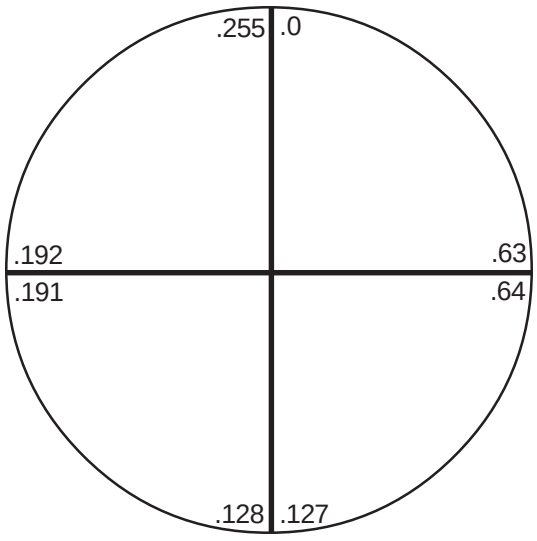
Circle Method

Problem 15

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



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

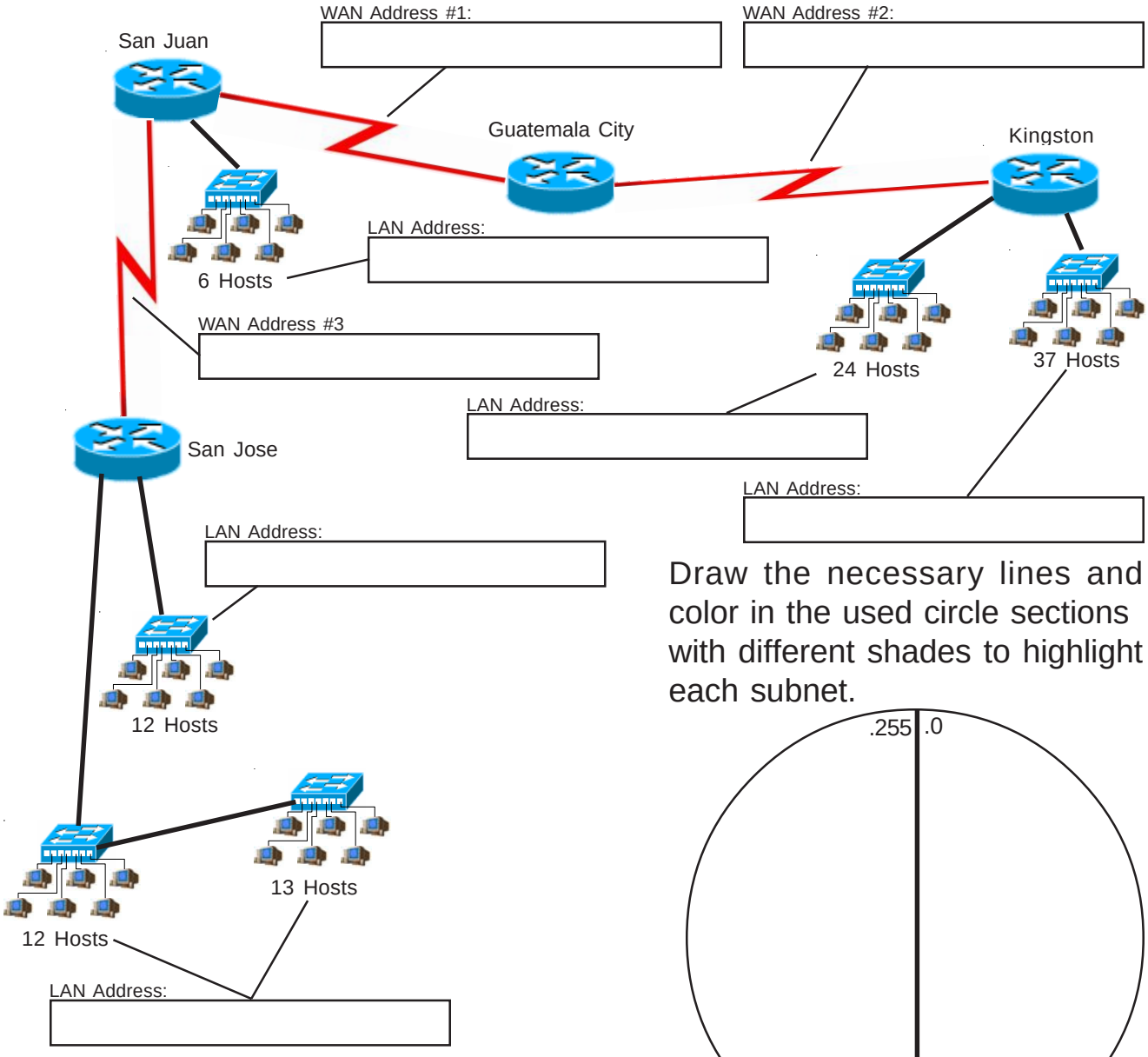


VLSM Addressing

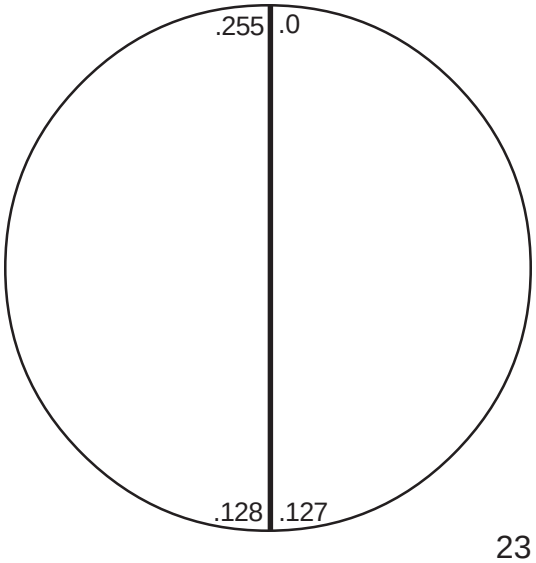
Circle Method

Problem 16

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



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



Visualizing Subnets Using a VLSM Chart

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

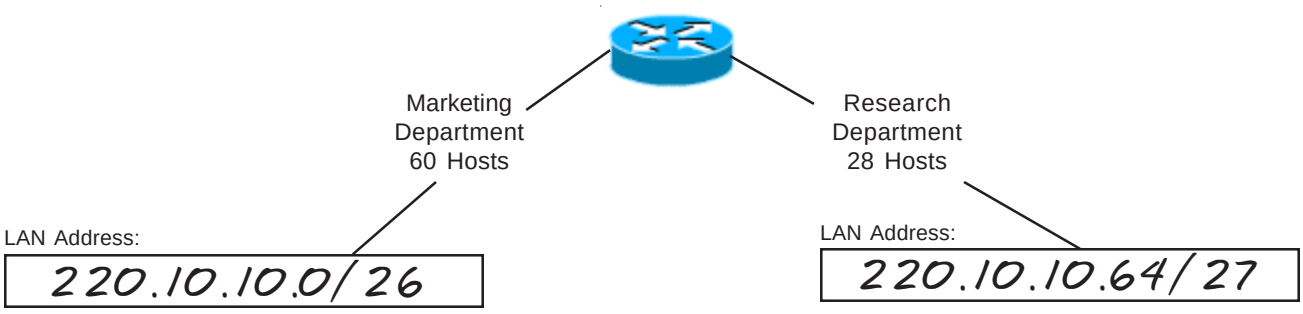
VLSM Addressing

VLSM Chart Method

(Sample)

Problem 17

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

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

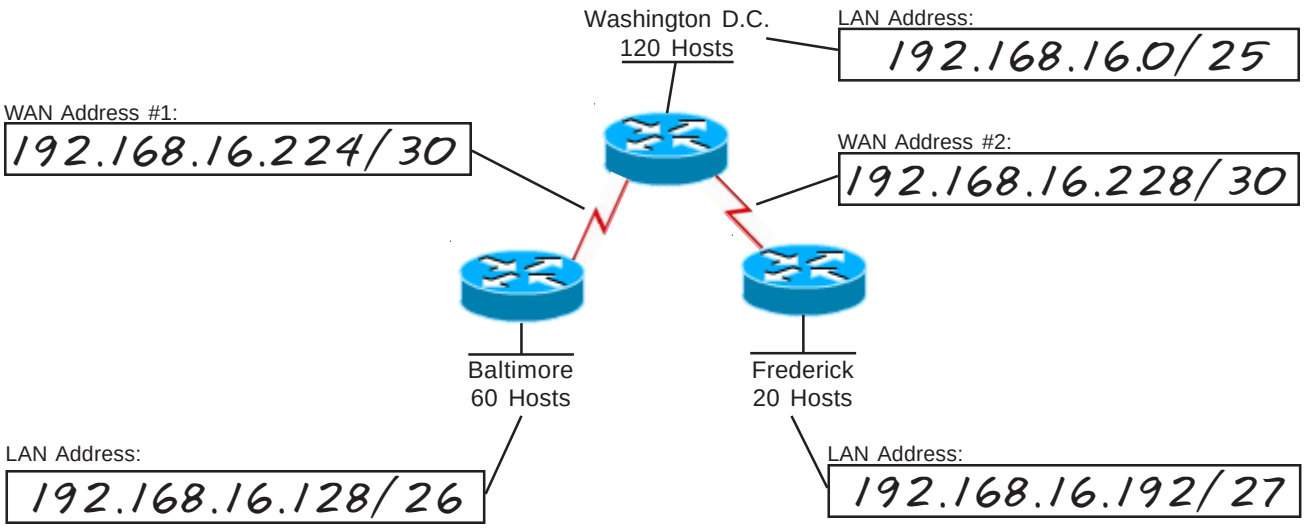
VLSM Addressing

VLSM Chart Method

(Sample)

Problem 18

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

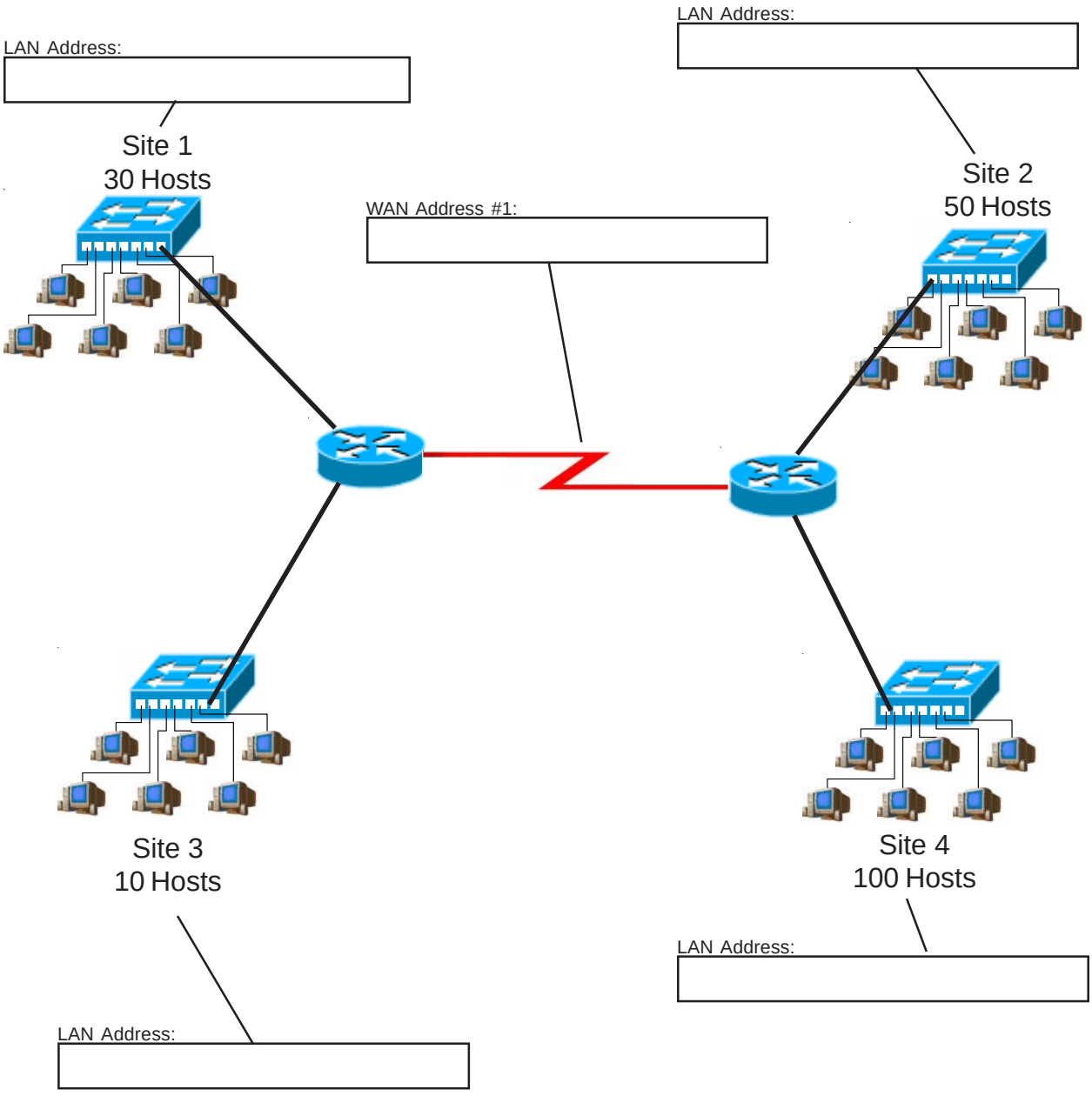
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
						20-23
					24-31	24-27
						28-31
			32-63	32-47	32-39	32-35
						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 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)

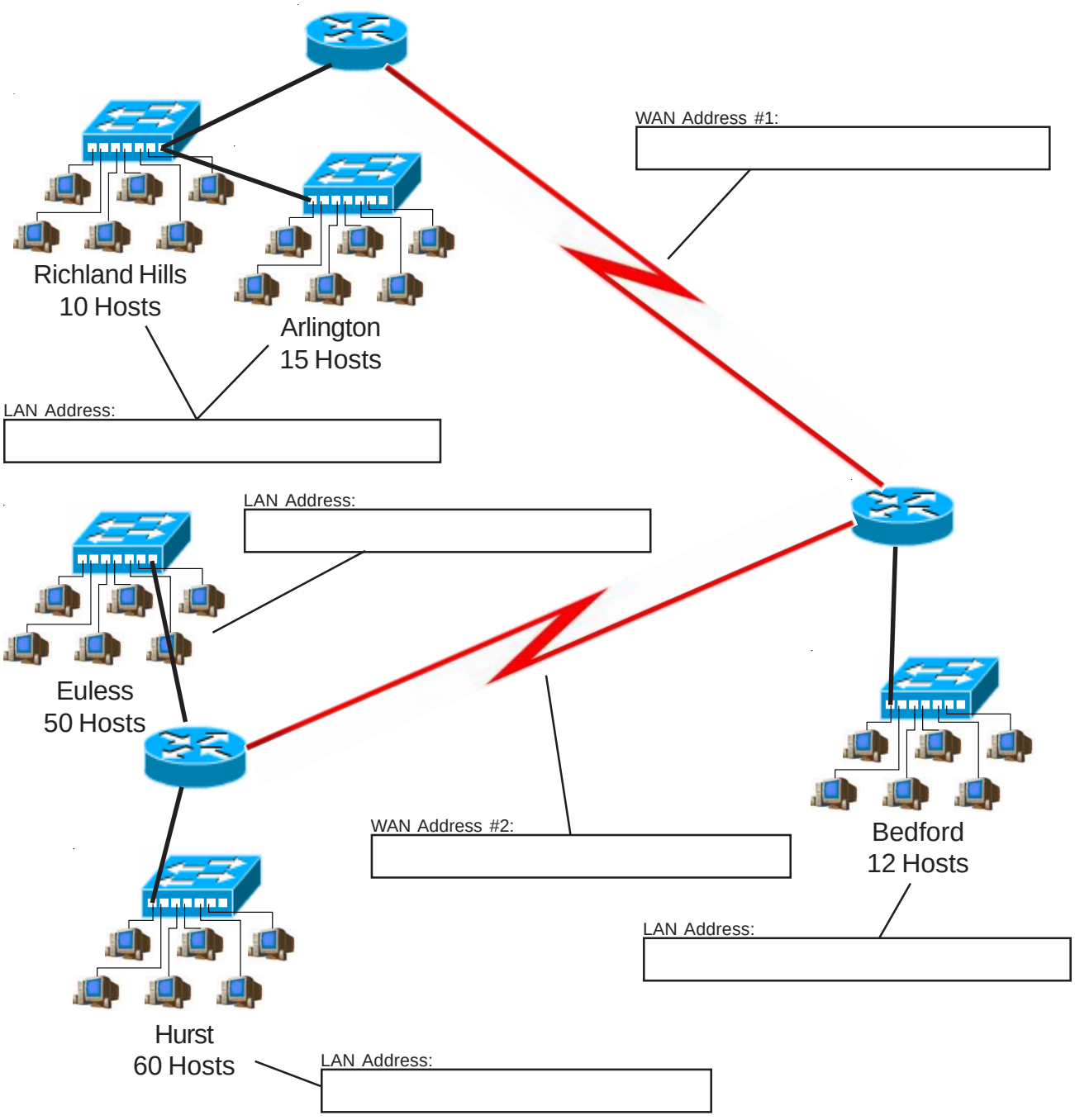
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

VLSM Addressing

VLSM Chart Method

Problem 20

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

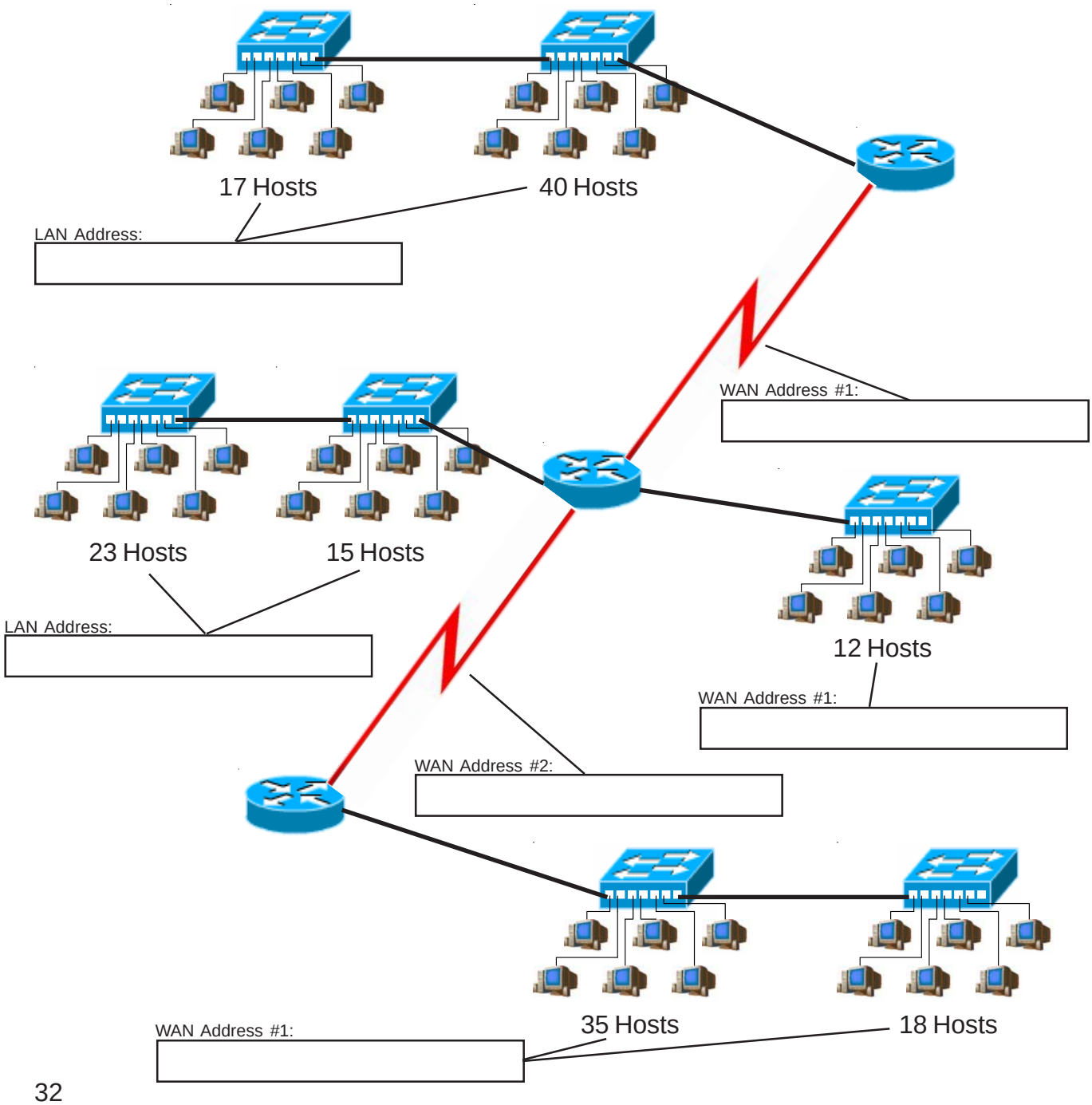
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

VLSM Addressing

VLSM Chart Method

Problem 21

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

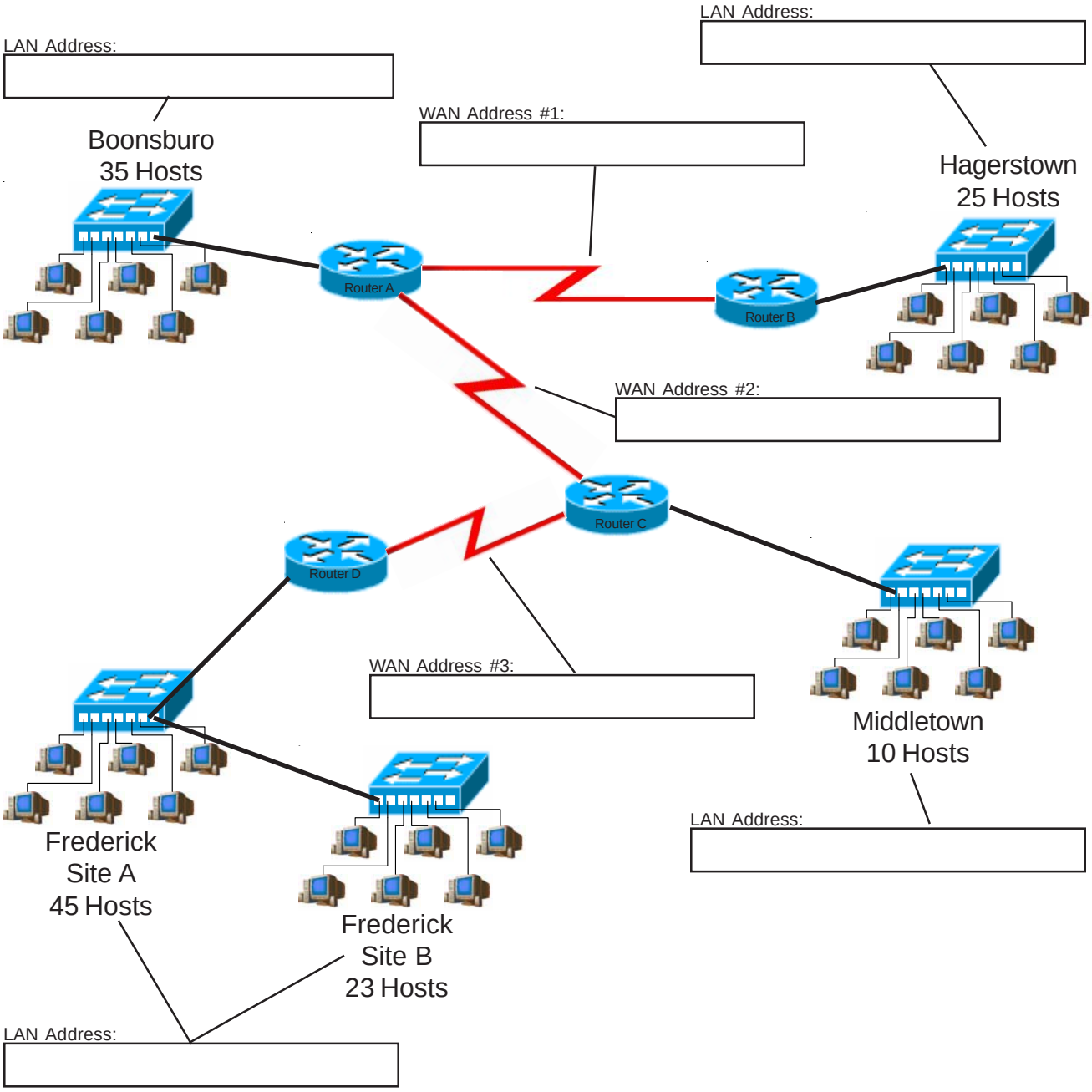
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

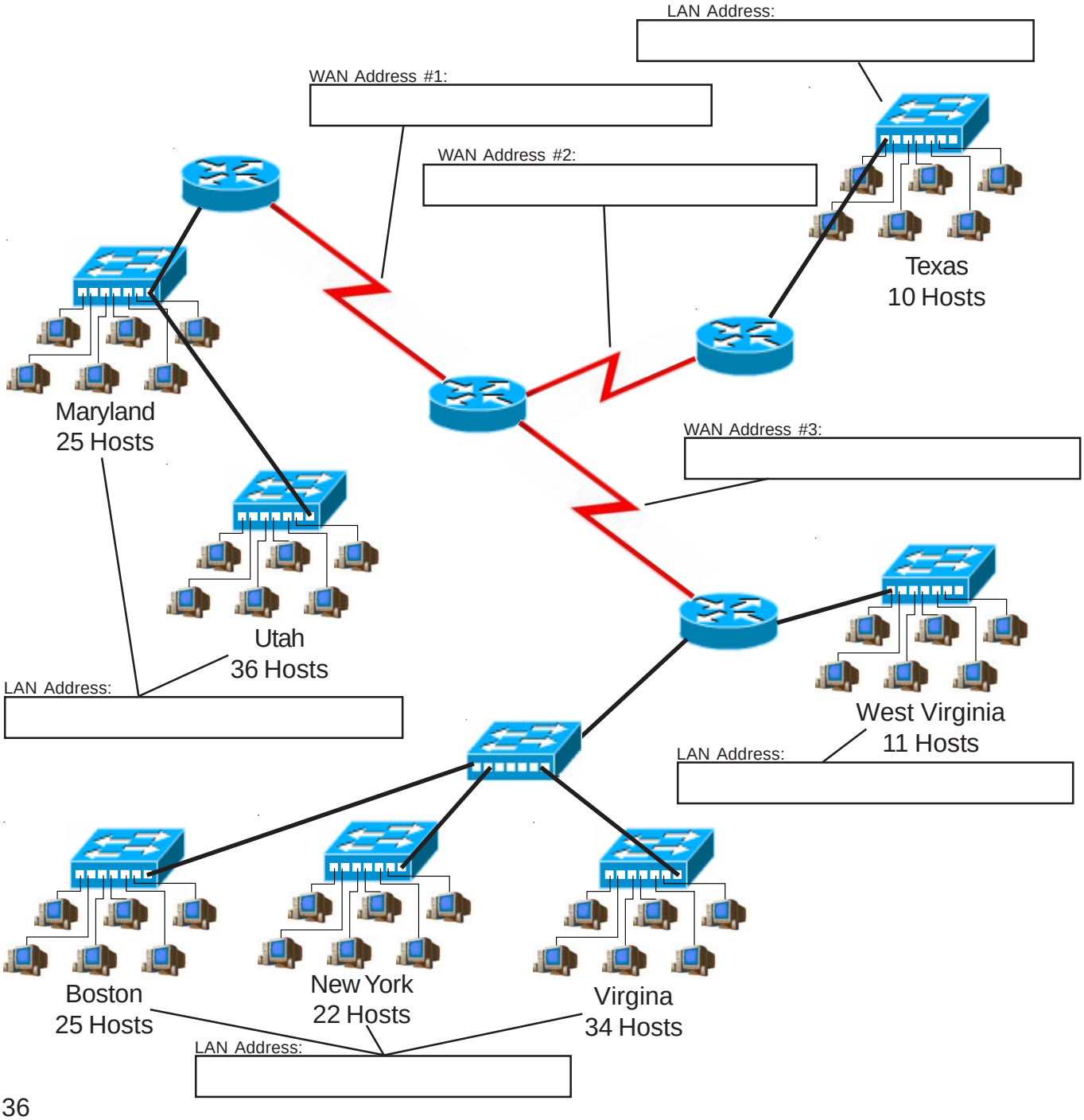
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

VLSM Addressing

VLSM Chart Method

Problem 23

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



Class C Addresses

VLSM Chart 24-30 Bits (4th octet)

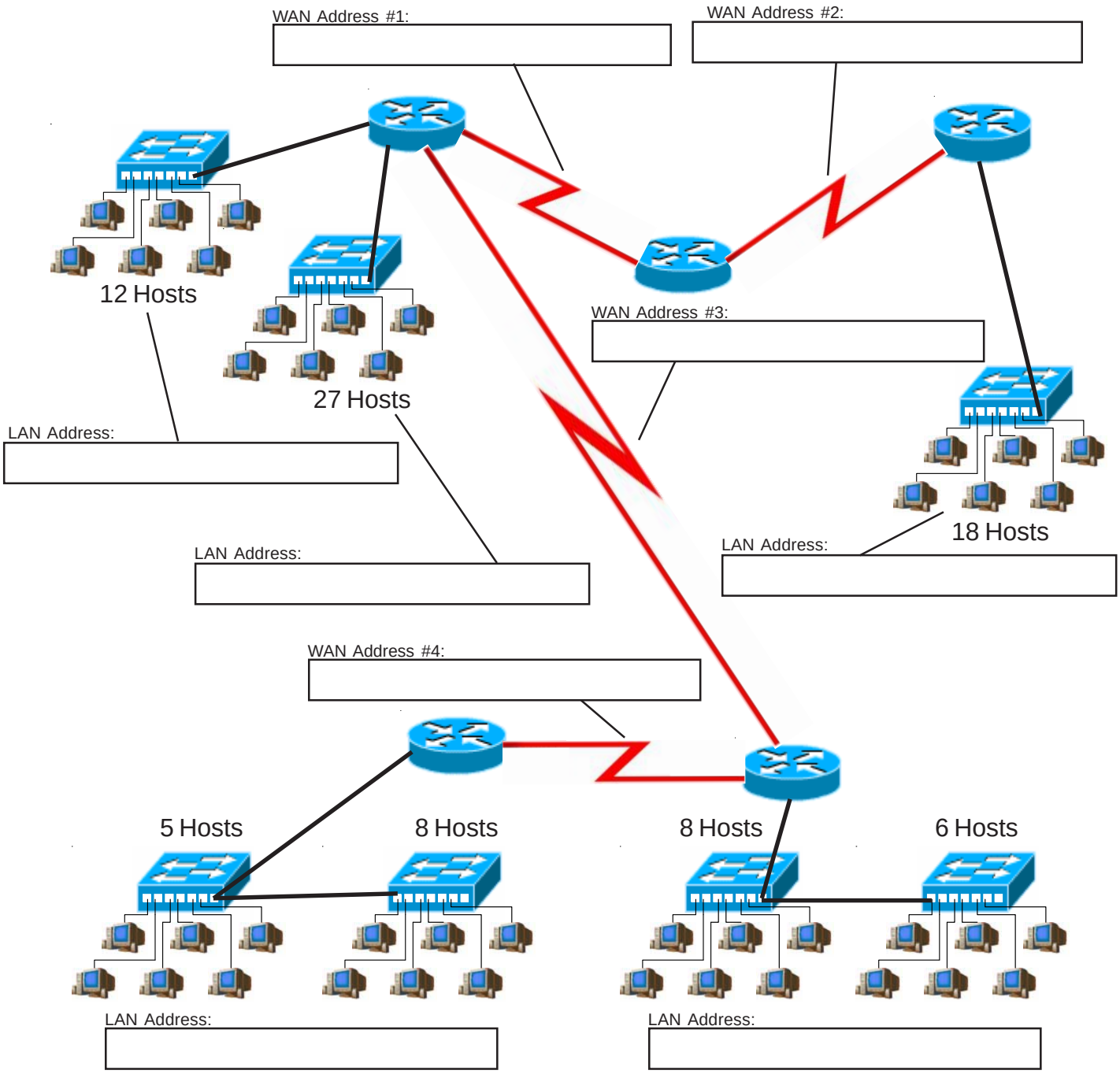
/24 255.255.255.0 256 Hosts	/25 255.255.255.128 128 Hosts	/26 255.255.255.192 64 Hosts	/27 255.255.255.224 32 Hosts	/28 255.255.255.240 16 Hosts	/29 255.255.255.248 8 Hosts	/30 255.255.255.252 4 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3
						4-7
					8-15	8-11
						12-15
				16-31	16-23	16-19
			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

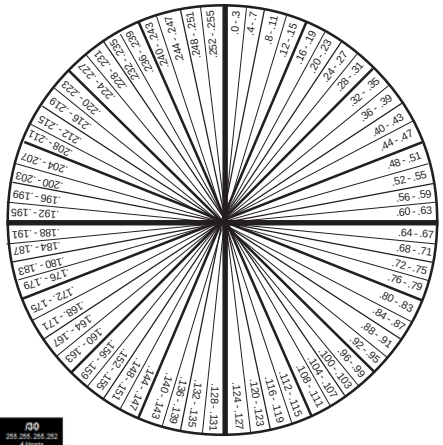
VLSM Chart 24-30 Bits (4th octet)

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

Practical VLSM
Problems

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

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



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
					72-79	68-71
						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 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 remolded. 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 sub-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.

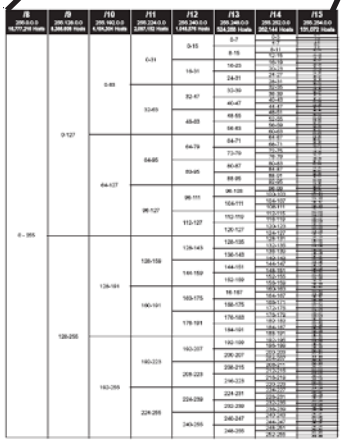
Class A and B

VLSM

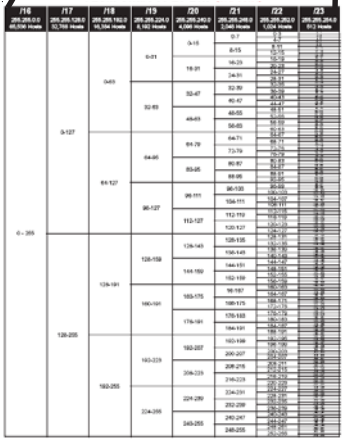
Problems

10 . 0 . 0 . 0

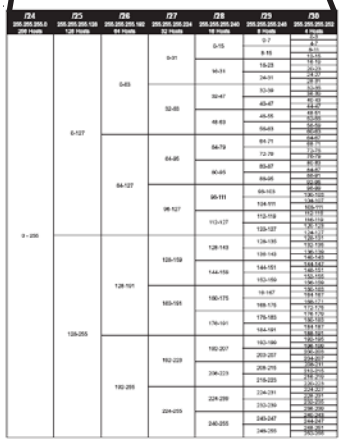
Class A Addresses
VLSM Chart 8-15 Bits (2nd octet)



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



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



VLSM

with

Class A and B Addresses

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

Sample Problem 35
Part 1 of 3

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

ISP Addresses 15.0.0.0

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

Class A Addresses

VLSM Chart 8-15 Bits (2nd octet)

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

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

VLSM

with

Class A and B Addresses

Sample Problem 35
Part 3 of 3

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

ISP Addresses 15.208.124.0

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

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 1 of 3

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

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

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

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

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

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

VLSM

with

Class A and B Addresses

Problem 36
Part 2 of 3

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

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

Hint:

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

Eastern Elementary School
Address Range 172.32.**42.0** to 172.32.**43.255**

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Students	250		
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 octect 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)

/24 255.255.255.0 256 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 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
							2 - 3
						4-7	4 - 5
							6 - 7
					8-15	8-11	8 - 9
							10 - 11
						12-15	12 - 13
							14 - 15
				16-31	16-23	16-19	16 - 17
							18 - 19
						20-23	20 - 21
							22 - 23
					24-31	24-27	24 - 25
							26 - 27
						28-31	28 - 29
							30 - 31
			32-63	32-47	32-39	32-35	32 - 33
							34 - 35
						36-39	36 - 37
							38 - 39
					40-47	40-43	40 - 41
							42 - 43
						44-47	44 - 45
							46 - 47
				48-63	48-55	48-51	48 - 49
							50 - 51
						52-55	52 - 53
							54 - 55
					56-63	56-59	56 - 57
							58 - 59
						60-63	60 - 61
							62 - 63
		64-127	64-95	64-79	64-71	64-67	64 - 65
							66 - 67
						68-71	68 - 69
							70 - 71
					72-79	72-75	72 - 73
							74 - 75
						76-79	76 - 77
							78 - 79
				80-95	80-87	80-83	80 - 81
							82 - 83
						84-87	84 - 85
							86 - 87
					88-95	88-91	88 - 89
							90 - 91
						92-95	92 - 93
							94 - 95
			96-127	96-111	96-103	96-99	96 - 97
							98 - 99
						100-103	100 - 101
							102 - 103
					104-111	104-107	104 - 105
							106 - 107
						108-111	108 - 109
							110 - 111
				112-127	112-119	112-115	112 - 113
							114 - 115
						116-119	116 - 117
							118 - 119
					120-127	120-123	120 - 121
							122 - 123
						124-127	124 - 125
							126 - 127
	128-255	128-191	128-159	128-143	128-135	128-131	128 - 129
							130 - 131
						132-135	132 - 133
							134 - 135
					136-143	136-139	136 - 137
							138 - 139
						140-143	140 - 141
							142 - 143
				144-159	144-151	144-147	144 - 145
							146 - 147
						148-151	148 - 149
							150 - 151
					152-159	152-155	152 - 153
							154 - 155
						156-159	156 - 157
							158 - 159
			160-191	160-175	160-167	160-163	160 - 161
							162 - 163
						164-167	164 - 165
							166 - 167
					168-175	168-171	168 - 169
							170 - 171
						172-175	172 - 173
							174 - 175
				176-191	176-183	176-179	176 - 177
							178 - 179
						180-183	180 - 181
							182 - 183
					184-191	184-187	184 - 185
							186 - 187
						188-191	188 - 189
							190 - 191
		192-255	192-223	192-207	192-199	192-195	192 - 193
							194 - 195
						196-199	196 - 197
							198 - 199
					200-207	200-203	200 - 201
							202 - 203
						204-207	204 - 205
							206 - 207
				208-223	208-215	208-211	208 - 209
							210 - 211
						212-215	212 - 213
							214 - 215
					216-223	216-219	216 - 217
							218 - 219
						220-223	220 - 221
							222 - 223
			224-255	224-239	224-231	224-227	224 - 225
							226 - 227
						228-231	228 - 229
							230 - 231
					232-239	232-235	232 - 233
							234 - 235
						236-239	236 - 237
							238 - 239
				240-255	240-247	240-243	240 - 241
							242 - 243
						244-247	244 - 245
							246 - 247
					248-255	248-251	248 - 249
							250 - 251
						252-255	252 - 253
							254 - 255

VLSM

with

Class A and B Addresses

Problem 37
Part 2 of 3

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

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

London
Address Range 110.128.0.0 to 110.143.255.255

Customer Name	Number of Addresses	Address Range (Include subnet & broadcast addresses)	CIDR
Office #1	6,450		
Office #2	3,780		
Office #3	2,750		
Office #4	2,000		
Office #5	1,000		
Office #6	845		
Office #7	500		
Office #8	450		
Office #9	300		

Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

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

VLSM

with

Class A and B Addresses

Problem 37

Part 3 of 3

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

Based on the information below supply the required address ranges and subnet masks for each school area. Use the **Class C** address chart to break down the sub-subnetwork addresses for the different areas of the network. **Hint:** Another way to look at this problem is to see that with the third octect 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
					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 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 2 - 3
						4-7	4 - 5 6 - 7
					8-15	8-11	8 - 9 10 - 11
						12-15	12 - 13 14 - 15
				16-31	16-23	16-19	16 - 17 18 - 19
						20-23	20 - 21 22 - 23
					24-31	24-27	24 - 25 26 - 27
						28-31	28 - 29 30 - 31
			32-63	32-47	32-39	32-35	32 - 33 34 - 35
						36-39	36 - 37 38 - 39
					40-47	40-43	40 - 41 42 - 43
						44-47	44 - 45 46 - 47
				48-63	48-55	48-51	48 - 49 50 - 51
						52-55	52 - 53 54 - 55
					56-63	56-59	56 - 57 58 - 59
						60-63	60 - 61 62 - 63
		64-127	64-95	64-79	64-71	64-67	64 - 65 66 - 67
						68-71	68 - 69 70 - 71
					72-79	72-75	72 - 73 74 - 75
						76-79	76 - 77 78 - 79
				80-95	80-87	80-83	80 - 81 82 - 83
						84-87	84 - 85 86 - 87
					88-95	88-91	88 - 89 90 - 91
						92-95	92 - 93 94 - 95
			96-127	96-111	96-103	96-99	96 - 97 98 - 99
						100-103	100 - 101 102 - 103
					104-111	104-107	104 - 105 106 - 107
						108-111	108 - 109 110 - 111
				112-127	112-119	112-115	112 - 113 114 - 115
						116-119	116 - 117 118 - 119
					120-127	120-123	120 - 121 122 - 123
						124-127	124 - 125 126 - 127
	128-255	128-191	128-159	128-143	128-135	128-131	128 - 129 130 - 131
						132-135	132 - 133 134 - 135
					136-143	136-139	136 - 137 138 - 139
						140-143	140 - 141 142 - 143
				144-159	144-151	144-147	144 - 145 146 - 147
						148-151	148 - 149 150 - 151
					152-159	152-155	152 - 153 154 - 155
						156-159	156 - 157 158 - 159
			160-191	160-175	160-167	160-163	160 - 161 162 - 163
						164-167	164 - 165 166 - 167
					168-175	168-171	168 - 169 170 - 171
						172-175	172 - 173 174 - 175
				176-191	176-183	176-179	176 - 177 178 - 179
						180-183	180 - 181 182 - 183
					184-191	184-187	184 - 185 186 - 187
						188-191	188 - 189 190 - 191
		192-255	192-223	192-207	192-199	192-195	192 - 193 194 - 195
						196-199	196 - 197 198 - 199
					200-207	200-203	200 - 201 202 - 203
						204-207	204 - 205 206 - 207
				208-223	208-215	208-211	208 - 209 210 - 211
						212-215	212 - 213 214 - 215
					216-223	216-219	216 - 217 218 - 219
						220-223	220 - 221 222 - 223
			224-255	224-239	224-231	224-227	224 - 225 226 - 227
						228-231	228 - 229 230 - 231
					232-239	232-235	232 - 233 234 - 235
						236-239	236 - 237 238 - 239
				240-255	240-247	240-243	240 - 241 242 - 243
						244-247	244 - 245 246 - 247
					248-255	248-251	248 - 249 250 - 251
						252-255	252 - 253 254 - 255

VLSM

with

Class A and B Addresses

Sample Problem 38
Part 2 of 4

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

Addresses Range: 75.**0**.0.0 to 75.**127**.255.255

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

Class A Addresses

VLSM Chart 8-15 Bits (2nd octet)

/8 255.0.0.0 16,777,216 Hosts	/9 255.128.0.0 8,388.608 Hosts	/10 255.192.0.0 4,194,304 Hosts	/11 255.224.0.0 2,097,152 Hosts	/12 255.240.0.0 1,048,576 Hosts	/13 255.248.0.0 524,288 Hosts	/14 255.252.0.0 262,144 Hosts	/15 255.254.0.0 131,072 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0 - 1
							2 - 3
						4-7	4 - 5
							6 - 7
					8-15	8-11	8 - 9
							10 - 11
						12-15	12 - 13
							14 - 15
				16-31	16-23	16-19	16 - 17
							18 - 19
						20-23	20 - 21
							22 - 23
					24-31	24-27	24 - 25
							26 - 27
						28-31	28 - 29
							30 - 31
			32-63	32-47	32-39	32-35	32 - 33
							34 - 35
						36-39	36 - 37
							38 - 39
					40-47	40-43	40 - 41
							42 - 43
						44-47	44 - 45
							46 - 47
				48-63	48-55	48-51	48 - 49
							50 - 51
						52-55	52 - 53
							54 - 55
					56-63	56-59	56 - 57
							58 - 59
						60-63	60 - 61
							62 - 63
		64-127	64-95	64-79	64-71	64-67	64 - 65
							66 - 67
						68-71	68 - 69
							70 - 71
					72-79	72-75	72 - 73
							74 - 75
						76-79	76 - 77
							78 - 79
				80-95	80-87	80-83	80 - 81
							82 - 83
						84-87	84 - 85
							86 - 87
					88-95	88-91	88 - 89
							90 - 91
						92-95	92 - 93
							94 - 95
			96-127	96-111	96-103	96-99	96 - 97
							98 - 99
						100-103	100 - 101
							102 - 103
					104-111	104-107	104 - 105
							106 - 107
						108-111	108 - 109
							110 - 111
				112-127	112-119	112-115	112 - 113
							114 - 115
						116-119	116 - 117
							118 - 119
					120-127	120-123	120 - 121
							122 - 123
						124-127	124 - 125
							126 - 127
	128-255	128-191	128-159	128-143	128-135	128-131	128 - 129
							130 - 131
						132-135	132 - 133
							134 - 135
					136-143	136-139	136 - 137
							138 - 139
						140-143	140 - 141
							142 - 143
				144-159	144-151	144-147	144 - 145
							146 - 147
						148-151	148 - 149
							150 - 151
					152-159	152-155	152 - 153
							154 - 155
						156-159	156 - 157
							158 - 159
			160-191	160-175	160-167	160-163	160 - 161
							162 - 163
						164-167	164 - 165
							166 - 167
					168-175	168-171	168 - 169
							170 - 171
						172-175	172 - 173
							174 - 175
				176-191	176-183	176-179	176 - 177
							178 - 179
						180-183	180 - 181
							182 - 183
					184-191	184-187	184 - 185
							186 - 187
						188-191	188 - 189
							190 - 191
		192-255	192-223	192-207	192-199	192-195	192 - 193
							194 - 195
						196-199	196 - 197
							198 - 199
					200-207	200-203	200 - 201
							202 - 203
						204-207	204 - 205
							206 - 207
				208-223	208-215	208-211	208 - 209
							210 - 211
						212-215	212 - 213
							214 - 215
					216-223	216-219	216 - 217
							218 - 219
						220-223	220 - 221
							222 - 223
			224-255	224-239	224-231	224-227	224 - 225
							226 - 227
						228-231	228 - 229
							230 - 231
					232-239	232-235	232 - 233
							234 - 235
						236-239	236 - 237
							238 - 239
				240-255	240-247	240-243	240 - 241
							242 - 243
						244-247	244 - 245
							246 - 247
					248-255	248-251	248 - 249
							250 - 251
						252-255	252 - 253
							254 - 255

VLSM

with

Class A and B Addresses

Sample Problem 38
Part 3 of 4

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

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

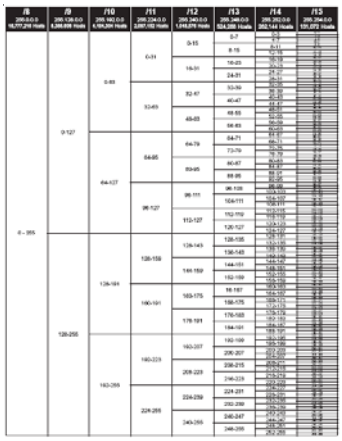
Class B Addresses

VLSM Chart 16-23 Bits (3rd octet)

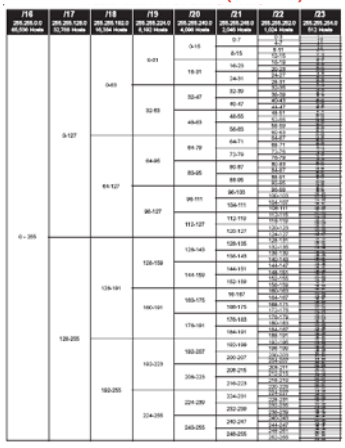
/16 255.255.0.0 65,536 Hosts	/17 255.255.128.0 32,768 Hosts	/18 255.255.192.0 16,384 Hosts	/19 255.255.224.0 8,192 Hosts	/20 255.255.240.0 4,096 Hosts	/21 255.255.248.0 2,048 Hosts	/22 255.255.252.0 1,024 Hosts	/23 255.255.254.0 512 Hosts
0 - 255	0-127	0-63	0-31	0-15	0-7	0-3	0 - 1 2 - 3
						4-7	4 -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

Reference Charts and Support Materials

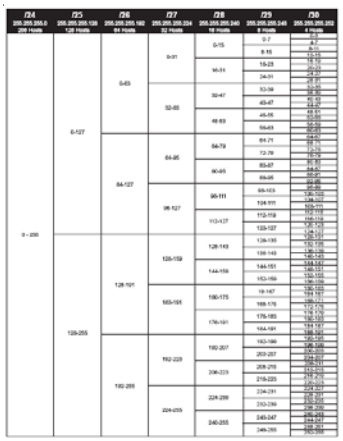
Class A Addresses
VLSM Chart 8-15 Bits (2nd octet)



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



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



Class A Addresses

VLSM Chart 8-15 Bits (2nd octet)

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

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

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