IP Addressing and Subnetting

Workbook

Version 1.5

11111110

10010101

00011011

10000110

11010011

Student Name:

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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

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Workbooks included in the series:

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

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

Binary To Decimal Conversion

128	64	32	16	8	4	2	1	Answers
1	0	0	1	0	0	1	0	146
0	1	1	1	0	1	1	1	119
1	1	1	1	1	1	1	1	255
1	1	0	0	0	1	0	1	197
1	1	1	1	0	1	1	0	246
0	0	0	1	0	0	1	1	19
1	0	0	0	0	0	0	1	129
0	0	1	1	0	0	0	1	49
0	1	1	1	1	0	0	0	120
1	1	1	1	0	0	0	0	240
0	0	1	1	1	0	1	1	59
0	0	0	0	0	1	1	1	7
						00011011		27
						10101010		170
						01101111		111
						11111000		248
						00100000		32
						01010101		85
						00111110		62
						00000011		3
						11101101		237
						11000000		192

Scratch Area

128 64
16 32
2 16
146 4
2
1
119

Decimal To Binary Conversion

Use all 8 bits for each problem

128	64	32	16	8	4	2	1	= 255
1	1	1	0	1	1	1	0	238
0	0	1	0	0	0	1	0	34
0	1	1	1	1	0	1	1	123
0	0	1	1	0	0	1	0	50
1	1	1	1	1	1	1	1	255
1	1	0	0	1	0	0	0	200
0	0	0	0	1	0	1	0	10
1	0	0	0	1	0	1	0	138
0	0	0	0	0	0	0	1	1
0	0	0	0	1	1	0	1	13
1	1	1	1	1	0	1	0	250
0	1	1	0	1	0	1	1	107
1	1	1	0	0	0	0	0	224
0	1	1	1	0	0	1	0	114
1	1	0	0	0	0	0	0	192
1	0	1	0	1	1	0	0	172
0	1	1	0	0	1	0	0	100
0	1	1	1	0	1	1	1	119
0	0	1	1	1	0	0	1	57
0	1	1	0	0	0	1	0	98
1	0	1	1	0	0	1	1	179
0	0	0	0	0	0	1	0	2

Scratch Area

```
238
-128
 110
 -64
  46
 -32
  14
  -8
   6
  -4
   2
  -2
   0
```

```
 34
-32
  2
 -2
  0
```

Address Class Identification

Address	Class
10.250.1.1	A
150.10.15.0	B
192.14.2.0	C
148.17.9.1	B
193.42.1.1	C
126.8.156.0	A
220.200.23.1	C
230.230.45.58	D
177.100.18.4	B
119.18.45.0	A
249.240.80.78	E
199.155.77.56	C
117.89.56.45	A
215.45.45.0	C
199.200.15.0	C
95.0.21.90	A
33.0.0.0	A
158.98.80.0	B
219.21.56.0	C

Network & Host Identification

Circle the network portion of these addresses:

177.100.18.4

119.18.45.0

209.240.80.78

199.155.77.56

117.89.56.45

215.45.45.0

192.200.15.0

95.0.21.90

33.0.0.0

158.98.80.0

217.21.56.0

10.250.1.1

150.10.15.0

192.14.2.0

148.17.9.1

193.42.1.1

126.8.156.0

220.200.23.1

Circle the host portion of these addresses:

10.15.123.50

171.2.199.31

198.125.87.177

223.250.200.222

17.45.222.45

126.201.54.231

191.41.35.112

155.25.169.227

192.15.155.2

123.102.45.254

148.17.9.155

100.25.1.1

195.0.21.98

25.250.135.46

171.102.77.77

55.250.5.5

218.155.230.14

10.250.1.1

Network Addresses

Using the IP address and subnet mask shown write out the network address:

188.10.18.2 255.255.0.0	188 . 10 . 0 . 0
10.10.48.80 255.255.255.0	10 . 10 . 48 . 0
192.149.24.191 255.255.255.0	192 . 149 . 24 . 0
150.203.23.19 255.255.0.0	150 . 203 . 0 . 0
10.10.10.10 255.0.0.0	10 . 0 . 0 . 0
186.13.23.110 255.255.255.0	186 . 13 . 23 . 0
223.69.230.250 255.255.0.0	223 . 69 . 0 . 0
200.120.135.15 255.255.255.0	200 . 120 . 135 . 0
27.125.200.151 255.0.0.0	27 . 0 . 0 . 0
199.20.150.35 255.255.255.0	199 . 20 . 150 . 0
191.55.165.135 255.255.255.0	191 . 55 . 165 . 0
28.212.250.254 255.255.0.0	28 . 212 . 0 . 0

Host Addresses

Using the IP address and subnet mask shown write out the host address:

188.10.18.2
255.255.0.0 — 0.0.18.2

10.10.48.80
255.255.255.0 — 0.0.0.80

222.49.49.11
255.255.255.0 — 0.0.0.11

128.23.230.19
255.255.0.0 — 0.0.230.19

10.10.10.10
255.0.0.0 — 0.10.10.10

200.113.123.11
255.255.255.0 — 0.0.0.11

223.169.23.20
255.255.0.0 — 0.0.23.20

203.20.35.215
255.255.255.0 — 0.0.0.215

117.15.2.51
255.0.0.0 — 0.15.2.51

199.120.15.135
255.255.255.0 — 0.0.0.135

191.55.165.135
255.255.255.0 — 0.0.0.135

48.21.25.54
255.255.0.0 — 0.0.25.54

Default Subnet Masks

Write the correct default subnet mask for each of the following addresses:

177.100.18.4	255 . 255 . 0 . 0
119.18.45.0	255 . 0 . 0 . 0
191.249.234.191	255 . 255 . 0 . 0
223.23.223.109	255 . 255 . 255 . 0
10.10.250.1	255 . 0 . 0 . 0
126.123.23.1	255 . 0 . 0 . 0
223.69.230.250	255 . 255 . 255 . 0
192.12.35.105	255 . 255 . 255 . 0
77.251.200.51	255 . 0 . 0 . 0
189.210.50.1	255 . 255 . 0 . 0
88.45.65.35	255 . 0 . 0 . 0
128.212.250.254	255 . 255 . 0 . 0
193.100.77.83	255 . 255 . 255 . 0
125.125.250.1	255 . 0 . 0 . 0
1.1.10.50	255 . 0 . 0 . 0
220.90.130.45	255 . 255 . 255 . 0
134.125.34.9	255 . 255 . 0 . 0
95.250.91.99	255 . 0 . 0 . 0

ANDING With
Default subnet masks

Every IP address must be accompanied by a subnet mask. By now you should be able to look at an IP address and tell what class it is. Unfortunately your computer doesn't think that way. For your computer to determine the network and subnet portion of an IP address it must "AND" the IP address with the subnet mask.

Default Subnet Masks:

Class A	255.0.0.0
Class B	255.255.0.0
Class C	255.255.255.0

ANDING Equations:

1 AND 1 = 1
1 AND 0 = 0
0 AND 1 = 0
0 AND 0 = 0

Sample:

What you see...

IP Address: 192 . 100 . 10 . 33

What you can figure out in your head...

Address Class:	C
Network Portion:	**192 . 100 . 10** . 33
Host Portion:	192 . 100 . 10 . **33**

In order for you computer to get the same information it must AND the IP address with the subnet mask in binary.

	Network	Host	
IP Address:	1 1 0 0 0 0 0 0 . 0 1 1 0 0 1 0 0 . 0 0 0 0 1 0 1 0	. 0 0 1 0 0 0 0 1	(192 . 100 . 10 . 33)
Default Subnet Mask:	1 1 1 1 1 1 1 1 . 0 1 1 1 1 1 1 1 . 1 1 1 1 1 1 1 1	. 0 0 0 0 0 0 0 0	(255 . 255 . 255 . 0)
AND:	1 1 0 0 0 0 0 0 . 0 1 1 0 0 1 0 0 . 0 0 0 0 1 0 1 0	. 0 0 0 0 0 0 0 0	(192 . 100 . 10 . 0)

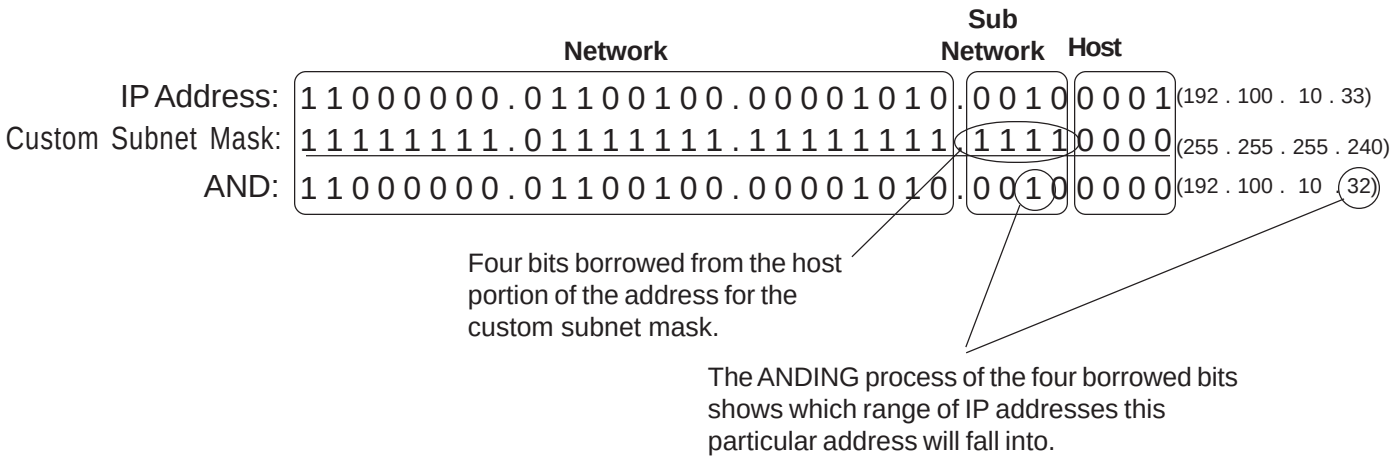
ANDING with the default subnet mask allows your computer to figure out the network portion of the address.

ANDING With
Custom subnet masks

When you take a single network such as 192.100.10.0 and divide it into five smaller networks (192.100.10.16, 192.100.10.32, 192.100.10.48, 192.100.10.64, 192.100.10.80) the outside world still sees the network as 192.100.10.0, but the internal computers and routers see five smaller subnetworks. Each independent of the other. This can only be accomplished by using a custom subnet mask. A custom subnet mask borrows bits from the host portion of the address to create a subnetwork address between the network and host portions of an IP address. In this example each range has 14 usable addresses in it. The computer must still AND the IP address against the custom subnet mask to see what the network portion is and which subnetwork it belongs to.

IP Address: 192 . 100 . 10 . 0
Custom Subnet Mask: 255.255.255.240

Address Ranges:
192.10.10.0 to 192.100.10.15
192.100.10.16 to 192.100.10.31
192.100.10.32 to 192.100.10.47 (Range in the sample below)
192.100.10.48 to 192.100.10.63
192.100.10.64 to 192.100.10.79
192.100.10.80 to 192.100.10.95
192.100.10.96 to 192.100.10.111
192.100.10.112 to 192.100.10.127
192.100.10.128 to 192.100.10.143
192.100.10.144 to 192.100.10.159
192.100.10.160 to 192.100.10.175
192.100.10.176 to 192.100.10.191
192.100.10.192 to 192.100.10.207
192.100.10.208 to 192.100.10.223
192.100.10.224 to 192.100.10.239
192.100.10.240 to 192.100.10.255



In the next set of problems you will determine the necessary information to determine the correct subnet mask for a variety of IP addresses.

How to determine the number of subnets and the number of hosts per subnet

Two formulas can provide this basic information:

Number of subnets = 2^s (Second subnet formula: **Number of subnets = 2^s - 2**)

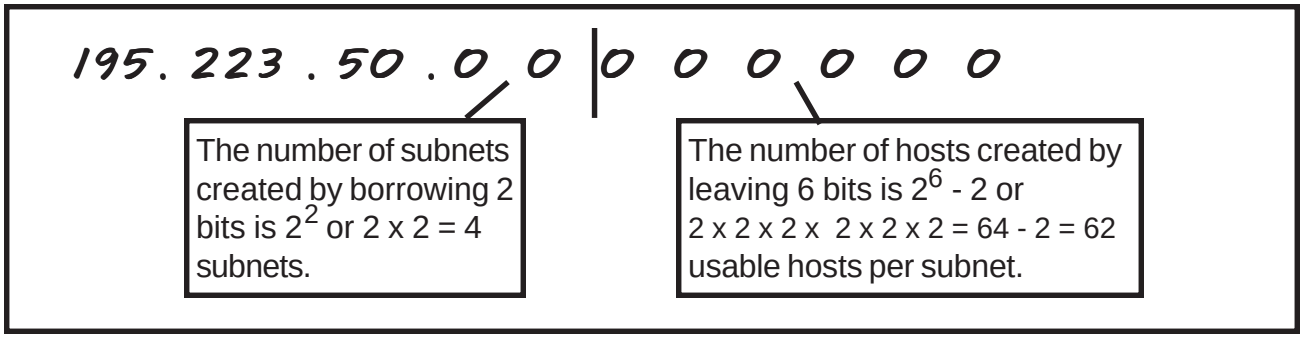
Number of hosts per subnet = 2^h - 2

Both formulas calculate the number of hosts or subnets based on the number of binary bits used. For example if you borrow three bits from the host portion of the address use the *number of subnets* formula to determine the total number of subnets gained by borrowing the three bits. This would be 2^3 or 2 x 2 x 2 = 8 subnets

To determine the number of hosts per subnet you would take the number of binary bits used in the host portion and apply this to the *number of hosts per subnet* formula If five bits are in the host portion of the address this would be 2^5 or 2 x 2 x 2 x 2 x 2 = 32 hosts.

When dealing with the *number of hosts per subnet* you have to subtract two addresses from the range. The first address in every range is the subnet number. The last address in every range is the broadcast address. These two addresses cannot be assigned to any device in the network which is why you have to subtract two addresses to find the number of usable addresses in each range.

For example if two bits are borrowed for the network portion of the address you can easily determine the number of subnets and hosts per subnets using the two formulas.



What about that second subnet formula:

Number of subnets = 2^s - 2

In some instances the first and last subnet range of addresses are reserved. This is similar to the first and last host addresses in each range of addreses.

The first range of addresses is the ***zero subnet***. The subnet number for the *zero subnet* is also the subnet number for the classful subnet address.

The last range of addresses is the ***broadcast subnet***. The broadcast address for the last subnet in *the broadcast subnet* is the same as the classful broadcast address.

Class C Address unsubnetted:

195. 223 . 50 . 0

195.223.50.0 to 195.223.50.255

Notice that the subnet and broadcast addresses match.

Class C Address subnetted (2 bits borrowed):

195. 223 . 50 . 0 0 | 0 0 0 0 0 0

(Invalid range) (0) 195.223.50.0 to 195.223.50.63
(1) 195.223.50.64 to 195.223.50.127
(2) 195.223.50.128 to 195.223.50.191
(Invalid range) (3) 195.223.50.192 to 195.223.50.255

The primary reason the the zero and broadcast subnets were not used had to do pirmarily with the broadcast addresses. If you send a broadcast to 195.223.255 are you sending it to all 255 addresses in the classful C address or just the 62 usable addresses in the broadcast range?

The **CCNA** and **CCENT** certification exams may have questions which will require you to determine which formula to use, and whehter or not you can use the first and last subnets. Use the chart below to help decide.

When to use which formula to determine the number of subnets	
Use the 2^S **- 2** formula and **don't use** the zero and broadcast ranges if...	Use the 2^S formula and **use** the zero and broadcast ranges if...
Classful routing is used	Classless routing or VLSM is used
RIP version 1 is used	RIP version 2, EIGRP, or OSPF is used
The ***no ip subnet zero*** command is configured on your router	The ***ip subnet zero*** command is configured on your router (default setting)
	No other clues are given

Bottom line for the CCNA exams; if a question does not give you any clues as to whether or not to allow these two subnets, assume you can use them.

This workbook has you use the number of subnets = 2^S formula.

Custom Subnet Masks

Problem 1

Number of needed subnets **14**
Number of needed usable hosts **14**
Network Address **192.10.10.0**

Address class C

Default subnet mask 255 . 255 . 255 . 0

Custom subnet mask 255 . 255 . 255 . 240

Total number of subnets 16

Total number of host addresses 16

Number of usable addresses 14

Number of bits borrowed 4

Show your work for Problem 1 in the space below.

	256	128	64	32	16	8	4	2	– Number of Hosts
Number of Subnets –	2	4	8	16	32	64	128	256	
	128	64	32	16	8	4	2	1	– Binary values
192 . 10 . 10 .	0	0	0	0	0	0	0	0	

Add the binary value numbers to the left of the line to create the custom subnet mask.

128
64
32
+16
240

16 Observe the total number of hosts.
−2 Subtract 2 for the number of usable hosts.
14

Custom Subnet Masks

Problem 2

Number of needed subnets **1000**
Number of needed usable hosts **60**
Network Address **165.100.0.0**

Address class _____B_____

Default subnet mask _____255 . 255 . 0 . 0_____

Custom subnet mask _____255 . 255 . 255 . 192_____

Total number of subnets _____1,024_____

Total number of host addresses _____64_____

Number of usable addresses _____62_____

Number of bits borrowed _____10_____

Show your work for <u>Problem 2</u> in the space below.

Number of Hosts →	65,536	32,768	16,384	8,192	4,096	2,048	1,024	512	.	256	128	64	32	16	8	4	2
Number of Subnets →	2	4	8	16	32	64	128	256	.	512	1024	2048	4,096	8,192	16,384	32,768	65,536
Binary values →	128	64	32	16	8	4	2	1	.	128	64	32	16	8	4	2	1
165 . 100 .	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0

Add the binary value numbers to the left of the line to create the custom subnet mask.

128
64
32
16
8
4
2
+1
255

128
+64
192

64 Observe the total number of hosts.
−2 Subtract 2 for the number of usable hosts.
62

Custom Subnet Masks

Problem 3

/26 indicates the total number of bits used for the network and subnetwork portion of the address. All bits remaining belong to the host portion of the address.

Network Address **148.75.0.0 /26**

Address class B

Default subnet mask 255 . 255 . 0 . 0

Custom subnet mask 255 . 255 . 255 . 192

Total number of subnets 1,024

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 10

Show your work for Problem 3 in the space below.

	65,536	32,768	16,384	8,192	4,096	2,048	1,024	512	. 256	128	64	32	16	8	4	2
Number of Hosts	–															
Number of Subnets	–	2	4	8	16	32	64	128	256.	512	1024	2048	4,096	8,192	16,384	32,768	65,536
Binary values	–	128	64	32	16	8	4	2	1 .	128	64	32	16	8	4	2	1
148 . 75 .		0	0	0	0	0	0	0	0 .	0	0	0	0	0	0	0	0

Add the binary value numbers to the left of the line to create the custom subnet mask.

128
64
32
16
8
4
2
+1
255

128
+64
192

64 Observe the total number of hosts.
−2 Subtract 2 for the number of usable hosts.
62

1024
−2
1,022

Subtract 2 for the total number of subnets to get the usable number of subnets.

Custom Subnet Masks

Problem 4

Number of needed subnets **6**
Number of needed usable hosts **30**
Network Address **195.85.8.0**

Address class C

Default subnet mask 255 . 255 . 255 . 0

Custom subnet mask 255 . 255 . 255 . 224

Total number of subnets 8

Total number of host addresses 32

Number of usable addresses 30

Number of bits borrowed 3

Show your work for Problem 5 in the space below.

	256	128	64	32	16	8	4	2	-	Number of Hosts
Number of Subnets -	2	4	8	16	32	64	128	256		
	128	64	32	16	8	4	2	1	-	Binary values
195 . 85 . 8 .	0	0	0	0	0	0	0	0		

128
64
+32
224

32
-2
30

8
-2
6

Custom Subnet Masks

Problem 5

Number of needed subnets **6**
Number of needed usable hosts **30**
Network Address **210.100.56.0**

Address class C

Default subnet mask 255 . 255 . 255 . 0

Custom subnet mask 255 . 255 . 255 . 224

Total number of subnets 8

Total number of host addresses 32

Number of usable addresses 30

Number of bits borrowed 3

Show your work for Problem 4 in the space below.

Number of Subnets	256	128	64	32	16	8	4	2	Number of Hosts
	2	4	8	16	32	64	128	256	
	128	64	32	16	8	4	2	1	Binary values
210 . 100 . 56 .	0	0	0	0	0	0	0	0	

128
64
+32
224

8
-2
6

32
-2
30

Custom Subnet Masks

Problem 6

Number of needed subnets **126**
Number of needed usable hosts **131,070**
Network Address **118.0.0.0**

Address class A

Default subnet mask 255 . 0 . 0 . 0

Custom subnet mask 255 . 254 . 0 . 0

Total number of subnets 128

Total number of host addresses 131,072

Number of usable addresses 131,070

Number of bits borrowed 7

Show your work for Problem 6 in the space below.

Number of Hosts	1			4,194,304	2,097,152	1,048,576	524,288	262,144	131,072		65,536	32,768	16,384	8,192	4,096	2,048	1,024	512		256	128	64	32	16	8	4	2						
Number of Subnets	1	2	4	8	16	32	64	128	256	.	512	1,024	2,048	4,096	8,192	16,384	32,768	65,536	.	131,072	262,144	524,288	1,048,576	2,097,152	4,194,304							
Binary values	128	64	32	16	8	4	2	1	.	128	64	32	16	8	4	2	1	.	128	64	32	16	8	4	2	1						
118.	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0						

128
64
32
16
8
4
+2
254

128
-2
126

131,072
-2
131,070

Custom Subnet Masks

Problem 7

Number of needed subnets **2000**
Number of needed usable hosts **15**
Network Address **178.100.0.0**

Address class B

Default subnet mask 255 . 255 . 0 . 0

Custom subnet mask 255 . 255 . 255 . 224

Total number of subnets 2,048

Total number of host addresses 32

Number of usable addresses 30

Number of bits borrowed 11

Show your work for Problem 7 in the space below.

Number of Hosts	–	65,536	32,768	16,384	8,192	4,096	2,048	1,024	512	.	256	128	64	32	16	8	4	2
Number of Subnets	–	2	4	8	16	32	64	128	256	.	512	1024	2048	4,096	8,192	16,384	32,768	65,536
Binary values	–	128	64	32	16	8	4	2	1	.	128	64	32	16	8	4	2	1
178 . 100 .		0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0

128
64
32
16
8
4
2
+1
255

2,048
-2
2,046

32
-2
30

Custom Subnet Masks

Problem 8

Number of needed subnets **3**
Number of needed usable hosts **45**
Network Address **200.175.14.0**

Address class C

Default subnet mask 255 . 255 . 255 . 0

Custom subnet mask 255 . 255 . 255 . 192

Total number of subnets 4

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 2

Show your work for Problem 8 in the space below.

	256	128	64	32	16	8	4	2	- Number of Hosts
Number of Subnets -	2	4	8	16	32	64	128	256	
	128	64	32	16	8	4	2	1	- Binary values
200 . 175 . 14 .	0	0	0	0	0	0	0	0	

128 + 64 = 240

4 - 2 = 2

64 - 2 = 62

Custom Subnet Masks

Problem 9

Number of needed subnets **60**
Number of needed usable hosts **1,000**
Network Address **128.77.0.0**

Address class B

Default subnet mask 255 . 255 . 0 . 0

Custom subnet mask 255 . 255 . 252 . 0

Total number of subnets 64

Total number of host addresses 1,024

Number of usable addresses 1,022

Number of bits borrowed 6

Show your work for Problem 9 in the space below.

									.								
Number of Hosts –	65,536	32,768	16,384	8,192	4,096	2,048	1,024	512	.	256	128	64	32	16	8	4	2
Number of Subnets –	2	4	8	16	32	64	128	256.		512	1024	2048	4,096	8,192	16,384	32,768	65,536
Binary values –	128	64	32	16	8	4	2	1	.	128	64	32	16	8	4	2	1
128 . 77 .	0	0	0	0	0	0	0	0	.	0	0	0	0	0	0	0	0

128
64
32
16
8
+4
252

64
-2
62

1,024
-2
1,022

Custom Subnet Masks

Problem 10

Number of needed usable hosts **60**

Network Address **198.100.10.0**

Address class C

Default subnet mask 255 . 255 . 255 . 0

Custom subnet mask 255 . 255 . 255 . 192

Total number of subnets 4

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 2

Show your work for Problem 10 in the space below.

	256	128	64	32	16	8	4	2	– Number of Hosts
Number of Subnets –	2	4	8	16	32	64	128	256	
	128	64	32	16	8	4	2	1	– Binary values
198 . 100 . 10 .	0	0	0	0	0	0	0	0	

128 + 64 = 192

64 − 2 = 62

4 − 2 = 2

Custom Subnet Masks

Problem 11

Number of needed subnets **250**

Network Address **101.0.0.0**

Address class A

Default subnet mask 255 . 0 . 0 . 0

Custom subnet mask 255 . 255 . 0 . 0

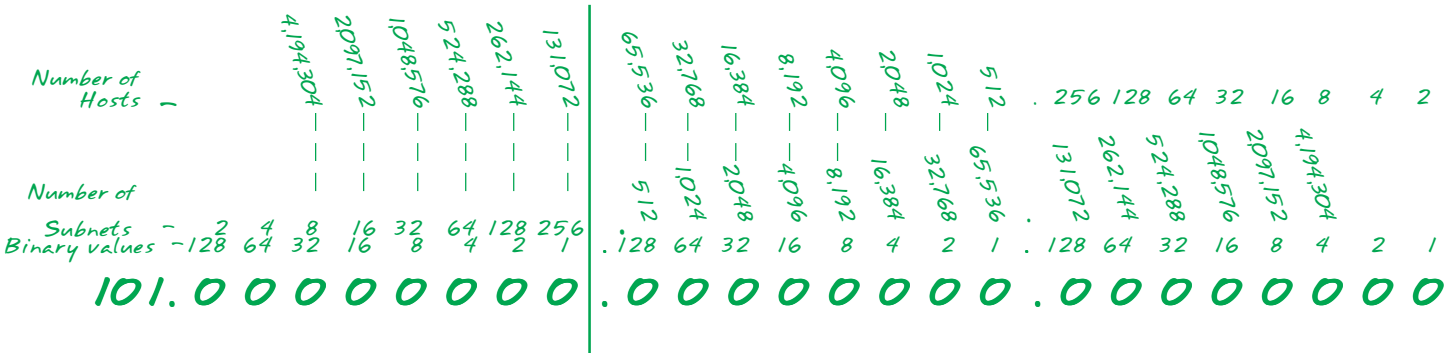
Total number of subnets 256

Total number of host addresses 65,536

Number of usable addresses 65,534

Number of bits borrowed 8

Show your work for Problem 11 in the space below.



128
64
32
16
8
4
2
+1
255

256
-2
254

65,536
-2
65,534

Custom Subnet Masks

Problem 12

Number of needed subnets **5**

Network Address **218.35.50.0**

Address class C

Default subnet mask 255 . 255 . 255 . 0

Custom subnet mask 255 . 255 . 255 . 224

Total number of subnets 8

Total number of host addresses 32

Number of usable addresses 30

Number of bits borrowed 3

Show your work for Problem 12 in the space below.

	256	128	64	32	16	8	4	2	– Number of Hosts
Number of Subnets –	2	4	8	16	32	64	128	256	
	128	64	32	16	8	4	2	1	– Binary values
218 . 35 . 50 .	0	0	0	0	0	0	0	0	

128
64
+32
224

64
−2
62

4
−2
2

Custom Subnet Masks

Problem 13

Number of needed usable hosts **25**

Network Address **218.35.50.0**

Address class C

Default subnet mask 255 . 255 . 255 . 0

Custom subnet mask 255 . 255 . 255 . 224

Total number of subnets 8

Total number of host addresses 32

Number of usable addresses 30

Number of bits borrowed 3

Show your work for Problem 13 in the space below.

	256	128	64	32	16	8	4	2	– Number of Hosts
Number of Subnets –	2	4	8	16	32	64	128	256	
	128	64	32	16	8	4	2	1	– Binary values
218 . 35 . 50 .	0	0	0	0	0	0	0	0	

128
64
+32
224

8
−2
6

32
−2
30

Custom Subnet Masks

Problem 14

Number of needed subnets **10**

Network Address **172.59.0.0**

Address class B

Default subnet mask 255 . 255 . 0 . 0

Custom subnet mask 255 . 255 . 240 . 0

Total number of subnets 16

Total number of host addresses 4,096

Number of usable addresses 4,094

Number of bits borrowed 4

Show your work for Problem 14 in the space below.

										.								
Number of Hosts →	65,536	32,768	16,384	8,192	4,096	2,048	1,024	512		.	256	128	64	32	16	8	4	2
Number of Subnets →	2	4	8	16	32	64	128	256		.	512	1024	2048	4,096	8,192	16,384	32,768	65,536
Binary values →	128	64	32	16	8	4	2	1		.	128	64	32	16	8	4	2	1
172 . 59 .	0	0	0	0	0	0	0	0		.	0	0	0	0	0	0	0	0

128
64
32
+16
240

16
-2
14

4,096
-2
4,094