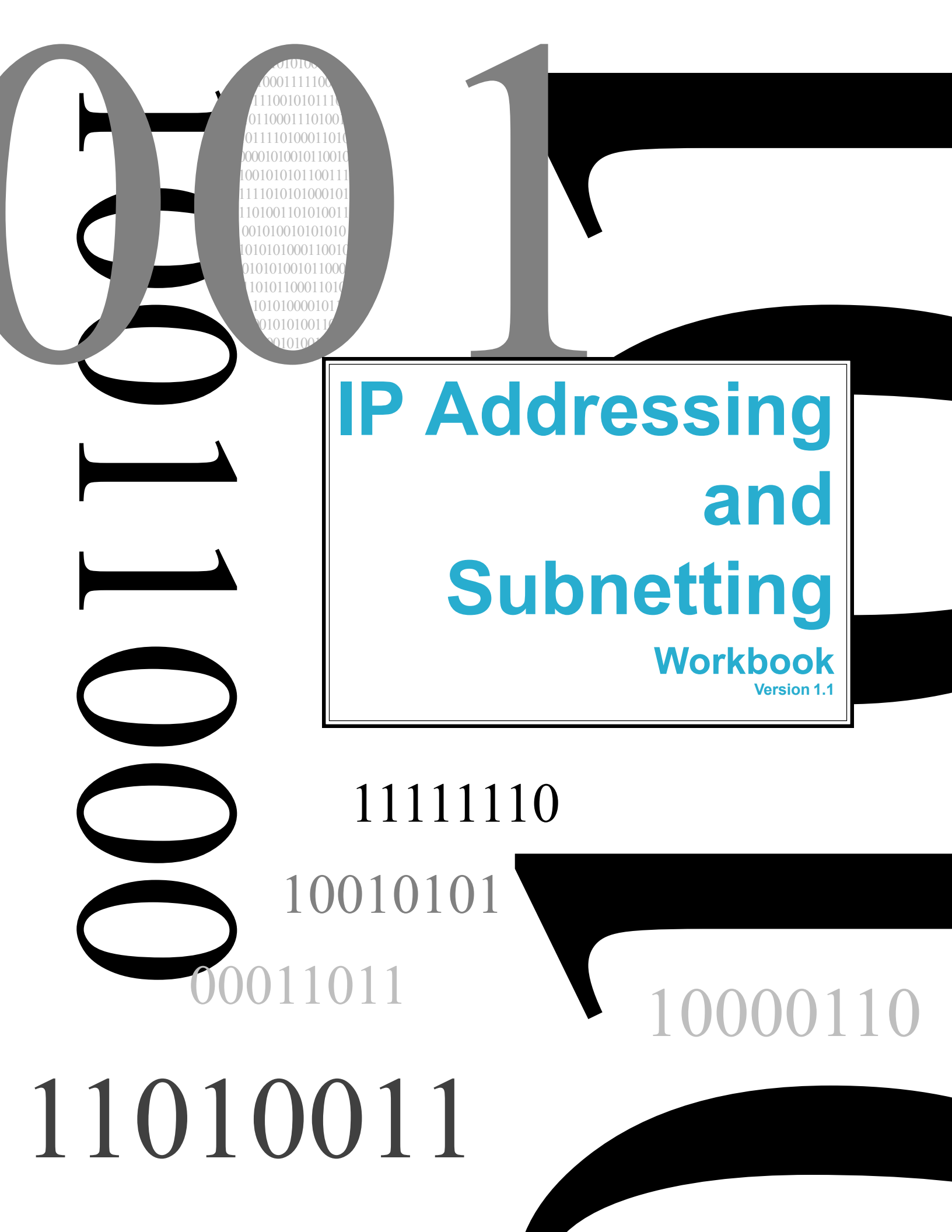

IP Addressing
and
Subnetting
Workbook
Version 1.1
11111110
10010101
00011011
10000110
11010011

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

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	
1	1	0	0	0	1	0	1	
1	1	1	1	0	1	1	0	
0	0	0	1	0	0	1	1	
1	0	0	0	0	0	0	1	
0	0	1	1	0	0	0	1	
0	1	1	1	1	0	0	0	
1	1	1	1	0	0	0	0	
0	0	1	1	1	0	1	1	
0	0	0	0	0	1	1	1	
						00011011		
						10101010		
						01101111		
						11111000		
						00100000		
						01010101		
						00111110		
						00000011		
						11101101		
						11000000		

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
								123
								50
								255
								200
								10
								138
								1
								13
								250
								107
								224
								114
								192
								172
								100
								119
								57
								98
								179
								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	_____
148.17.9.1	_____
193.42.1.1	_____
126.8.156.0	_____
220.200.23.1	_____
230.230.45.58	_____
177.100.18.4	_____
119.18.45.0	_____
249.240.80.78	_____
199.155.77.56	_____
117.89.56.45	_____
215.45.45.0	_____
199.200.15.0	_____
95.0.21.90	_____
33.0.0.0	_____
158.98.80.0	_____
219.21.56.0	_____

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

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	
223.23.223.109	
10.10.250.1	
126.123.23.1	
223.69.230.250	
192.12.35.105	
77.251.200.51	
189.210.50.1	
88.45.65.35	
128.212.250.254	
193.100.77.83	
125.125.250.1	
1.1.10.50	
220.90.130.45	
134.125.34.9	
95.250.91.99	

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 . 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 . 1 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 . 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)

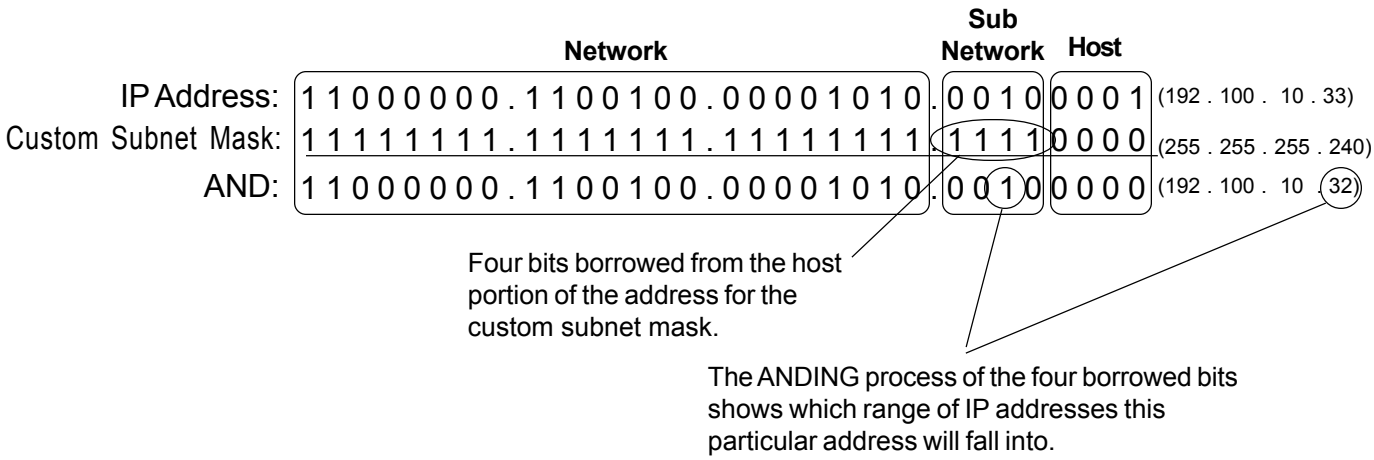
ANDING with the default subnet mask allows your computer to figure out the network portion of the address.

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 (Invalid Range)
192.100.10.16 to 192.100.10.31 (1st Usable Range)
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 (Invalid Range)



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

Custom Subnet Masks

Problem 1

Number of needed usable 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

Number of usable subnets 14

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

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

16
−2
14

Custom Subnet Masks

Problem 2

Number of needed usable 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

Number of usable subnets 1,022

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 10

Show your work for Problem 2 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

1024 − 2 = 1,022

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

64 − 2 = 62

Observe the total number of hosts.

Subtract 2 for the number of usable hosts.

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

Number of usable subnets 1,022

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 usable subnets **6**

Number of needed usable hosts **30**

Network Address **210.100.56.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 4 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
210 . 100 . 56 .		0	0	0	0	0	0	0	0	

Custom Subnet Masks

Problem 5

Number of needed usable subnets **6**

Number of needed usable hosts **30**

Network Address **195.85.8.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

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		

Custom Subnet Masks

Problem 6

Number of needed usable subnets **126**

Number of needed usable hosts **131,070**

Network Address **118.0.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

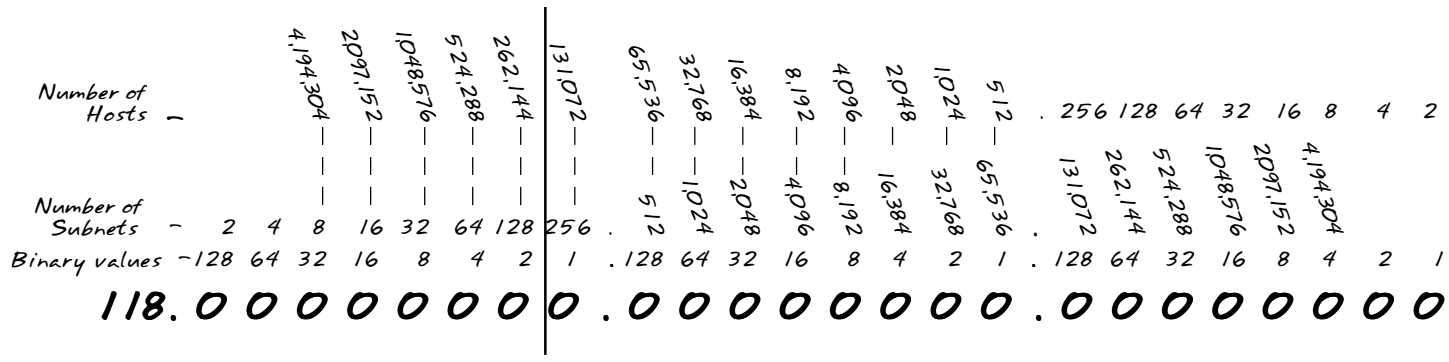
Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 6 in the space below.



Custom Subnet Masks

Problem 7

Number of needed usable subnets **2000**

Number of needed usable hosts **15**

Network Address **178.100.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

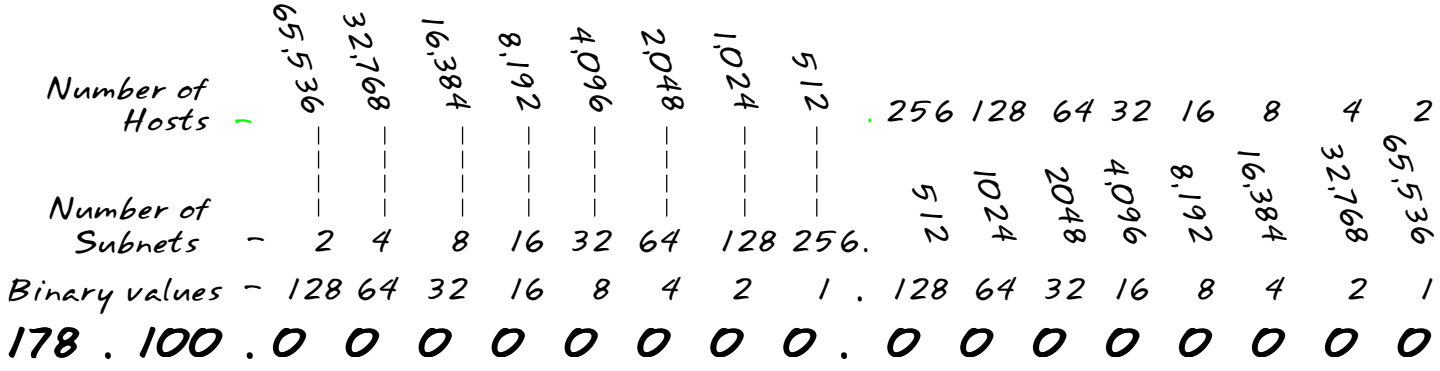
Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 7 in the space below.



Custom Subnet Masks

Problem 8

Number of needed usable subnets **1**

Number of needed usable hosts **45**

Network Address **200.175.14.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 8 in the space below.

Custom Subnet Masks

Problem 9

Number of needed usable subnets **60**

Number of needed usable hosts **1,000**

Network Address **128.77.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 9 in the space below.

Custom Subnet Masks

Problem 10

Number of needed usable hosts **60**

Network Address **198.100.10.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 10 in the space below.

Custom Subnet Masks

Problem 11

Number of needed usable subnets **250**

Network Address **101.0.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 11 in the space below.

Custom Subnet Masks

Problem 12

Number of needed usable subnets **5**

Network Address **218.35.50.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 12 in the space below.

Custom Subnet Masks

Problem 13

Number of needed usable hosts **25**

Network Address **218.35.50.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 13 in the space below.

Custom Subnet Masks

Problem 14

Number of needed usable subnets **10**

Network Address **172.59.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 14 in the space below.

Custom Subnet Masks

Problem 15

Number of needed usable hosts **50**

Network Address **172.59.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 15 in the space below.

Custom Subnet Masks

Problem 16

Number of needed usable hosts **29**

Network Address **23.0.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for Problem 16 in the space below.

Subnetting

Problem 1

Number of needed usable 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

Number of usable subnets 14

Total number of host addresses 16

Number of usable addresses 14

Number of bits borrowed 4

What is the 3rd usable subnet range? 192.10.10.48 to 192.10.10.63

What is the subnet number for the 7th usable subnet? 192 . 10 . 10 . 112

What is the subnet broadcast address for the 12th usable subnet? 192 . 10 . 10 . 207

What are the assignable addresses for the 8th usable subnet? 192.10.10.129 to 192.10.10.142

Show your work for Problem 1 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
192. 10 . 10 . 0	0	0	0	0	0	0	0	0	

(Invalid range)				0	192.10.10.0	to	192.10.10.15
				1	192.10.10.16	to	192.10.10.31
			1	0	192.10.10.32	to	192.10.10.47
			1	1	192.10.10.48	to	192.10.10.63
		1	0	0	192.10.10.64	to	192.10.10.79
		1	0	1	192.10.10.80	to	192.10.10.95
		1	1	0	192.10.10.96	to	192.10.10.111
		1	1	1	192.10.10.112	to	192.10.10.127
	1	0	0	0	192.10.10.128	to	192.10.10.143
	1	0	0	1	192.10.10.144	to	192.10.10.159
	1	0	1	0	192.10.10.160	to	192.10.10.175
	1	0	1	1	192.10.10.176	to	192.10.10.191
	1	1	0	0	192.10.10.192	to	192.10.10.207
	1	1	0	1	192.10.10.208	to	192.10.10.223
	1	1	1	0	192.10.10.224	to	192.10.10.239
(Invalid range)	1	1	1	1	192.10.10.240	to	192.10.10.255

Custom subnet mask:
128
64
32
+16
240

Usable subnets:
16
-2
14

Usable hosts:
16
-2
14

The binary value of the last bit borrowed is the range. In this problem the range is 16.

The first and last range of addresses are not usable.

The first usable range of addresses is: 192.10.10.16 to 192.10.10.31.

The first address in each subnet range is the subnet number.

The last address in each subnet range is the subnet broadcast address.

Subnetting

Problem 2

Number of needed usable 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

Number of usable subnets 1,022

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 10

What is the 14th usable subnet range? 165.100.3.128 to 165.100.3.191

What is the subnet number for the 5th usable subnet? 165 . 100 . 1 . 64

What is the subnet broadcast address for the 5th usable subnet? 165 . 100 . 1 . 127

What are the assignable addresses for the 8th usable subnet? 165.100.2.1 to 165.100.0.62

Show your work for Problem 2 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**	

64
Usable hosts: −2 = 62

1024
Usable subnets: −2 = 1,022

128
Custom subnet mask: +64 = 192

64
+1
255

						(Invalid range)	0	165.100.0.0	to 165.100.0.63
							1	165.100.0.64	to 165.100.0.127
						1	0	165.100.0.128	to 165.100.0.191
						1	1	165.100.0.192	to 165.100.0.255
					1	0	0	165.100.1.0	to 165.100.1.63
					1	0	1	165.100.1.64	to 165.100.1.127
					1	1	0	165.100.1.128	to 165.100.1.191
					1	1	1	165.100.1.192	to 165.100.1.255
				1	0	0	0	165.100.2.0	to 165.100.0.63
				1	0	0	1	165.100.2.64	to 165.100.0.127
				1	0	1	0	165.100.2.128	to 165.100.0.191
				1	0	1	1	165.100.2.192	to 165.100.0.255
				1	1	0	0	165.100.3.0	to 165.100.3.63
				1	1	0	1	165.100.3.64	to 165.100.3.127
				1	1	1	0	165.100.3.128	to 165.100.3.191
				1	1	1	1	165.100.3.192	to 165.100.3.255

Down to

		165.100.255.128	to 165.100.255.191
(Invalid range)		165.100.255.192	to 165.100.255.255

The binary value of the last bit borrowed is the range. In this problem the range is 64.

The first and last range of addresses are not usable.

The first usable range of addresses is: 165.100.0.64 to 165.100.0.127

The first address in each subnet range is the subnet number.

The last address in each subnet range is the subnet broadcast address.

Subnetting

Problem 3

Number of needed usable subnets **1**

Network Address **195.223.50.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 2nd usable subnet range? _____

What is the subnet number for the 1st usable subnet? _____

What is the subnet broadcast address for the 1st usable subnet? _____

What are the assignable addresses for the 2nd usable subnet? _____

Show your work for Problem 3 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
195.223.50.0	0	0	0	0	0	0	0	0	

Subnetting

Problem 4

Number of needed usable subnets **750**

Network Address **190.35.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 14th usable subnet range? _____

What is the subnet number for the 12th usable subnet? _____

What is the subnet broadcast address for the 9th usable subnet? _____

What are the assignable addresses for the 5th usable subnet? _____

Show your work for Problem 4 in the space below.

Subnetting

Problem 5

Number of needed usable hosts **6**

Network Address **126.0.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 1st usable subnet range? _____

What is the subnet number for the 4th usable subnet? _____

What is the subnet broadcast address for the 6th usable subnet? _____

What are the assignable addresses for the 9th usable subnet? _____

Show your work for Problem 5 in the space below.

Subnetting

Problem 6

Number of needed usable subnets **10**

Network Address **192.70.10.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 8th usable subnet range? _____

What is the subnet number for the 3rd usable subnet? _____

What is the subnet broadcast address for the 11th usable subnet? _____

What are the assignable addresses for the 9th usable subnet? _____

Show your work for Problem 6 in the space below.

Subnetting

Problem 7

Network Address **10.0.0.0 /16**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 10th usable subnet range? _____

What is the subnet number for the 5th usable subnet? _____

What is the subnet broadcast address for the 1st usable subnet? _____

What are the assignable addresses for the 8th usable subnet? _____

Show your work for Problem 7 in the space below.

Subnetting

Problem 8

Number of needed usable subnets **4**

Network Address **172.50.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 3rd usable subnet range? _____

What is the subnet number for the 4th usable subnet? _____

What is the subnet broadcast address for the 5th usable subnet? _____

What are the assignable addresses for the 2nd usable subnet? _____

Show your work for Problem 8 in the space below.

Subnetting

Problem 9

Number of needed usable hosts **28**

Network Address **172.50.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 1st usable subnet range? _____

What is the subnet number for the 9th usable subnet? _____

What is the subnet broadcast address for the 3rd usable subnet? _____

What are the assignable addresses for the 5th usable subnet? _____

Show your work for Problem 9 in the space below.

Subnetting

Problem 10

Number of needed usable subnets **45**

Network Address **220.100.100.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 4th usable subnet range? _____

What is the subnet number for the 3rd usable subnet? _____

What is the subnet broadcast address for the 12th usable subnet? _____

What are the assignable addresses for the 11th usable subnet? _____

Show your work for Problem 10 in the space below.

Subnetting

Problem 11

Number of needed usable hosts **8,000**

Network Address **135.70.0.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 5th usable subnet range? _____

What is the subnet number for the 6th usable subnet? _____

What is the subnet broadcast address for the 2nd usable subnet? _____

What are the assignable addresses for the 4th usable subnet? _____

Show your work for Problem 11 in the space below.

Subnetting

Problem 12

Number of needed usable hosts **45**

Network Address **198.125.50.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 1st usable subnet range? _____

What is the subnet number for the 1st usable subnet? _____

What is the subnet broadcast address for the 2nd usable subnet? _____

What are the assignable addresses for the 2nd usable subnet? _____

Show your work for Problem 12 in the space below.

Subnetting

Problem 13

Network Address **165.200.0.0 /26**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 9th usable subnet range? _____

What is the subnet number for the 10th usable subnet? _____

What is the subnet broadcast address for the 1022nd usable subnet? _____

What are the assignable addresses for the 1021st usable subnet? _____

Show your work for Problem 13 in the space below.

Subnetting

Problem 14

Number of needed usable hosts **16**

Network Address **200.10.10.0**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 6th usable subnet range? _____

What is the subnet number for the 4th usable subnet? _____

What is the subnet broadcast address for the 3rd usable subnet? _____

What are the assignable addresses for the 5th usable subnet? _____

Show your work for Problem 14 in the space below.

Subnetting

Problem 15

Network Address **93.0.0.0 \19**

Address class _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Number of usable subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 14th usable subnet range? _____

What is the subnet number for the 8th usable subnet? _____

What is the subnet broadcast address for the 6th usable subnet? _____

What are the assignable addresses for the 11th usable subnet? _____

Show your work for Problem 15 in the space below.

Valid and Non-Valid IP Addresses

Using the material in this workbook identify which of the addresses below are correct and usable. If they are not usable addresses explain why.

IP Address: 0.230.190.192
Subnet Mask: 255.0.0.0

The network ID cannot be 0.

IP Address: 192.10.10.1
Subnet Mask: 255.255.255.0

OK

IP Address: 245.150.190.10
Subnet Mask: 255.255.255.0

IP Address: 135.70.191.255
Subnet Mask: 255.255.254.0

IP Address: 127.100.100.10
Subnet Mask: 255.0.0.0

IP Address: 93.0.128.1
Subnet Mask: 255.255.224.0

IP Address: 200.10.10.128
Subnet Mask: 255.255.255.224

IP Address: 165.100.255.189
Subnet Mask: 255.255.255.192

IP Address: 190.35.0.10
Subnet Mask: 255.255.255.192

IP Address: 218.35.50.195
Subnet Mask: 255.255.0.0

IP Address: 200.10.10.175 /22

IP Address: 135.70.255.255
Subnet Mask: 255.255.224.0

Class A Addressing Guide

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

Class B Addressing Guide

# of Bits Borrowed	Subnet Mask	Total # of Subnets	Usable # of Subnets	Total # of Hosts	Usable # of Hosts
2	255.255.192.0	4	2	16,384	16,382
3	255.255.224.0	8	6	8,192	8,190
4	255.255.240.0	16	14	4,096	4,094
5	255.255.248.0	32	30	2,048	2,046
6	255.255.252.0	64	62	1,024	1,022
7	255.255.254.0	128	126	512	510
8	255.255.255.0	256	254	256	254
9	255.255.255.128	512	510	128	126
10	255.255.255.192	1,024	1,022	64	62
11	255.255.255.224	2,048	2,046	32	30
12	255.255.255.240	4,096	4,094	16	14
13	255.255.255.248	8,192	8,190	8	6
14	255.255.255.252	16,384	16,382	4	2

Class C Addressing Guide

# of Bits Borrowed	Subnet Mask	Total # of Subnets	Usable # of Subnets	Total # of Hosts	Usable # of Hosts
2	255.255.255.192	4	2	64	62
3	255.255.255.224	8	6	32	30
4	255.255.255.240	16	14	16	14
5	255.255.255.248	32	30	8	6
6	255.255.255.252	64	62	4	2