

## 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	1	Number of Hosts
Number of Subnets	-	2	4	8	16	32	64	128	256	
	128	64	32	16	8	4	2	1	-	Binary values
<b>192 . 10 . 10 . 0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	

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	
14	Subtract 2 for the number of usable hosts.

## 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 Problem 2 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	4096	8192	16384	32768
Binary values	-	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2
		165	100	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	128
64	+64
32	192
16	
8	
4	
2	
+1	
<u>255</u>	

64	Observe the total number of hosts.
-2	
<u>62</u>	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

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	1,024	2,048	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																
	128			128												
	64			+64												
	32			192												
	16															
	8															
	4															
	2															
	+1															
	255															
							1024									
							-2									
							1,022									

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

64 Observe the total number of hosts.

-2 Subtract 2 for the number of usable hosts.

62

1024 Subtract 2 for the total number of subnets to get the usable number of subnets.

-2

1,022

## 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 2048

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.

	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	4096	8192	16384	32768	65536
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																

$1+2+4+8+16+32+64+128 = 255$

$32+64+128 = 224$

$32 - 2 = 30$

## Custom Subnet Masks

### **Problem 15**

Number of needed usable hosts **50**

Network Address **172.59.0.0**

Address class B

Default subnet mask 255.255.0.0

Custom subnet mask 255.255.255.192

Total number of subnets 1024

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 10

**Show your work for Problem 15 in the space below.**

$$1+2+4+8+16+32+64+128 = 255$$

$$64-2 = 62$$

$$32+64+128 = 192$$

# Subnetting

## 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

What is the 4th subnet range? 192.10.10.48 to 192.10.10.63

What is the subnet number for the 8th subnet? 192 . 10 . 10 . 112

What is the subnet broadcast address for the 13th subnet? 192 . 10 . 10 . 207

What are the assignable addresses for the 9th 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	0	
(0)	0	0	0	0						192.10.10.0 to 192.10.10.15
(1)	0	0	0	1						192.10.10.16 to 192.10.10.31
(2)	0	0	1	0						192.10.10.32 to 192.10.10.47
(3)	0	0	1	1						192.10.10.48 to 192.10.10.63
(4)	0	1	0	0						192.10.10.64 to 192.10.10.79
(5)	0	1	0	1						192.10.10.80 to 192.10.10.95
(6)	0	1	1	0						192.10.10.96 to 192.10.10.111
(7)	0	1	1	1						192.10.10.112 to 192.10.10.127
(8)	1	0	0	0						192.10.10.128 to 192.10.10.143
(9)	1	0	0	1						192.10.10.144 to 192.10.10.159
(10)	1	0	1	0						192.10.10.160 to 192.10.10.175
(11)	1	0	1	1						192.10.10.176 to 192.10.10.191
(12)	1	1	0	0						192.10.10.192 to 192.10.10.207
(13)	1	1	0	1						192.10.10.208 to 192.10.10.223
(14)	1	1	1	0						192.10.10.224 to 192.10.10.239
(15)	1	1	1	1						192.10.10.240 to 192.10.10.255

$$\begin{array}{r}
 128 \\
 64 \\
 32 \\
 +16 \\
 \hline
 \text{Custom subnet mask } 240
 \end{array}$$

$$\begin{array}{r}
 16 \\
 -2 \\
 \hline
 \text{Usable subnets } 14
 \end{array}$$

$$\begin{array}{r}
 16 \\
 -2 \\
 \hline
 \text{Usable hosts } 14
 \end{array}$$

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

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 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

What is the 15th subnet range? 165.100.3.128 to 165.100.3.191

What is the subnet number for the 6th subnet? 165 . 100 . 1 . 64

What is the subnet broadcast address for the 6th subnet? 165 . 100 . 1 . 127

What are the assignable addresses for the 9th 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	4096	8192	16384	32768	65536
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	165.100.0.0	to	165.100.0.63
						(1)	1	165.100.0.64	to	165.100.0.127
	64	128				(2)	1	165.100.0.128	to	165.100.0.191
Usable	-2	64				(3)	1	165.100.0.192	to	165.100.0.255
hosts	62	32				(4)	1	165.100.1.0	to	165.100.1.63
		16				(5)	1	165.100.1.64	to	165.100.1.127
		8				(6)	1	165.100.1.128	to	165.100.1.191
Custom	128	4				(7)	1	165.100.1.192	to	165.100.1.255
subnet mask	+64	2				(8)	1	165.100.2.0	to	165.100.2.63
	192	+1				(9)	1	165.100.2.64	to	165.100.2.127
		255				(10)	1	165.100.2.128	to	165.100.2.191
						(11)	1	165.100.2.192	to	165.100.2.255
						(12)	1	165.100.3.0	to	165.100.3.63
						(13)	1	165.100.3.64	to	165.100.3.127
						(14)	1	165.100.3.128	to	165.100.3.191
						(15)	1	165.100.3.192	to	165.100.3.255

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

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

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

Down to

(1022)	1	1	1	1	1	1	1	1	1	0	165.100.255.128	to	165.100.255.191
(1023)	1	1	1	1	1	1	1	1	1	1	165.100.255.192	to	165.100.255.255

# Subnetting

## **Problem 11**

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

Network Address **135.70.0.0**

Address class B

Default subnet mask 255.255.0.0

Custom subnet mask 255.255.224.0

Total number of subnets 8

Total number of host addresses 8192

Number of usable addresses 8190

Number of bits borrowed 3

What is the 6th subnet range? 135.70.160.0 to 135.70.191.255

What is the subnet number for the 7th subnet? 135.70.192.0

What is the subnet broadcast address for the 3rd subnet? 135.70.95.255

What are the assignable addresses for the 5th subnet? 135.70.128.1 to 135.70.159.254

Show your work for Problem 11 in the space below.

0) 135.70.0.0 - 135.70.31.255

1) 135.70.32.0 - 135.70.63.255

2) 135.70.64.0 - 135.70.95.255 3rd Broadcast address

3) 135.70.96.0 - 135.70.127.255

4) 135.70.128.0 - 135.70.159.255

5) 135.70.160.0 - 135.70.191.255 6th subnet range

6) 135.70.192.0 - 135.70.223.255

7) 135.70.224.0 - 135.70.223.255

5th subnet range = 135.70.128.0 - 135.70.159.255

Assignable range/addresses = 135.70.128.1 - 135.159.254

# Subnetting

## **Problem 12**

Number of needed usable hosts **45**

Network Address **198.125.50.0**

Address class   c  

Default subnet mask   255.255.255.0  

Custom subnet mask   255.255.255.192  

Total number of subnets   1024  

Total number of host addresses   64  

Number of usable addresses   62  

Number of bits borrowed   10  

What is the 2nd subnet range?   198.125.50.16 to 198.125.50.31  

What is the subnet number for the 2nd subnet?   198.125.50.16  

What is the subnet broadcast address for the 4th subnet?   198.125.50.63  

What are the assignable addresses for the 3rd subnet?   198.125.50.33 to 198.125.50.46

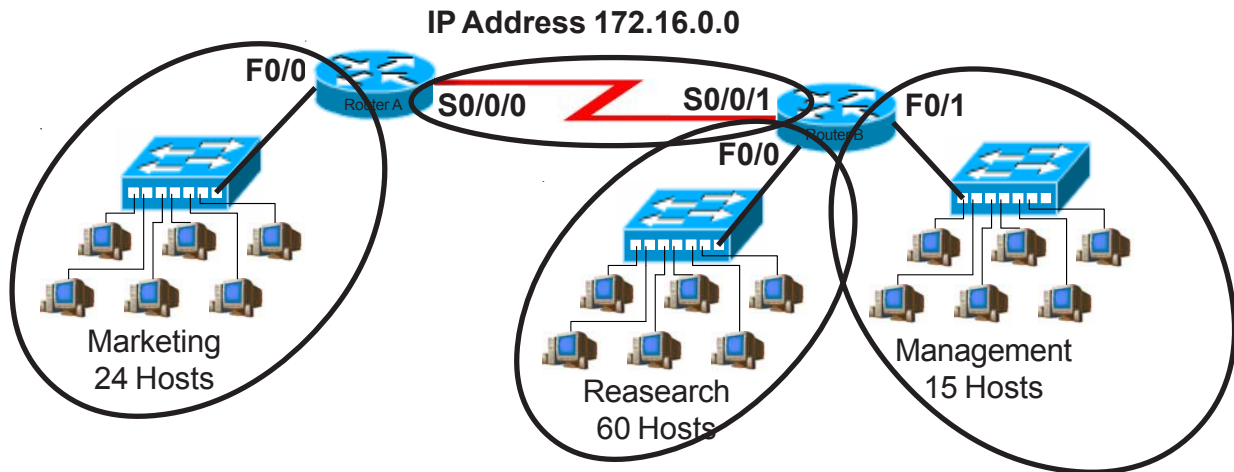
subnet number for 2nd subnet

Show your work for Problem 12 in the space below.

- 0) 198.125.50.0 - 198.125.50.15
- 1) 198.125.50.16 - 198.125.50.31 2nd subnet range
- 2) 198.125.50.32 - 198.125.50.47
- 3) 198.125.50.48 - 198.125.50.63
- 4) 198.125.50.64 - 198.125.50.79
- 5) 198.125.50.80 - 198.125.50.95
- 6) 198.125.50.96 - 198.125.50.111
- 7) 198.125.50.112 - 198.125.50.127
- 8) 198.125.50.128 - 198.125.50.143
- 9) 198.125.50.144 - 198.125.50.159
- 10) 198.125.50.160 - 198.125.50.175
- 11) 198.125.50.176 - 198.125.50.191
- 12) 198.125.50.192 - 198.125.50.207
- 13) 198.125.50.208 - 198.125.50.223
- 14) 198.125.50.224 - 198.125.50.239
- 15) 198.125.50.240 - 198.125.50.255
- +1 And -1 for assignable addresses for the 3rd subnet

# Practical Subnetting 1

Based on the information in the graphic shown, design a network addressing scheme that will supply the **minimum number of subnets**, and allow enough extra subnets and hosts for 100% growth in both areas. Circle each subnet on the graphic and answer the questions below.



Address class	<u>B</u>
Custom subnet mask	<u>255.255.224.0</u>
Minimum number of subnets needed	<u>4</u>
Extra subnets required for 100% growth (Round up to the next whole number)	<u>+ 4</u>
Total number of subnets needed	<u>= 8</u>
Number of host addresses in the largest subnet group	<u>60</u>
Number of addresses needed for 100% growth in the largest subnet (Round up to the next whole number)	<u>+ 60</u>
Total number of address needed for the largest subnet	<u>= 120</u>

Start with the first subnet and arrange your sub-networks from the largest group to the smallest.

IP address range for Research	<u>172.16.0.0 to 172.31.255</u>
IP address range for Marketing	<u>172.16.32.0 to 172.63.255</u>
IP address range for Management	<u>172.16.64.0 to 172.95.255</u>
IP address range for Router A to Router B serial connection	<u>172.16.96.0 to 172.127.255</u>

**Show your work for Practical Subnetting 1 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	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	4096	8192	16384	32768	65536
Binary values	128	64	32	16	8	4	2	1	128	64	32	16	8	4	2	1
	172	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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	(0)	0	172.16.0.0	to	172.16.31.255
	(1)	1	172.16.32.0	to	172.16.63.255
	(2)	1 0	172.16.64.0	to	172.16.95.255
	(3)	1 1	172.16.96.0	to	172.16.127.255
	(4)	1 0 0	172.16.128.0	to	172.16.159.255
	(5)	1 0 1	172.16.160.0	to	172.16.191.255
	(6)	1 1 0	172.16.192.0	to	172.16.223.255
	(7)	1 1 1	172.16.224.0	to	172.16.255.255

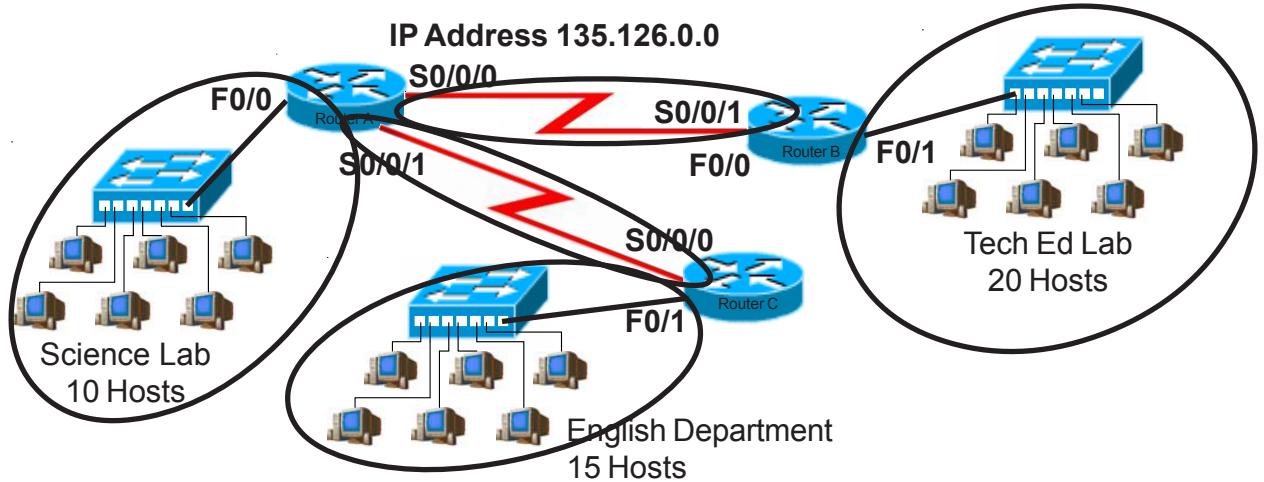
4  
x 1.0  
4

60  
x 1.0  
60

60

## Practical Subnetting 2

Based on the information in the graphic shown, design a network addressing scheme that will supply the **minimum number of hosts per subnet**, and allow enough extra subnets and hosts for 30% growth in all areas. Circle each subnet on the graphic and answer the questions below.



Address class	<u>B</u>
Custom subnet mask	<u>255.255.255.224</u>
Minimum number of subnets needed	<u>5</u>
Extra subnets required for 30% growth (Round up to the next whole number)	<u>+ 2</u>
Total number of subnets needed	<u>= 7</u>
Number of host addresses in the largest subnet group	<u>20</u>
Number of addresses needed for 30% growth in the largest subnet (Round up to the next whole number)	<u>+ 6</u>
Total number of address needed for the largest subnet	<u>= 26</u>

Start with the first subnet and arrange your sub-networks from the largest group to the smallest.

IP address range for Tech Ed	<u>135.126.0.0 to 135.126.0.31</u>
IP address range for English	<u>135.126.0.32 to 135.126.0.63</u>
IP address range for Science	<u>135.126.0.64 to 135.126.0.95</u>
IP address range for Router A to Router B serial connection	<u>135.126.0.96 to 135.126.0.127</u>
IP address range for Router A to Router C serial connection	<u>135.126.0.128 to 135.126.0.159</u>



Show your work for Problem 2 in the space below.

Number of Hosts	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
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
Binary values	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
	135	126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

$$\begin{array}{r} 5 \\ \times 3 \\ \hline 15 \end{array}$$

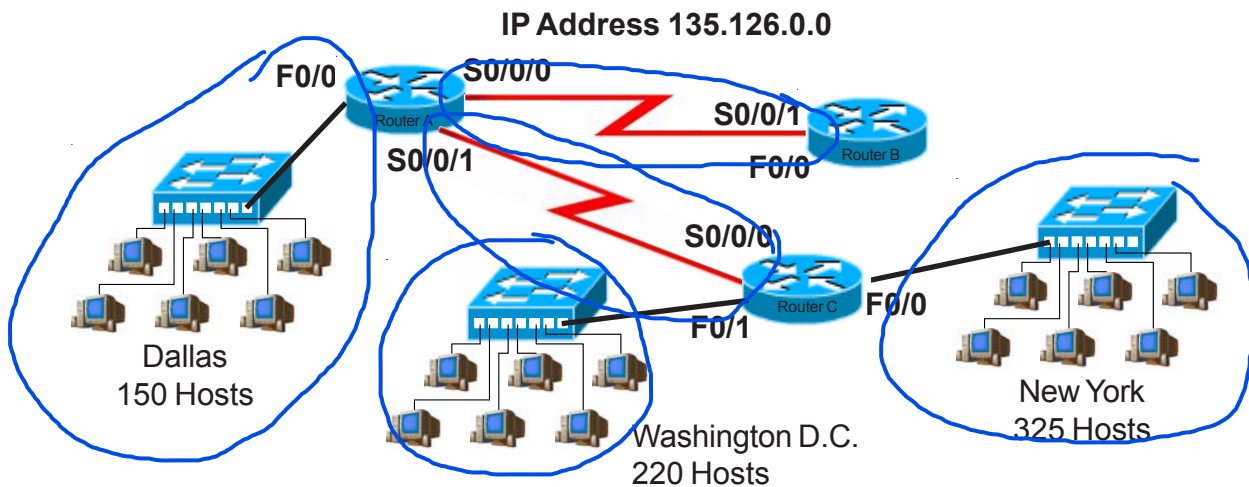
(Round up to 2)

$$\begin{array}{r} 20 \\ \times 3 \\ \hline 60 \end{array}$$

(0)	135.126.0.0	to	135.126.0.31
(1)	135.126.0.32	to	135.126.0.63
(2)	135.126.0.64	to	135.126.0.95
(3)	135.126.0.96	to	135.126.0.127
(4)	135.126.0.128	to	135.126.0.159
(5)	135.126.0.160	to	135.126.0.191
(6)	135.126.0.192	to	135.126.0.223
(7)	135.126.0.224	to	135.126.0.255
(8)	135.126.1.0	to	135.126.1.31
(9)	135.126.1.32	to	135.126.1.63
(10)	135.126.1.64	to	135.126.1.95
(11)	135.126.1.96	to	135.126.1.127
(12)	135.126.1.128	to	135.126.1.159
(13)	135.126.1.160	to	135.126.1.191
(14)	135.126.1.192	to	135.126.1.223
(15)	135.126.1.224	to	135.126.1.255

## Practical Subnetting 4

Based on the information in the graphic shown, design a network addressing scheme that will supply the **minimum number of subnets**, and allow enough extra subnets and hosts for 70% growth in all areas. Circle each subnet on the graphic and answer the questions below.



Address class B

Custom subnet mask 255.255.252.0

Minimum number of subnets needed 5

Extra subnets required for 70% growth + 4  
(Round up to the next whole number)

Total number of subnets needed = 9

Number of host addresses in the largest subnet group 325

Number of addresses needed for 70% growth in the largest subnet + 228  
(Round up to the next whole number)

Total number of address needed for the largest subnet = 553

Start with the first subnet and arrange your sub-networks from the largest group to the smallest.

IP address range for New York 135.126.0.0 - 135.126.3.255

IP address range for Washington D. C. 135.126.4.0 - 135.126.7.255

IP address range for Dallas 135.126.8.0 - 135.126.11.255

IP address range for Router A to Router B serial connection 135.126.12.0 - 135.126.15.255

IP address range for Router A to Router C serial connection 135.126.16.0 - 135.126.19.255

Show your work for Problem 4 in the space below.

New York needs:  $325 + (325 * 0.7) = 553$  addresses/hosts

Washington needs:  $220 + (220 * 0.7) = 374$  hosts

Dallas will need:  $150 + (150 * 0.7) = 255$  hosts

553 = largest hosts in subnets

553 rounded = 1024

135.126.0.0 to 135.126.3.255

135.126.4.0 to 135.126.7.255

135.126.8.0 to 135.126.11.255

135.126.12.0 to 135.126.15.255

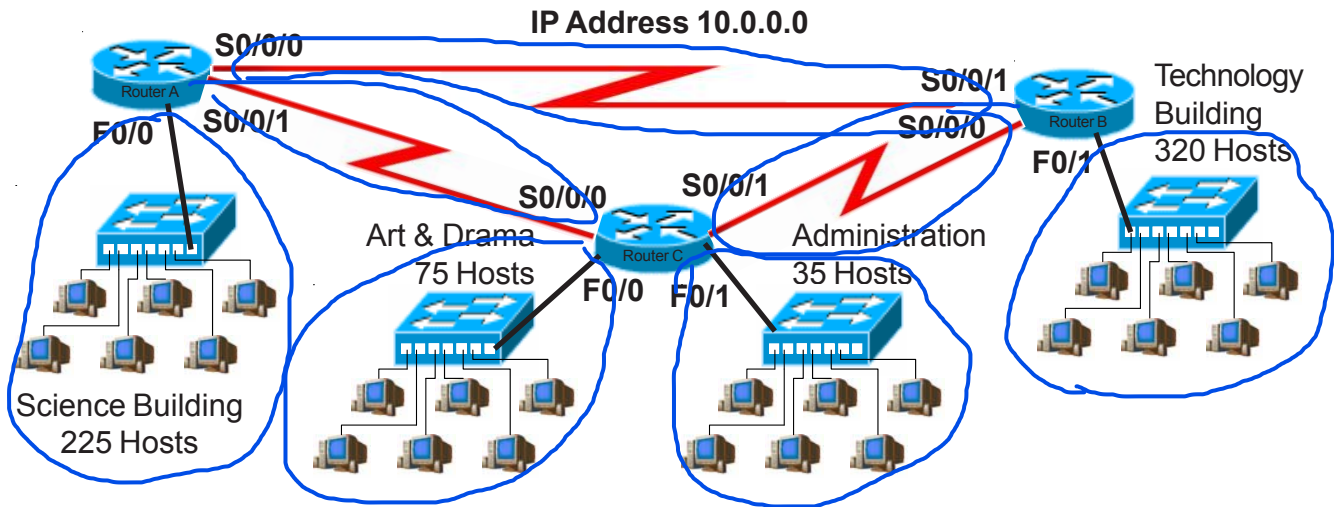
135.126.16.0 to 135.126.19.255

135.126.20.0 to 135.126.23.255

135.126.24.0 to 135.126.27.255

## Practical Subnetting 6

Based on the information in the graphic shown, design a network addressing scheme that will supply the **minimum number of subnets**, and allow enough extra subnets and hosts for 20% growth in all areas. Circle each subnet on the graphic and answer the questions below.



Address class A

Custom subnet mask 255.255.254.0

Minimum number of subnets needed 7

Extra subnets required for 20% growth + 2  
(Round up to the next whole number)

Total number of subnets needed = 9

Start with the first subnet and arrange your sub-networks from the largest group to the smallest.

IP address range for Technology 10.0.0.0 to 10.0.1.255

IP address range for Science 10.0.2.0 to 10.0.3.255

IP address range for Arts & Drama 10.0.4.0 to 10.0.5.255

IP Address range Administration 10.0.6.0 to 10.0.7.255

IP address range for Router A  
to Router B serial connection 10.0.8.0 to 10.0.9.255

IP address range for Router A  
to Router C serial connection 10.0.10.0 to 10.0.11.255

IP address range for Router B  
to Router C serial connection 10.0.12.0 to 10.0.13.255

Show your work for Problem 6 in the space below.

$$225 + 20\% = 270$$

$$75 + 20\% = 90$$

$$35 + 20\% = 42$$

$$320 + 20\% = 384$$

$$7 + 20\% = 1.4$$

$$\text{rounded} = 2$$

$$7 + 2 = 9$$

384 = largest hosts in a subnet

Rounded = 512

$$128 + 64 = 192$$

subnet mask = 255.255.254.0

10.0.0.0 to 10.0.1.255

10.0.2.0 to 10.0.3.255

10.0.4.0 to 10.0.5.255

10.0.6.0 to 10.0.7.255

10.0.8.0 to 10.0.9.255

10.0.10.0 to 10.0.11.255

10.0.12.0 to 10.0.13.255

10.0.14.0 to 10.0.15.255

10.0.16.0 to 10.0.17.255

10.0.18.0 to 10.0.19.255