

## 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
-2
14

Observe the total number of hosts.  
 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
<div style="display: flex; justify-content: space-between;"> <span><b>165 . 100 . 0 0 0 0 0 0 0 0 . 0 0</b></span> <span><b>0 0 0 0 0 0 0 0</b></span> </div>																

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	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
148 . 75 . 0 0 0 0 0 0 0 0 . 0 0											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 255.255.224

Total number of subnets 2046

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	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

## 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 255.255.192

Total number of subnets 1022

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.**

# 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

0

0

0

0

0

0

Usable hosts

64

128

64

32

16

8

4

2

1

128

64

32

16

8

4

2

1

Custom subnet mask

128

64

32

16

8

4

2

1

128

64

32

16

8

4

2

1

128

64

32

16

8

4

2

1

255

255

255

255

255

255

255

255

255

255

255

255

255

255

255

255

(0)

(1)

(2)

(3)

(4)

(5)

(6)

(7)

(8)

(9)

(10)

(11)

(12)

(13)

(14)

(15)

0

1

0

1

0

1

0

1

0

1

0

1

0

1

0

1

165.100.0.0

165.100.0.64

165.100.0.128

165.100.0.192

165.100.0.255

165.100.0.63

165.100.0.127

165.100.0.191

165.100.0.255

165.100.0.63

165.100.0.127

165.100.0.191

165.100.0.255

165.100.0.63

165.100.0.127

165.100.0.191

165.100.0.255

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

165.100.255.128

165.100.255.192

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   255.255.124  

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 ---> 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 ---> 135.70.159.254

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 C

Default subnet mask 255.255.0.0

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

What is the 2nd subnet range? 196.125.50.64 ---> 198.125.50.127

What is the subnet number for the 2nd subnet? 198.125.50.64

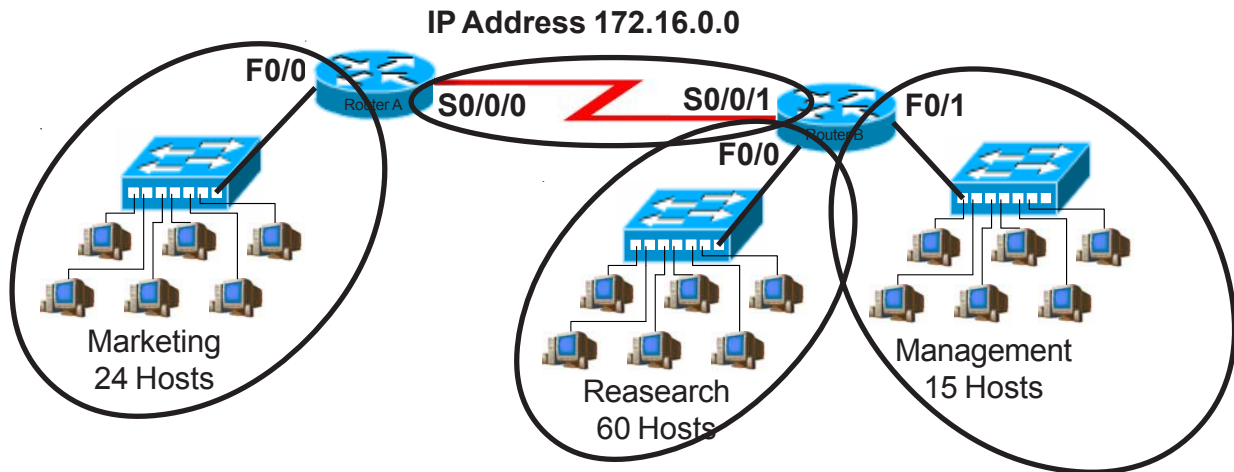
What is the subnet broadcast address for the 4th subnet? 198.125.50.255

What are the assignable addresses for the 3rd subnet? 198.125.50.128 ---> 198.125.50.191

Show your work for Problem 12 in the space below.

# 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.

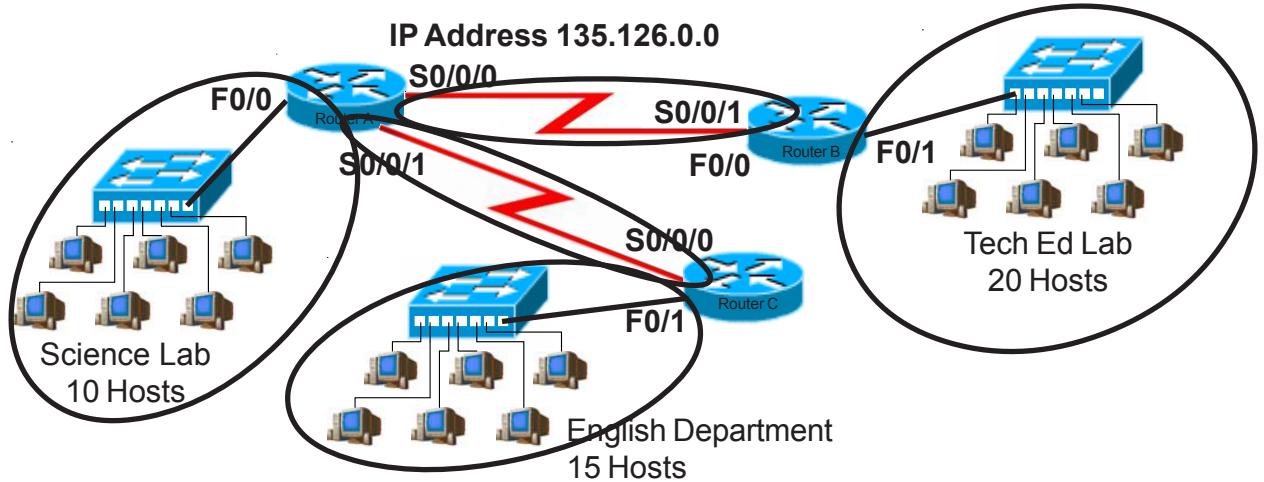
IP address range for Research	<u>172.16.0.0 to 172.31.255</u>
IP address range for Marketing	<u>172.16.32.0 to 172.63.255</u>
IP address range for Management	<u>172.16.64.0 to 172.95.255</u>
IP address range for Router A to Router B serial connection	<u>172.16.96.0 to 172.127.255</u>

**Show your work for Practical Subnetting 1 in the space below.**

[illegible]

## 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>

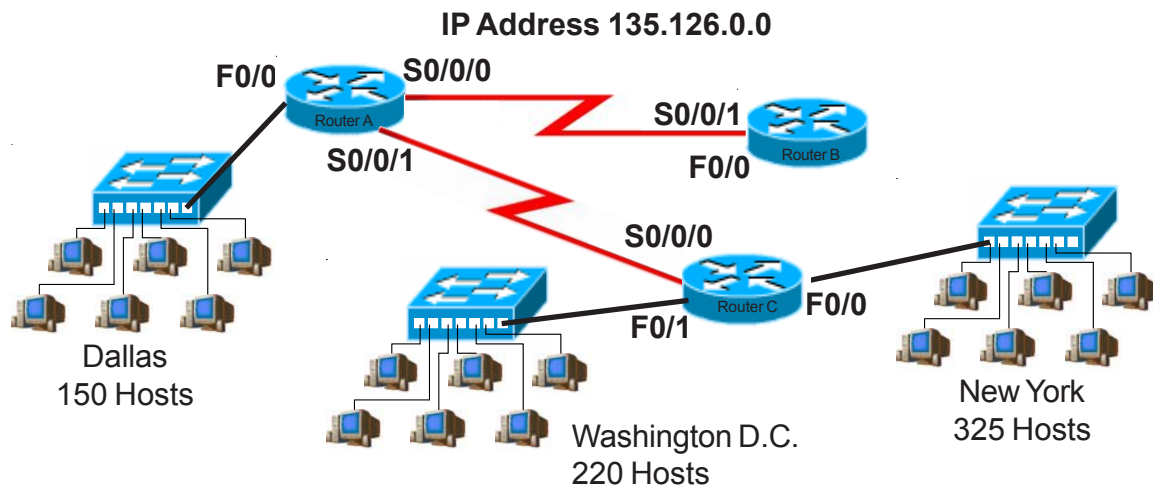


Show your work for Problem 2 in the space below.

Number of Hosts -	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	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
135.126.0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(0)	0															
(1)	1															
(2)		1														
(3)		1	1													
(4)		1	0	0												
(5)		1	0	1												
(6)		1	1	0												
(7)		1	1	1												
(8)	1	0	0	0												
(9)	1	0	0	1												
(10)	1	0	1	0												
(11)	1	0	1	1												
(12)	1	1	0	0												
(13)	1	1	0	1												
(14)	1	1	1	0												
(15)	1	1	1	1												
5 x.3 1.5 (Round up to 2)																
20 x.3 6																
	135.126.0.31	135.126.0.63	135.126.0.95	135.126.0.127	135.126.0.159	135.126.0.191	135.126.0.223	135.126.0.255	135.126.1.31	135.126.1.63	135.126.1.95	135.126.1.127	135.126.1.159	135.126.1.191	135.126.1.223	135.126.1.255
	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to	to

## 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	<u>B</u>
Custom subnet mask	<u>255.255.240.0</u>
Minimum number of subnets needed	<u>5</u>
Extra subnets required for 70% growth (Round up to the next whole number)	<u>+ 4</u>
Total number of subnets needed	<u>= 9</u>
Number of host addresses in the largest subnet group	<u>325</u>
Number of addresses needed for 70% growth in the largest subnet (Round up to the next whole number)	<u>+ 228</u>
Total number of address needed for the largest subnet	<u>= 558</u>

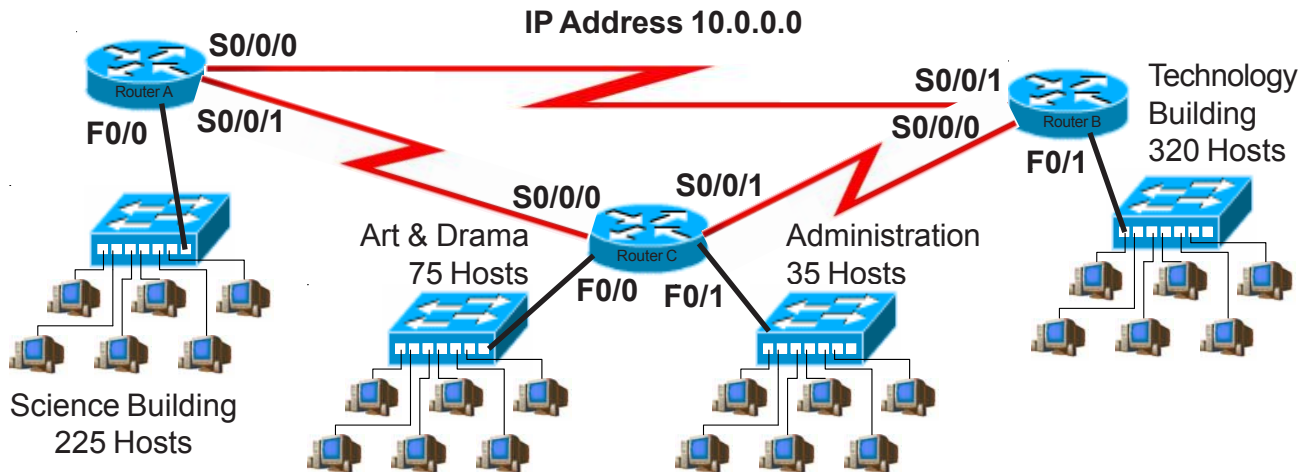
Start with the first subnet and arrange your sub-networks from the largest group to the smallest.

IP address range for New York	<u>135.126.0.0 ---&gt; 135.126.15.255</u>
IP address range for Washington D. C.	<u>135.126.16.0 ---&gt; 135.126.31.255</u>
IP address range for Dallas	<u>135.126.32.0 ---&gt; 135.126.47.255</u>
IP address range for Router A to Router B serial connection	<u>135.126.48.0 ---&gt; 135.126.63.255</u>
IP address range for Router A to Router C serial connection	<u>135.126.64.0 ---&gt; 135.126.79.255</u>

Show your work for Problem 4 in the space below.

## 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 255.240.0.0

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 ---> 10.15.255.255

IP address range for Science 10.16.0.0 ---> 10.31.255.255

IP address range for Arts & Drama 10.32.0.0 ---> 10.47.255.255

IP Address range Administration 10.48.0.0 ---> 10.63.255.255

IP address range for Router A  
to Router B serial connection 10.64.0.0 ---> 10.79.255.255

IP address range for Router A  
to Router C serial connection 10.80.0.0 ---> 10.95.255.255

IP address range for Router B  
to Router C serial connection 10.96.0.0 ---> 10.111.255.255

Show your work for Problem 6 in the space below.