

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 |
| 192 . 10 . 10 . 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 |
| 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 | 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 |

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 255.255.255.244

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.

| | | | | | | | | | | | | | | | | |
|-------------------|--------|--------|--------|-------|-------|-------|-------|-----|-----|------|------|------|------|-------|-------|-------|
| 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 255.255.255.192

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.

172.59.00000000.00000000

| | | |
|-------|----|-------|
| 128 | 64 | 128 |
| +64 | -2 | 64 |
| <hr/> | | 32 |
| 192 | 62 | 16 |
| | | 8 |
| | | 4 |
| | | 2 |
| | | <hr/> |
| | | 1 |
| | | 255 |

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.

[illegible]

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.

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 4

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 2

What is the 2nd subnet range? 198.125.50.64 to 198.125.50.127

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

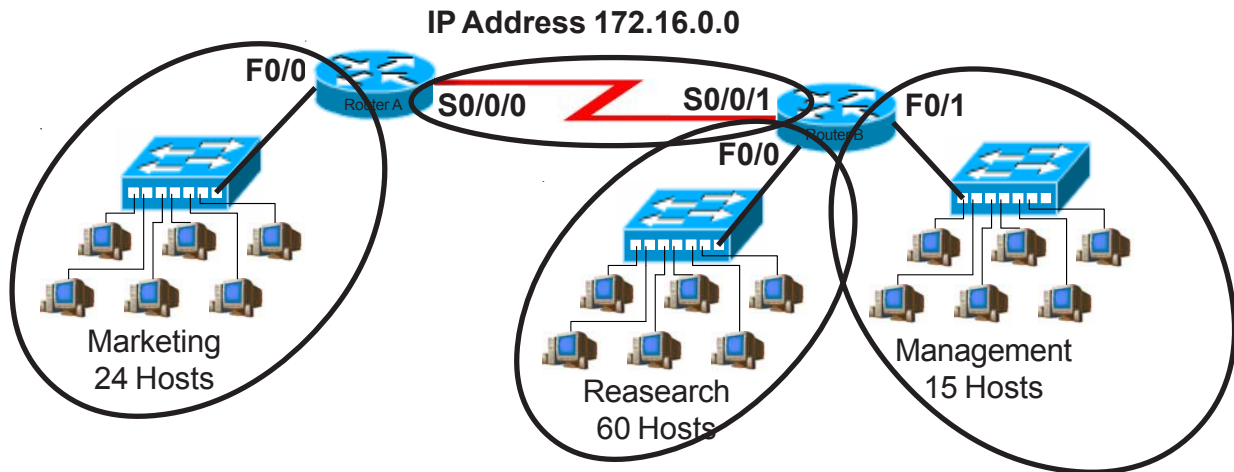
What is the subnet broadcast address for the 4th subnet? 198.125.50.255

What are the assignable addresses for the 3rd subnet? 198.125.50.129 to 198.125.50.190

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.

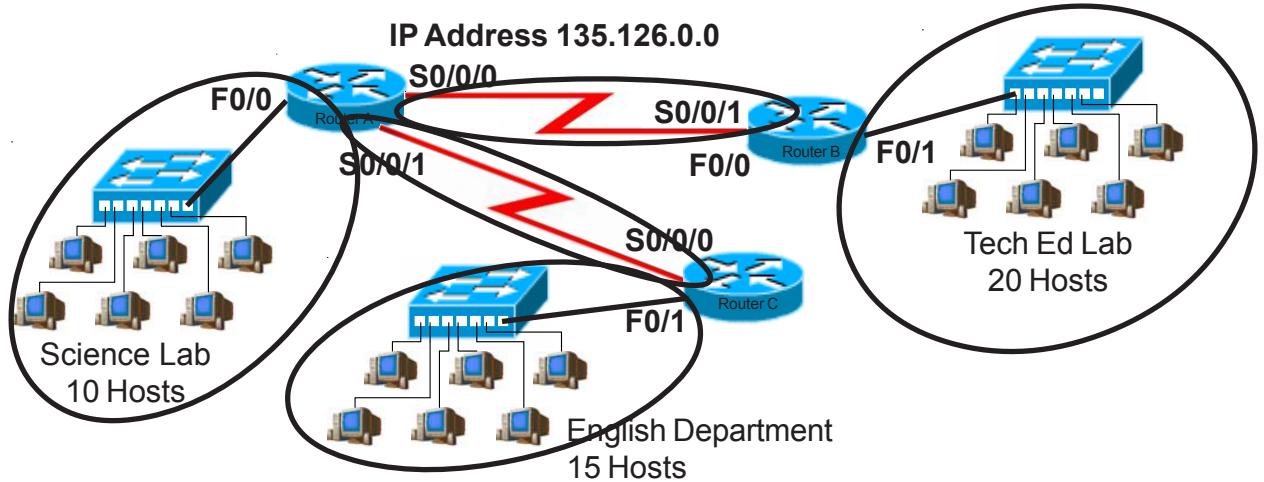
| | |
|--|-----------------------------------|
| IP address range for Research | <u>172.16.0.0 to 172.31.255</u> |
| IP address range for Marketing | <u>172.16.32.0 to 172.63.255</u> |
| IP address range for Management | <u>172.16.64.0 to 172.95.255</u> |
| IP address range for Router A to Router B serial 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.

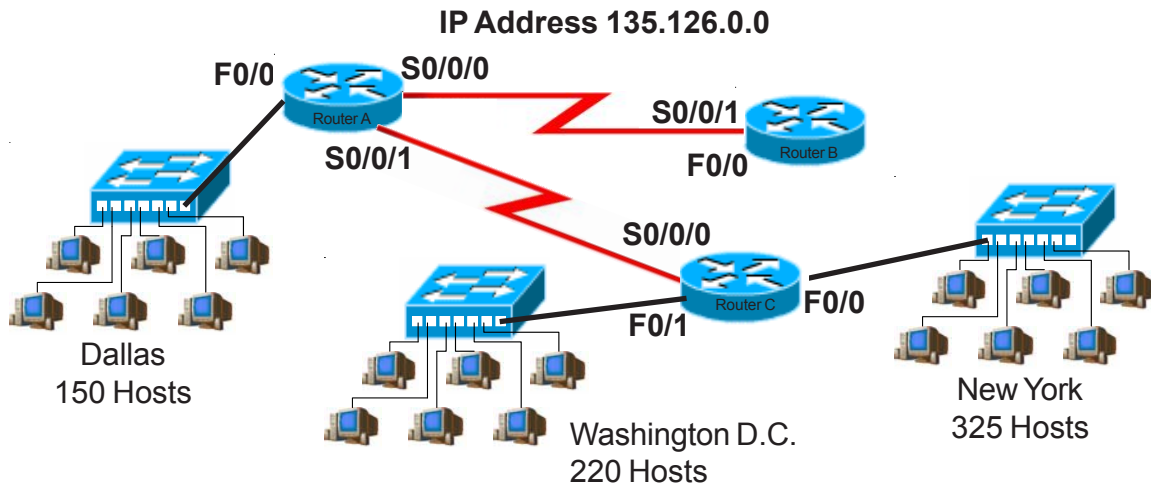
| | |
|--|---------------------------------------|
| IP address range for Tech Ed | <u>135.126.0.0 to 135.126.0.31</u> |
| IP address range for English | <u>135.126.0.32 to 135.126.0.63</u> |
| IP address range for Science | <u>135.126.0.64 to 135.126.0.95</u> |
| IP address range for Router A to Router 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

B

Custom subnet mask

255.255.240.0

Minimum number of subnets needed

5

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

+ 4

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
(Round up to the next whole number)

+ 228

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 to 135.126.15.255

IP address range for Washington D. C. 135.126.16.0 to 135.126.31.255

IP address range for Dallas 135.126.32.0 to 135.126.47.255

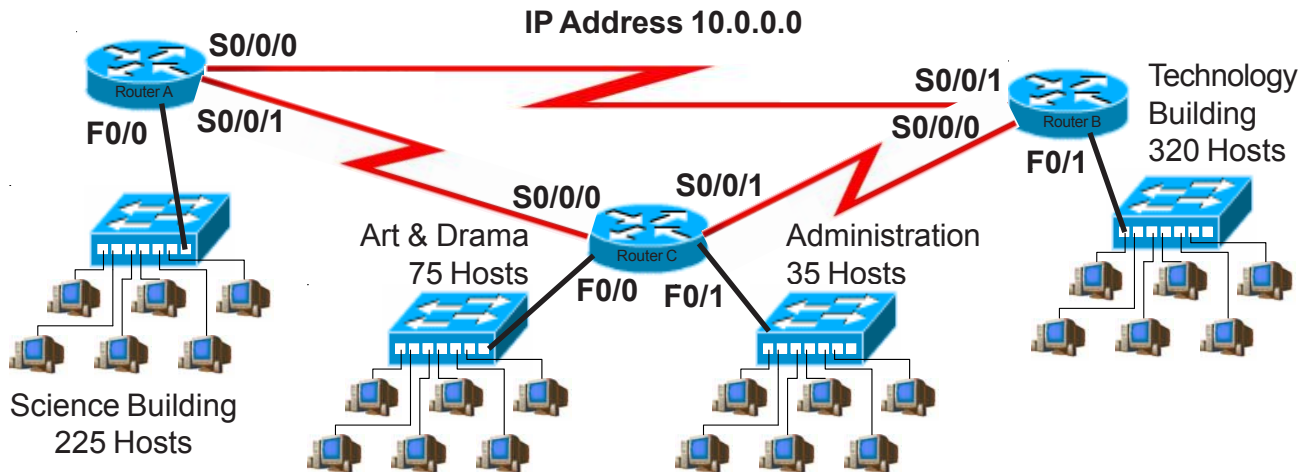
IP address range for Router A
to Router B serial connection 135.126.48.0 to 135.126.63.255

IP address range for Router A
to Router C serial connection 135.126.64.0 to 135.126.79.255

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 to 10.15.255.255

IP address range for Science 10.16.0.0 to 10.31.255.255

IP address range for Arts & Drama 10.32.0.0 to 10.47.255.255

IP Address range Administration 10.48.0.0 to 10.63.255.255

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

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

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

Show your work for Problem 6 in the space below.