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
- 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.

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	0

```
          128    128
           64    +64
           32    ───
           16    192
            8
            4
            2
           +1
          ────
          255
```

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
```

13

Custom Subnet Masks

Problem 3

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.

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

148 . 75 . 0 0 0 0 0 0 0 0 . 0 0 | 0 0 0 0 0 0

```
128     128
 64    +64
 32    ─────
 16     192
  8
  4
  2
 +1
─────
255
```

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

```
 64
 ─2
────
 62
```

64 — Observe the total number of hosts.

─2 — Subtract 2 for the number of usable hosts.

```
1024
 ─2
─────
1,022
```

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

14

Custom Subnet Masks

Problem 7

Number of needed 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 _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

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

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 _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

Show your work for <u>Problem 15</u> 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 <u>Problem 1</u> 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

(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

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

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

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

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*

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	128
Usable	−2	64
hosts	62	32
		16
		8
Custom	128	4
subnet mask	+64	2
	192	+1
		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.

(0)			.		0	165.100.0.0	to	165.100.0.63
(1)					1	165.100.0.64	to	165.100.0.127
(2)				1	0	165.100.0.128	to	165.100.0.191
(3)				1	1	165.100.0.192	to	165.100.0.255
(4)		1	.	0	0	165.100.1.0	to	165.100.1.63
(5)		1	.	0	1	165.100.1.64	to	165.100.1.127
(6)		1	.	1	0	165.100.1.128	to	165.100.1.191
(7)		1	.	1	1	165.100.1.192	to	165.100.1.255
(8)	1	0	.	0	0	165.100.2.0	to	165.100.0.63
(9)	1	0	.	0	1	165.100.2.64	to	165.100.0.127
(10)	1	0	.	1	0	165.100.2.128	to	165.100.0.191
(11)	1	0	.	1	1	165.100.2.192	to	165.100.0.255
(12)	1	1	.	0	0	165.100.3.0	to	165.100.3.63
(13)	1	1	.	0	1	165.100.3.64	to	165.100.3.127
(14)	1	1	.	1	0	165.100.3.128	to	165.100.3.191
(15)	1	1	.	1	1	165.100.3.192	to	165.100.3.255

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 _____

Default subnet mask _____

Custom subnet mask _____

Total number of subnets _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 6th
subnet range? _____

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

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

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

Show your work for <u>Problem 11</u> 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 _____

Total number of host addresses _____

Number of usable addresses _____

Number of bits borrowed _____

What is the 2nd
subnet range? _____

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

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

What are the assignable
addresses for the 3rd
subnet? _____

Show your work for <u>Problem 12</u> 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.

IP Address 172.16.0.0
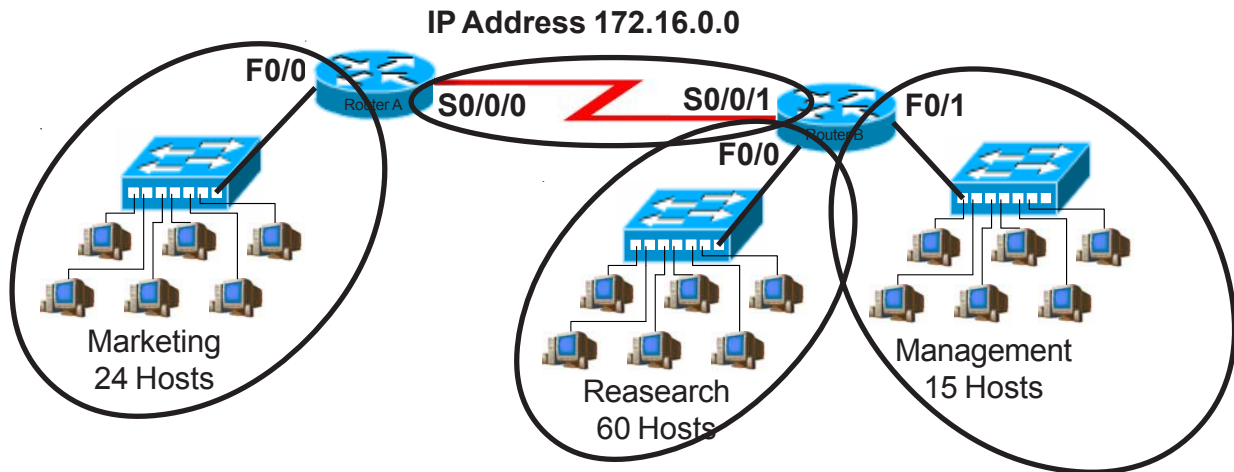
Address class	_B_
Custom subnet mask	_255.255.224.0_
Minimum number of subnets needed	_4_
Extra subnets required for 100% growth (Round up to the next whole number)	+ _4_
Total number of subnets needed	= _8_
Number of host addresses in the largest subnet group	_60_
Number of addresses needed for 100% growth in the largest subnet (Round up to the next whole number)	+ _60_
Total number of address needed for the largest subnet	= _120_

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

IP address range for Research	_172.16.0.0 to 172.31.255_
IP address range for Marketing	_172.16.32.0 to 172.63.255_
IP address range for Management	_172.16.64.0 to 172.95.255_
IP address range for Router A to Router B serial connection	_172.16.96.0 to 172.127.255_

		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	–									.								
										512					16,384	8,192	4,096	2048	1024	32,768	65,536

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 . 16 . 0 0 0 | 0 0 0 0 0 . 0 0 0 0 0 0 0 0

(0)			0	172.16.0.0	to	172.16.31.255
(1)			0 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

$$\begin{array}{r} 4 \\ \times 1.0 \\ \hline 4 \end{array}$$

$$\begin{array}{r} 60 \\ \times 1.0 \\ \hline 60 \end{array}$$

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 subne**t, and allow enough extra subnets and hosts for 30% growth in all areas. Circle each subnet on the graphic and answer the questions below.

IP Address 135.126.0.0

Science Lab
10 Hosts

English Department
15 Hosts

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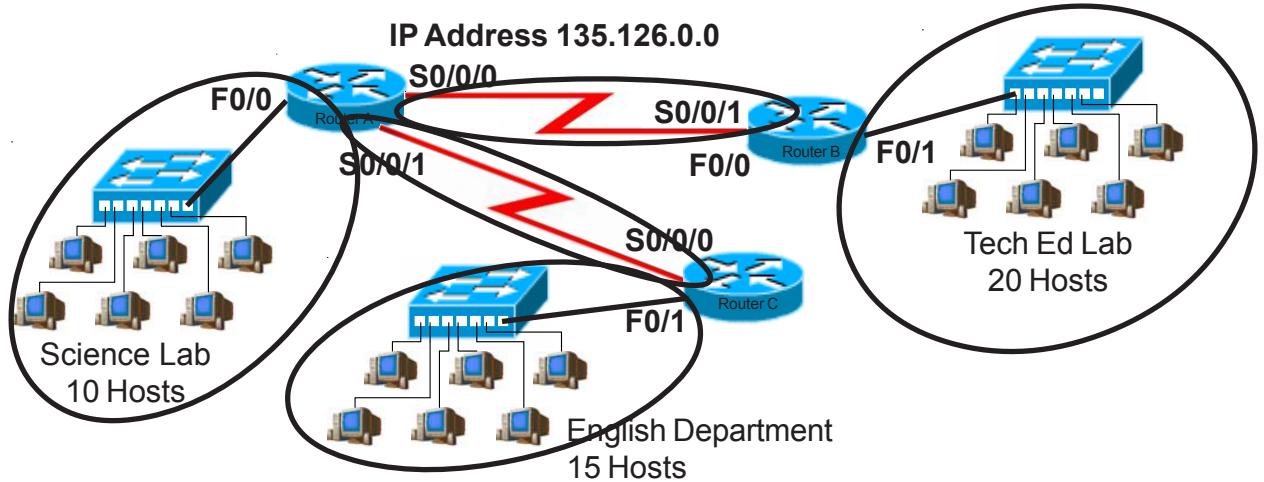
Address class	*B*
Custom subnet mask	*255.255.255.224*
Minimum number of subnets needed	*5*
Extra subnets required for 30% growth (Round up to the next whole number)	+ *2*
Total number of subnets needed	= *7*
Number of host addresses in the largest subnet group	*20*
Number of addresses needed for 30%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

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

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

60

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
																32,768	65,536
Number of Subnets →	2	4	8	16	32	64	128	256.			512	1024	2048	4,096	8,192	16,384	
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	135.126.0.0	to	135.126.0.31
(1)				1	135.126.0.32	to	135.126.0.63
(2)			1	0	135.126.0.64	to	135.126.0.95
(3)			1	1	135.126.0.96	to	135.126.0.127
(4)		1	0	0	135.126.0.128	to	135.126.0.159
(5)		1	0	1	135.126.0.160	to	135.126.0.191
(6)		1	1	0	135.126.0.192	to	135.126.0.223
(7)		1	1	1	135.126.0.224	to	135.126.0.255
(8)	1	0	0	0	135.126.1.0	to	135.126.1.31
(9)	1 .	0	0	1	135.126.1.32	to	135.126.1.63
(10)	1 .	0	1	0	135.126.1.64	to	135.126.1.95
(11)	1 .	0	1	1	135.126.1.96	to	135.126.1.127
(12)	1	1	0	0	135.126.1.128	to	135.126.1.159
(13)	1 .	1	0	1	135.126.1.160	to	135.126.1.191
(14)	1 .	1	1	0	135.126.1.192	to	135.126.1.223
(15)	1 .	1	1	1	135.126.1.224	to	135.126.1.255

5
x.3
———
1.5

(Round up to 2)

20
x.3
———
6

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.
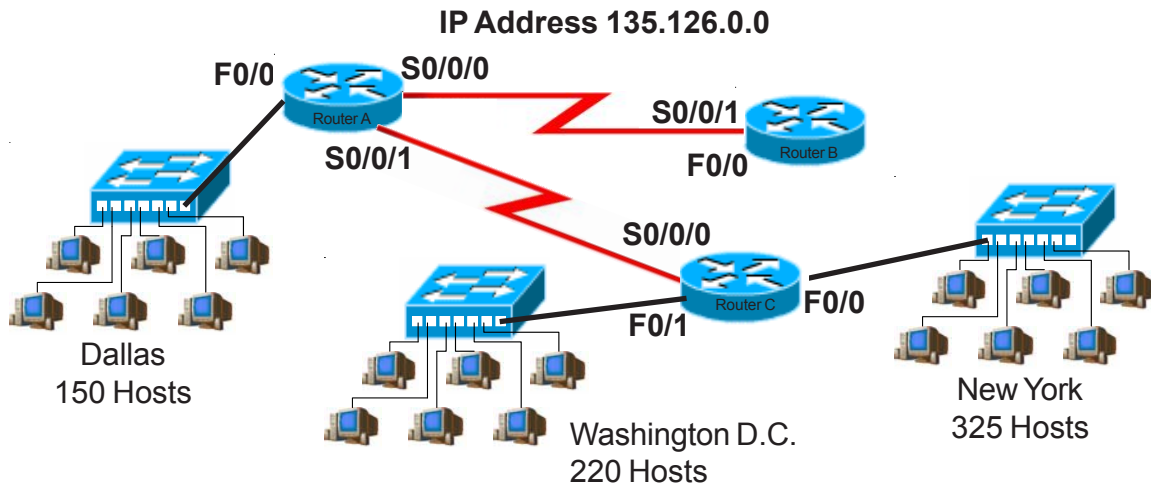
IP Address 135.126.0.0

Dallas
150 Hosts

Washington D.C.
220 Hosts

New York
325 Hosts

Address class _____

Custom subnet mask _____

Minimum number of subnets needed _____

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

Total number of subnets needed = _____

Number of host addresses
in the largest subnet group _____

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

Total number of address
needed for the largest subnet = _____

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

IP address range for New York _____

IP address range for Washington D. C. _____

IP address range for Dallas _____
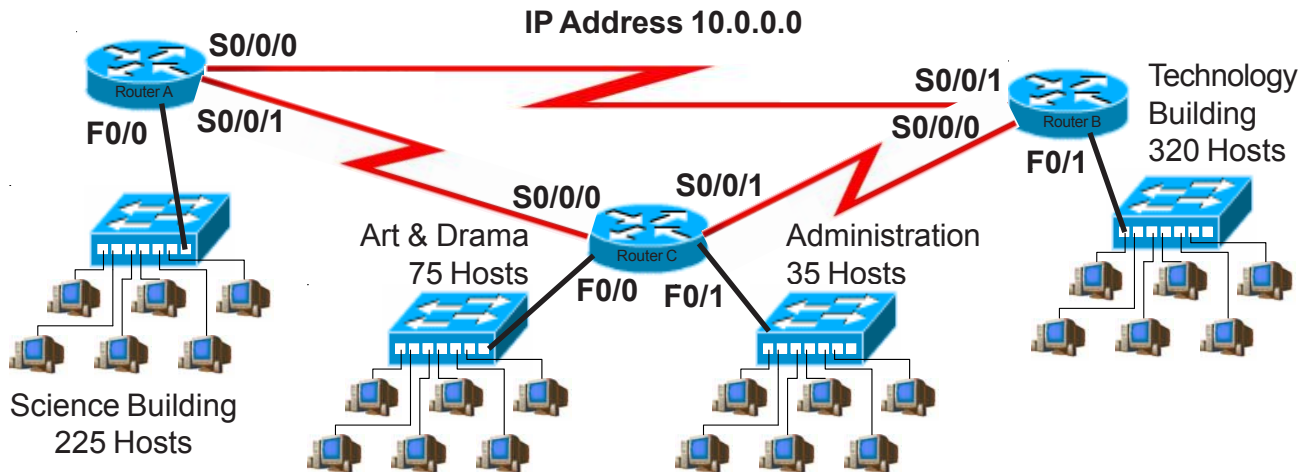
IP address range for Router A
to Router B serial connection _____

IP address range for Router A
to Router C serial connection _____

Show your work for <u>Problem 4</u> 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.

IP Address 10.0.0.0

Router A
S0/0/0
F0/0
S0/0/1

Science Building
225 Hosts

Art & Drama
75 Hosts
Router C
S0/0/0
F0/0 F0/1
S0/0/1

Administration
35 Hosts

Router B
S0/0/1
S0/0/0
F0/1

Technology
Building
320 Hosts

Address class _____

Custom subnet mask _____

Minimum number of subnets needed _____

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

Total number of subnets needed = _____

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

IP address range for Technology _____

IP address range for Science _____

IP address range for Arts & Drama _____

IP Address range Administration _____

IP address range for Router A
to Router B serial connection _____

IP address range for Router A
to Router C serial connection _____

IP address range for Router B
to Router C serial connection _____

Show your work for <u>Problem 6</u> in the space below.