**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.

*Number of Subnets -*

## 192 . 10 . 10 . 0 0 0 0

## 0 0 0 0

*Number of*

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

*128*

*64*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *256 128 64* | *32* | *16* | *8* | *4* | *2* | *- Hosts* |
| *2 4 8* | *16* | *32* | *64 128 256* | | | |
| *128 64 32* | *16* | *8* | *4* | *2* | *1* | *- Binary values* |

*32*

*+16 240*

*16*

*-2 14*

Observe the total number of hosts.

Subtract 2 for the number of usable hosts.

12

**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.

*512*

*1,024*

*2,048*

*4,096*

*8,192*

*16,384*

*32,768*

*Number of*

*65,536*

*Hosts -*

*1024*

*512*

*. 256 128*

*64 32 16 8 4 2*

*65,536*

*32,768*

*16,384*

*8,192*

*4,096*

*2048*

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

*128*

*64*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Number of Subnets* | *-* | *2* | *4 8* | *16 32* | *64* | *128 256.* | | | | | | |
| *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*** |

*32*

*16*

*8*

*4*

*2*

*128*

*+64*

*192*

*64*

*-2 62*

Observe the total number of hosts.

Subtract 2 for the number of usable hosts.

*+1 255*

13

**Problem 3**

**Custom Subnet Masks**

Network Address **148.75.0.0 /26**

**/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.

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.

*512*

*1,024*

*2,048*

*4,096*

*8,192*

*16,384*

*32,768*

*65,536*

*Number of*

*Hosts -*

*1024*

*512*

*. 256 128*

*64 32 16 8 4 2*

*65,536*

*32,768*

*16,384*

*8,192*

*4,096*

*2048*

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

*128*

*64*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Number of Subnets* | *-* | *2* | *4 8* | *16 32* | *64* | *128 256.* | | | | | | |
| *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*** |

*32*

*16*

*8*

*4*

*128*

*+64*

*192*

*64*

*-2*

*62*

Observe the total number of hosts.

Subtract 2 for the number of usable hosts.

*2*

*+1 255*

14

*1024*

*-2 1,022*

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

**Custom Subnet Masks**

**Problem 7**

Number of needed subnets **2000**

Number of needed usable hosts **15**

Network Address **178.100.0.0**

Address class Class B

Default subnet mask 255.255.0.0

Custom subnet mask 255.255.224.0

Total number of subnets 2000

Total number of host addresses 65534

Number of usable addresses 65532

Number of bits borrowed 11

# Show your work for Problem 7 in the space below.

*Number of*

*65,536*

*Hosts -*

*Number of*

*32,768*

*16,384*

*8,192*

*4,096*

*2048*

*1024*

*512*

*512*

*1,024*

*2,048*

*4,096*

*8,192*

*16,384*

*32,768*

*. 256 128 64 32 16 8 4 2*

*Subnets - 2 4 8 16 32 64 128 256.*

*Binary values -*

*65,536*

*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

***Address Class: 128 to 191 = Class B***

***Default Subnet Mask: Class B default is 255.255.0.0***

***Custom Subnet Mask: 2^11 = 2048 - Mask in binary 11111111.11111111.11100000.00000000 in decimal is 255.255.224.0***

***Total Number of Subnets: We were told already 2000***

***Total Number of Host Addresses : Class B - 16 bits for hosts - 2 ^16-2 = 65534***

***Number of Usable Addresses : 65534 - 2 = 65532***

***Number of Bits : 11 because we used 11 already***

**Custom Subnet Masks**

**Problem 15**

Number of needed usable hosts **50**

Network Address **172.59.0.0**

Address class Class B

Default subnet mask 255.255.0.0

Custom subnet mask 255.255.252.0

Total number of subnets 64

Total number of host addresses 64

Number of usable addresses 62

Number of bits borrowed 6

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

26

**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?

What is the subnet broadcast address for the 13th subnet?

What are the assignable addresses for the 9th

*192 . 10 . 10 . 112*

*192 . 10 . 10 . 207*

subnet? *192.10.10.129 to 192.10.10.142*

28

# Show your work for Problem 1 in the space below.

*Number of*

*Number of*

*256 128 64 32 16 8 4 2 - Hosts*

*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*

*(1) 0*

*(2) 0*

*(3) 0*

*(4) 0*

*(5) 0*

*(6) 0*

*(7) 0*

*(8) 1*

*(9) 1*

*(10) 1*

*(11) 1*

*(12) 1*

*(13) 1*

*(14) 1*

*(15) 1*

*0 0 0*

*0 0 1*

*0 1 0*

*0 1 1*

*1 0 0*

*1 0 1*

*1 1 0*

*1 1 1*

*0 0 0*

*0 0 1*

*0 1 0*

*0 1 1*

*1 0 0*

*1 0 1*

*1 1 0*

*1 1 1*

*192.10.10.0 to 192.10.10.15*

*192.10.10.16 to 192.10.10.31*

*192.10.10.32 to 192.10.10.47*

*192.10.10.48 to 192.10.10.63*

*192.10.10.64 to 192.10.10.79*

*192.10.10.80 to 192.10.10.95*

*192.10.10.96 to 192.10.10.111*

*192.10.10.112 to 192.10.10.127*

*192.10.10.128 to 192.10.10.143*

*192.10.10.144 to 192.10.10.159*

*192.10.10.160 to 192.10.10.175*

*192.10.10.176 to 192.10.10.191*

*192.10.10.192 to 192.10.10.207*

*192.10.10.208 to 192.10.10.223*

*192.10.10.224 to 192.10.10.239*

*192.10.10.240 to 192.10.10.255*

Custom subnet

mask

*128*

*64*

*32*

*+16 240*

Usable subnets

*16*

*-2 14*

*16*

Usable hosts *-2*

*14*

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.

29

**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?

What is the subnet broadcast address for

the 6th subnet?

What are the assignable addresses for the 9th

*165 . 100 . 1 . 64*

*165 . 100 . 1 . 127*

subnet? *165.100.2.1 to 165.100.0.62*

30

*Number of*

*65,536*

*Hosts -*

*Number of*

*32,768*

*16,384*

*8,192*

*4,096*

*2048*

*1024*

*512*

*512*

*1,024*

*2,048*

*4,096*

*8,192*

*16,384*

*32,768*

*. 256 128*

*64 32 16 8 4 2*

*65,536*

*Subnets - 2 4 8 16 32 64 128 256.*

*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 *-2*

hosts *62*

*128*

*64*

*32*

*16*

*(0)*

*(1)*

*(2)*

*(3)*

*(4)*

*(5)*

*. 0*

*1*

*1*

*0*

*1*

*1*

*1 . 0 0*

*1 . 0 1*

*165.100.0.0 to 165.100.0.63*

*165.100.0.64 to 165.100.0.127*

*165.100.0.128 to 165.100.0.191*

*165.100.0.192 to 165.100.0.255*

*165.100.1.0 to 165.100.1.63*

*165.100.1.64 to 165.100.1.127*

Custom

*128*

*8 (6)*

*1 . 1*

*0 165.100.1.128 to 165.100.1.191*

subnet mask *+64*

*192*

*4 (7)*

*2 (8)*

*1 . 1 1*

*1 0 . 0 0*

*165.100.1.192 to 165.100.1.255*

*165.100.2.0 to 165.100.0.63*

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

*+1*

*255*

*(9) 1 0 . 0 1*

*(10) 1 0 . 1 0*

*165.100.2.64 to 165.100.0.127*

*165.100.2.128 to 165.100.0.191*

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

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

*(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*

*165.100.2.192 to 165.100.0.255*

*165.100.3.0 to 165.100.3.63*

*165.100.3.64 to 165.100.3.127*

*165.100.3.128 to 165.100.3.191*

*165.100.3.192 to 165.100.3.255*

*Down to*

*(1022) 1 1 1 1 1 1*

**Show**

**your**

**work**

**for**

**Problem 2**

**in**

**the**

**space**

**below.**

*(1023) 1 1 1 1 1 1*

31

*1 1 . 1*

*1 1 . 1*

*0 165.100.255.128 to 165.100.255.191*

*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?

48

# Show your work for Problem 11 in the space below.

49

**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?

50

# Show your work for Problem 12 in the space below.

51

**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**



**F0/0**

Router A

**S0/0/0**

**S0/0/1**

**F0/0**

**F0/1**

Router B

Marketing 24 Hosts

Reasearch 60 Hosts

Management 15 Hosts

Address class Custom subnet mask

Minimum number of subnets needed

*B*

*255.255.224.0*

*4*

Extra subnets required for 100% growth + *4*

(Round up to the next whole number)

Total number of subnets needed = *8*

Number of host addresses in the largest subnet group

Number of addresses needed for 100% growth in the largest subnet

(Round up to the next whole number)

Total number of address needed for the largest subnet

*60*

+ *60*

= *120*

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

IP address range for Research IP address range for Marketing

IP address range for Management

IP address range for Router A to Router B serial connection

58

*172.16.0.0 to 172.31.255*

*172.16.32.0 to 172.63.255*

*172.16.64.0 to 172.95.255*

*172.16.96.0 to 172.127.255*

*Number of*

*16,384*

*32,768*

*65,536*

*Hosts -*

*8,192*

*2048*

*1024*

*512*

*. 256 128 64 32 16 8 4 2*

*32,768*

*16,384*

*4,096*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Number of Subnets* | *-* | | *2* | *4 8* | *16 32* | *64 128 256.* | | | | | |
| *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*** |

*4 x1.0*

*4*

*60 x1.0*

*60*

*(0) 0*

*(1) 1*

*(2) 1 0*

*(3) 1 1*

*(4) 1 0 0*

*(5) 1 0 1*

*(6) 1 1 0*

*(7) 1 1 1*

*172.16.0.0*

*172.16.32.0*

*172.16.64.0*

*172.16.96.0*

*172.16.128.0*

*172.16.160.0*

*172.16.192.0*

*172.16.224.0*

*to 172.16.31.255*

*to 172.16.63.255*

*65,536*

*to 172.16.95.255*

*to 172.16.127.255*

*to 172.16.159.255*

*to 172.16.191.255*

*to 172.16.223.255*

*to 172.16.255.255*

*512*

*1,024*

*2,048*

*4,096*

*8,192*

**Show**

**your**

**work**

**for**

**Practical**

**Subnetting**

**1**

**in**

**the**

**space**

**below.**

59

**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.

Address class Custom subnet mask

Minimum number of subnets needed

Extra subnets required for 30% 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 30% growth in the largest subnet

(Round up to the next whole number)

Total number of address needed for the largest subnet

*B*

*255.255.255.224*

*5*

+ *2*

= *7*

*20*

+ *6*

= *26*

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

IP address range for Tech Ed IP address range for English IP address range for Science

IP address range for Router A to Router B serial connection

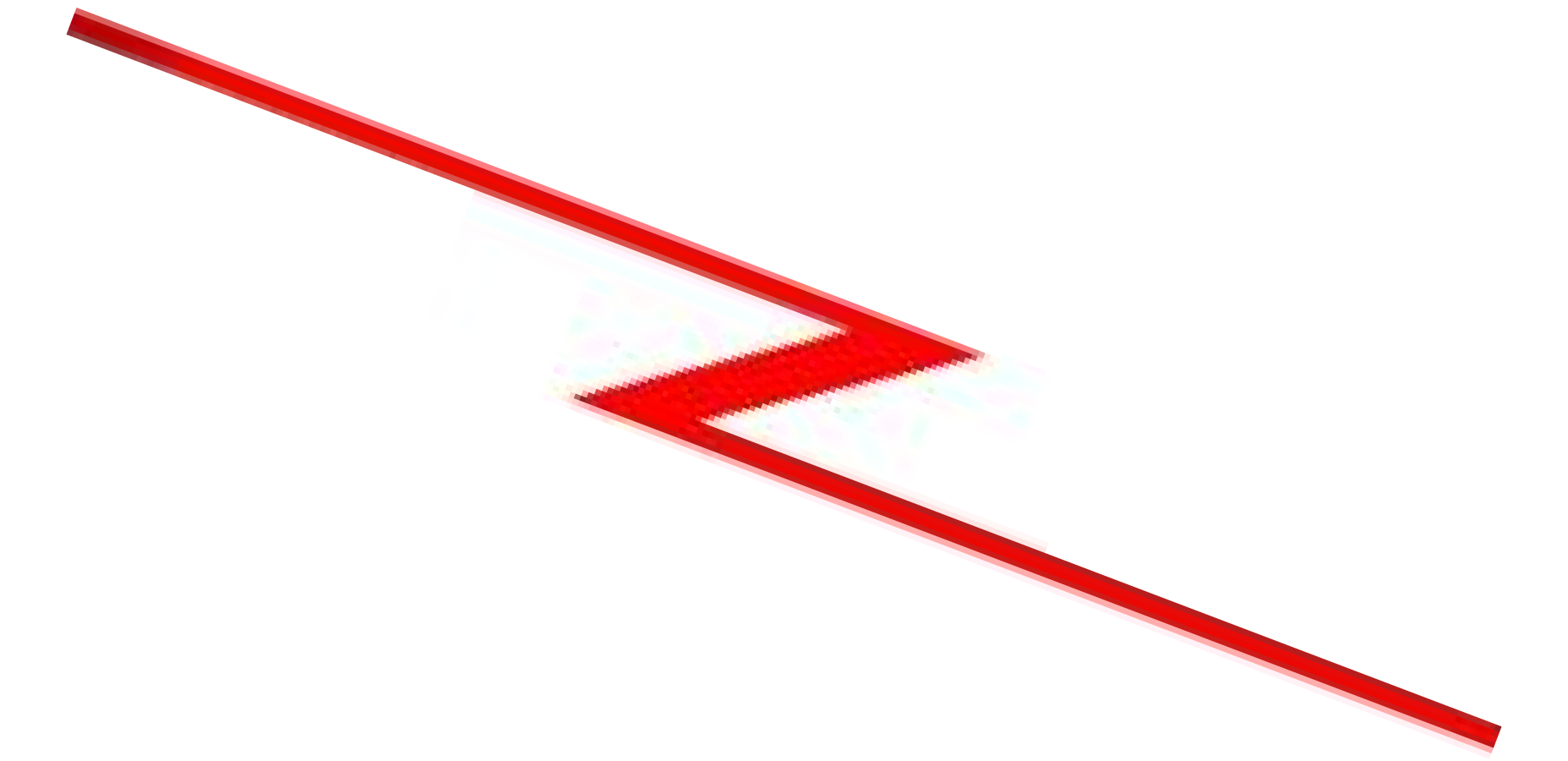
IP address range for Router A

*135.126.0.0 to 135.126.0.31 135.126.0.32 to 135.126.0.63*

*135.126.0.64 to 135.126.0.95*

*135.126.0.96 to 135.126.0.127*

to Router B serial connection*135.126.0.128 to 135.126.0.159*



**IP Address 135.126.0.0**

**S0/0/0**

**F0/0**

Router A **S0/0/1**

**S0/0/1**

**F0/0**

Router B

**F0/1**

**S0/0/0**

Tech Ed Lab 20 Hosts

**F0/1**

Router C

Science Lab 10 Hosts

English Department 15 Hosts

60

*Number of*

*65,536*

*Hosts -*

*Number of*

*32,768*

*16,384*

*8,192*

*4,096*

*2048*

*1024*

*512*

*512*

*1,024*

*2,048*

*4,096*

*8,192*

*16,384*

*32,768*

*. 256 128 64 32 16 8 4 2*

*Subnets - 2 4 8 16 32 64 128 256.*

*Binary values -*

*65,536*

*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

*5*

*x.3*

*1.5*

*(Round up to 2)*

*20*

*x.3*

*6*

*(0) . 0*

*(1) 1*

*(2) 1 0*

*(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*

*135.126.0.0 to*

*135.126.0.32 to*

*135.126.0.64 to*

*135.126.0.96 to*

*135.126.0.128 to*

*135.126.0.160 to*

*135.126.0.192 to*

*135.126.0.224 to*

*135.126.1.0 to*

*135.126.1.32 to*

*135.126.1.64 to*

*135.126.1.96 to*

*135.126.1.128 to*

*135.126.1.160 to*

*135.126.1.192 to*

*135.1261.224 to*

*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*

**Show**

**your**

**work**

**for**

**Problem 2**

**in**

**the**

**space**

**below.**

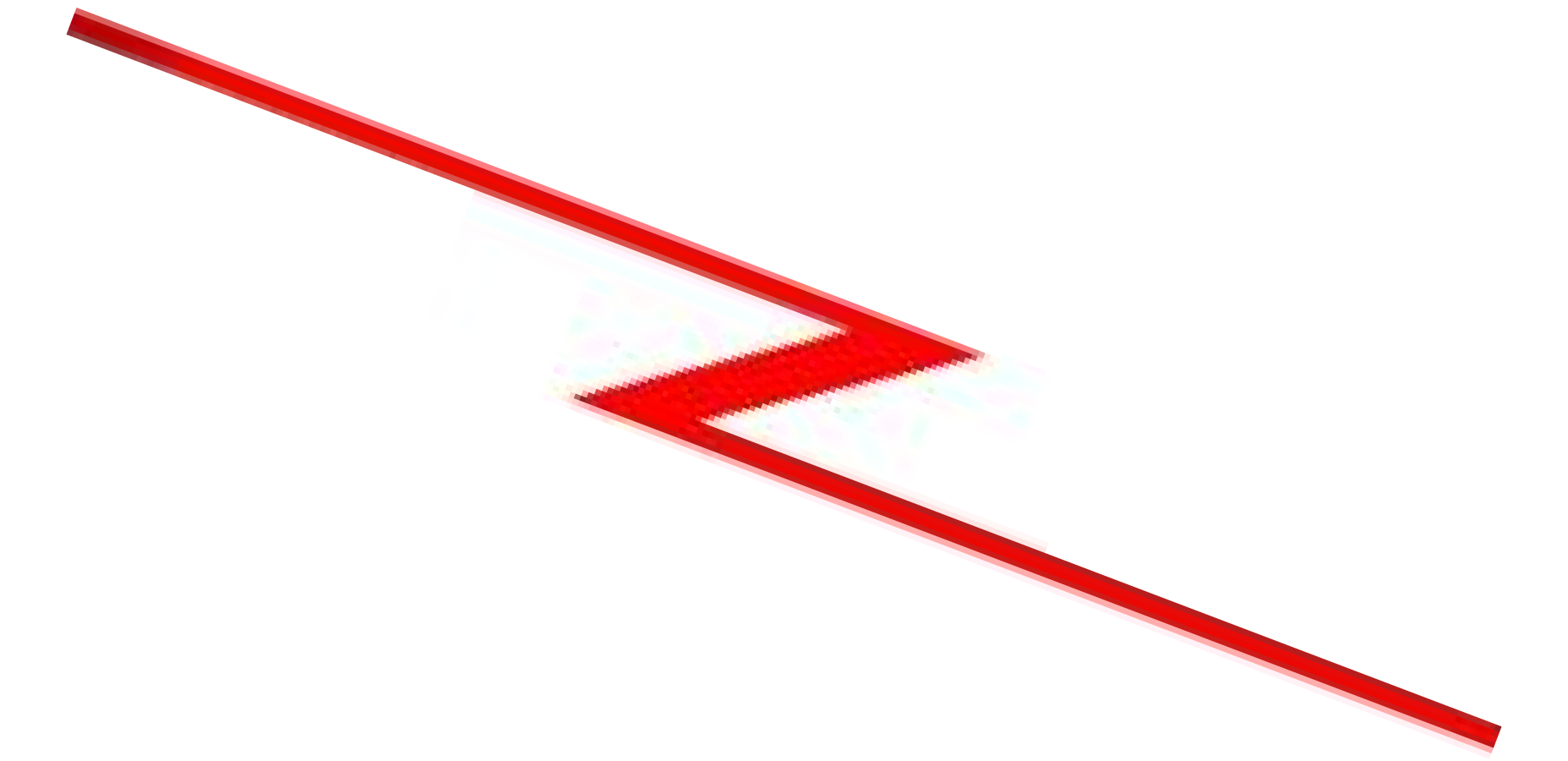
61

**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**

**F0/0 S0/0/0**



Router A

**S0/0/1**

**S0/0/1**

**F0/0**

**S0/0/0**

Router B

Dallas

**F0/1**

Router C **F0/0**

150 Hosts New York

Washington D.C. 220 Hosts

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

64

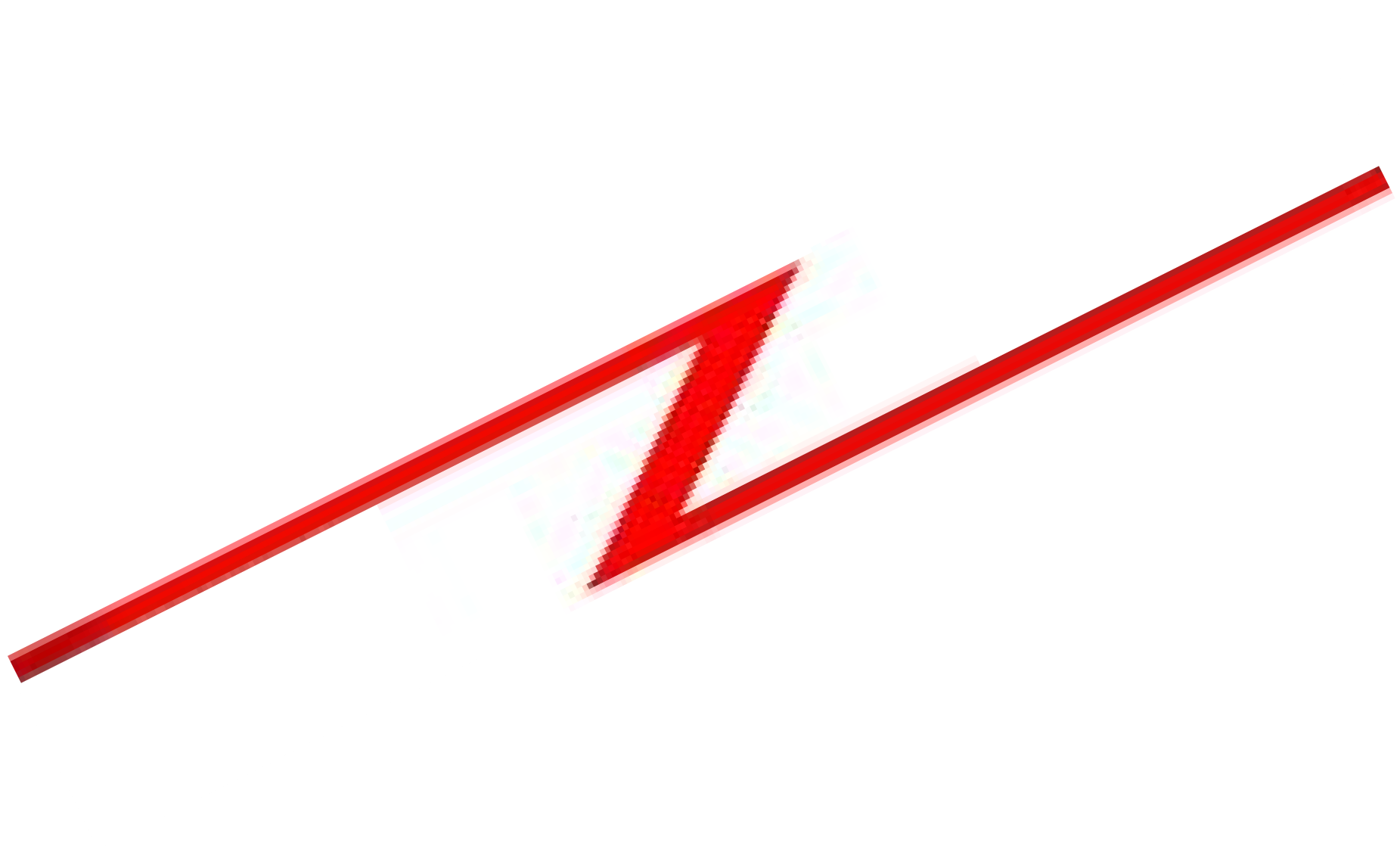
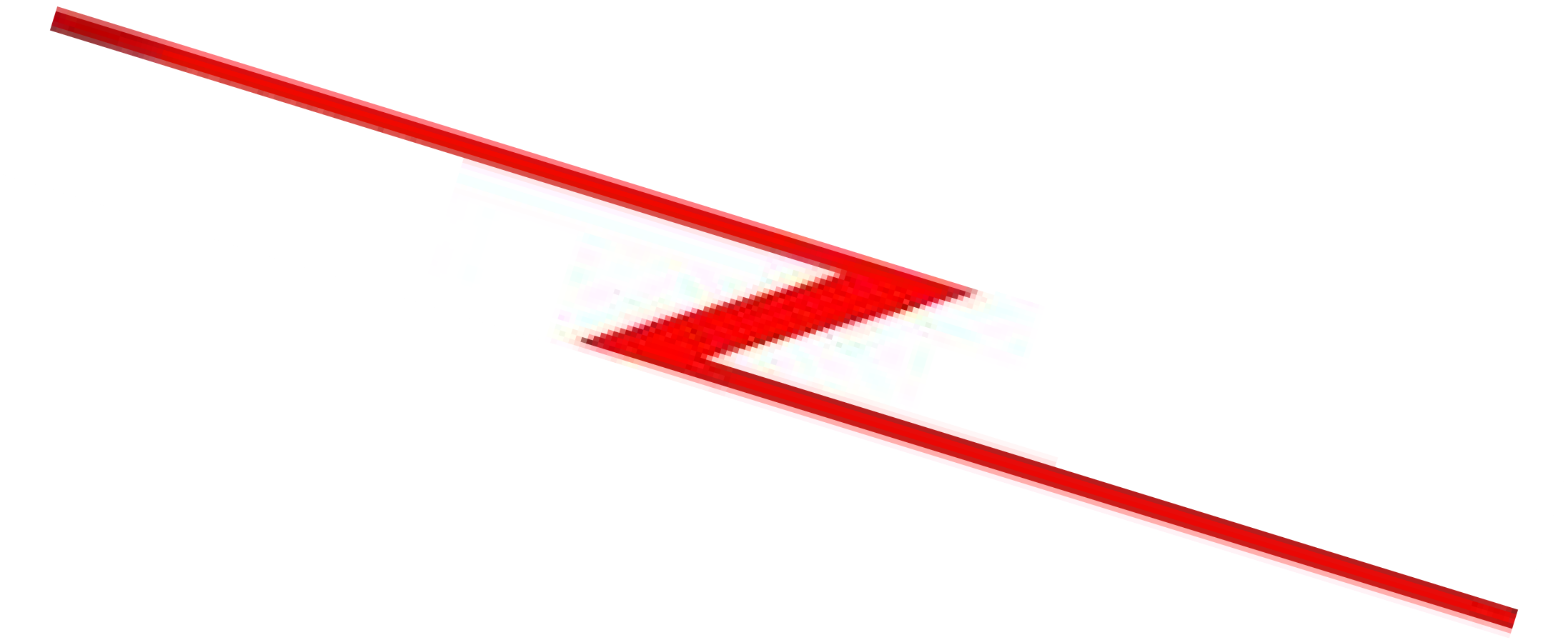
# Show your work for Problem 4 in the space below.

65

**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**



**S0/0/0**

Router A

**F0/0**

**S0/0/1**

**S0/0/1**

**S0/0/0**

Technology Building 320 Hosts

**S0/0/0**

Art & Drama

**S0/0/1**

Router B

**F0/1**

75 Hosts

Router C

**F0/0**

**F0/1**

Administration 35 Hosts

Science Building 225 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

68

# Show your work for Problem 6 in the space below.

69