

The CIDRD mail list archive: <<ftp://aarnet.edu.au/pub/mailling-lists/cidrd>>

Internet Drafts published by the CIDRD working group are available from:
<<http://www.ietf.cnri.reston.va.us/ids.by.wg/cidrd.html>>

Procedures for Internet/Enterprise Renumbering (PIER)

General information about the PIER working group of the IETF and its charter is available from: <<http://www.ietf.cnri.reston.va.us/html.charters/pier-charter.html>>

To subscribe to the PIER mailing list: <pier-request@isi.edu>

The PIER mail list archive: <<ftp://ftp.isi.edu/pier-archive>>

Papers developed by PIER are available from: <<http://www.isi.edu:80/div7/pier/>>.

Dynamic Host Configuration (DHCP)

For information about the DHCP working group, current Internet-Drafts, and Requests for Comments: <<http://www.ietf.cnri.reston.va.us/html.charters/dhc-charter.html>>

To access the DHCP Home Page: <<http://charlotte.acns.nwu.edu/internet/tech/dhcp/>>

To subscribe to the DHCP mailing list: <host-conf-request@sol.eg.bucknell.edu>

The DHCP mail list archive: <<ftp://ftp.bucknell.edu/pub/dhcp>>

IPng (IPNGWG)

For information about the IPng working group, current Internet-Drafts, and Requests for Comments: <<http://www.ietf.cnri.reston.va.us/html.charters/ipngwg-charter.html>>

To access the IPng Home Page: <<http://playground.sun.com/pub/ipng/html/ipng-main.html>>

To subscribe to the IPng mailing list: <majordomo@sunroof.eng.sun.com>

The IPng mail list archive: <<ftp://parcftp.xerox.com/pub/ipng>>

Appendix A - References

Requests for Comments

Requests for Comments are available on the WWW from: <<http://ds.internic.net/ds/dspg2intdoc.html>>

- 950 J. Mogul, J. Postel, "Internet standard subnetting procedure", 08/01/1985. (Pages=18) (STD 5)
- 985 National Science Foundation, Network Technical Advisory Group, "Requirements for Internet gateways - draft", 05/01/1986. (Pages=23) (Obsoleted by RFC1009)
- 1009 R. Braden, J. Postel, "Requirements for Internet gateways", 06/01/1987. (Pages=55) (Obsoletes RFC985) (STD 4) (Obsoleted by RFC1716)
- 1245 J. Moy, "OSPF Protocol Analysis", 08/08/1991. (Pages=12)
- 1246 J. Moy, "Experience with the OSPF Protocol", 08/08/1991. (Pages=31)
- 1247 J. Moy, "OSPF Version 2", 08/08/1991. (Pages=189) (Format=.txt, .ps) (Obsoletes RFC1131) (Obsoleted by RFC1583)
- 1338 V. Fuller, T. Li, K. Varadhan, J. Yu, "Supernetting: an Address Assignment and Aggregation Strategy", 06/26/1992. (Pages=20) (Obsoleted by RFC1519)
- 1366 E. Gerich, "Guidelines for Management of IP Address Space", 10/22/1992. (Pages=8) (Obsoleted by RFC1466)
- 1466 E. Gerich, "Guidelines for Management of IP Address Space", 05/26/1993. (Pages=10) (Obsoletes RFC1366)
- 1517 R. Hinden, "Applicability Statement for the Implementation of Classless Inter-Domain Routing (CIDR)", 09/24/1993. (Pages=4)
- 1518 Y. Rekhter, T. Li, "An Architecture for IP Address Allocation with CIDR", 09/24/1993. (Pages=27)
- 1519 V. Fuller, T. Li, J. Yu, K. Varadhan, "Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy", 09/24/1993. (Pages=24) (Obsoletes RFC1338)
- 1520 Y. Rekhter, C. Topolcic, "Exchanging Routing Information Across Provider Boundaries in the CIDR Environment", 09/24/1993. (Pages=9)
- 1583 J. Moy, "OSPF Version 2", 03/23/1994. (Pages=212) (Obsoletes RFC1247)
- 1716 P. Almquist, F. Kastenholtz, "Towards Requirements for IP Routers", 11/04/1994. (Pages=186) (Obsoletes RFC1009) (Obsoleted by RFC1812)
- 1721 G. Malkin, "RIP Version 2 Protocol Analysis", 11/15/1994. (Pages=4) (Obsoletes RFC1387)
- 1722 G. Malkin, "RIP Version 2 Protocol Applicability Statement", 11/15/1994. (Pages=5)
- 1723 G. Malkin, "RIP Version 2 Carrying Additional Information", 11/15/1994. (Pages=9) (Updates RFC1058) (Obsoletes RFC1388)

- 1724 G. Malkin, F. Baker, "RIP Version 2 MIB Extension", 11/15/1994. (Pages=18) (Obsoletes RFC1389)
- 1812 F. Baker, "Requirements for IP Version 4 Routers", 06/22/1995. (Pages=175) (Obsoletes RFC1716)
- 1900 B. Carpenter, Y. Rekhter, "Renumbering Needs Work", 02/28/1996. (Pages=4)
- 1916 H. Berkowitz, P. Ferguson, W. Leland, P. Nesser, "Enterprise Renumbering: Experience and Information Solicitation", 02/28/1996. (Pages=8)
- 1917 P. Nesser, "An Appeal to the Internet Community to Return Unused IP Network (Prefixes) to the IANA", 02/29/1996. (Pages=10)
- 1918 Y. Rekhter, R. Moskowitz, D. Karrenberg, G. de Groot, E. Lear, , "Address Allocation for Private Internets", 02/29/1996. (Pages=9) (Obsoletes RFC1627)

Internet Drafts

Internet Drafts are available on the WWW from: <<http://www.ietf.cnri.reston.va.us/lid-abstracts.html>>

"Suggestions for Market-Based Allocation of IP Address Blocks", <draft-ietf-cidr-blocks-00.txt>, P. Resnick, 02/23/1996. (24590 bytes)

"Observations on the use of Components of the Class A Address Space within the Internet", <draft-ietf-cidr-classa-01.txt>, G.Huston, 12/22/1995. (21347 bytes)

Classless in-addr.arpa delegation", <draft-ietf-cidr-classless-inaddr-00.txt>, H. Eidnes, G. de Groot, 01/18/1996. (13224 bytes)

"Implications of Various Address Allocation Policies for Internet Routing", <draft-ietf-cidr-addr-ownership-07.txt>, Y. Rekhter, T. Li, 01/15/1996. (34866 bytes)

"Suggestions for Market-Based Allocation of IP Address Blocks", <draft-ietf-cidr-blocks-00.txt>, P. Resnick, 02/23/1996. (24590 bytes)

Textbooks

Comer, Douglas E. *Internetworking with TCP/IP Volume 1 Principles, Protocols, and Architecture Second Edition*, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1991

Huitema, Christian. *Routing in the Internet*, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1995

Stevens, W. Richard. *TCP/IP Illustrated: Volume 1 The Protocols*, Addison Wesley Publishing Company, Reading MA, 1994

Wright, Gary and W. Richard Stevens. *TCP/IP Illustrated: Volume 2 The Implementation*, Addison Wesley Publishing Company, Reading MA, 1995

Appendix B - Classful IP Addressing

Practice Exercises

1. Complete the following table which provides practice in converting a number from binary notation to decimal format.

Binary	128	64	32	16	8	4	2	1	Decimal
11001100	1	1	0	0	1	1	0	0	$128+64+8+4 = 204$
10101010									
11100011									
10110011									
00110101									

2. Complete the following table which provides practice in converting a number from decimal notation to binary format.

Decimal	128	64	32	16	8	4	2	1	Binary
48	0	0	1	1	0	0	0	0	$48=32+16=00110000_2$
222									
119									
135									
60									

3. Express 145.32.59.24 in binary format and identify the address class:

4. Express 200.42.129.16 in binary format and identify the address class:

5. Express 14.82.19.54 in binary format and identify the address class:

Solutions to Classful IP Addressing Practice Exercises

- Complete the following table which provides practice in converting a number from binary notation to decimal format.

Binary	128	64	32	16	8	4	2	1	Decimal
11001100	1	1	0	0	1	1	0	0	204
10101010	1	0	1	0	1	0	1	0	170
11100011	1	1	1	0	0	0	1	1	227
10110011	1	0	1	1	0	0	1	1	179
00110101	0	0	1	1	0	1	0	1	53

- Complete the following table which provides practice in converting a number from decimal notation to binary format.

Decimal	128	64	32	16	8	4	2	1	Binary
48	0	0	1	1	0	0	0	0	0011 0000
222	1	1	0	1	1	1	1	0	1101 1110
119	0	1	1	1	0	1	1	1	0111 0111
135	1	0	0	0	0	1	1	1	1000 0111
60	0	0	1	1	1	1	0	0	0011 1100

- Express 145.32.59.24 in binary format and identify the classful prefix length.
10010001.00100000.00111011.00011000 /16 or Class B
- Express 200.42.129.16 in binary format and identify the classful prefix length.
11001000.00101010.10000001.00010000 /24 or Class C
- Express 14.82.19.54 in binary format and identify the classful prefix length.
00001110.01010010.00010011.00110110 /8 or Class A

Appendix C - Subnetting Examples

Subnetting Exercise #1

Assume that you have been assigned the 132.45.0.0/16 network block. You need to establish eight subnets

1. _____ binary digits are required to define eight subnets.
2. Specify the extended-network-prefix that allows the creation of 8 subnets.

3. Express the subnets in binary format and dotted decimal notation:

#0 _____

#1 _____

#2 _____

#3 _____

#4 _____

#5 _____

#6 _____

#7 _____

4. List the range of host addresses that can be assigned to Subnet #3 (132.45.96.0/19).

6. What is the broadcast address for Subnet #3 (132.45.96.0/19).

Subnetting Exercise #2

1. Assume that you have been assigned the 200.35.1.0/24 network block. Define an extended-network-prefix that allows the creation of 20 hosts on each subnet.

2. What is the maximum number of hosts that can be assigned to each subnet?

3. What is the maximum number of subnets that can be defined?

4. Specify the subnets of 200.35.1.0/24 in binary format and dotted decimal notation.

5. List range of host addresses that can be assigned to Subnet #6 (200.35.1.192/27)

6. What is the broadcast address for subnet 200.35.1.192/27?

Solution for Subnetting Exercise #1

Assume that you have been assigned the 132.45.0.0/16 network block. You need to establish 8 subnets.

1. Three binary digits are required to define the eight subnets.
2. Specify the extended-network-prefix that allows the creation of 8 subnets.

 /19 or 255.255.224.0

3. Express the subnets in binary format and dotted decimal notation:

Subnet #0: 10000100.00101101.00000000.00000000 = 132.45.0.0/19
Subnet #1: 10000100.00101101.00100000.00000000 = 132.45.32.0/19
Subnet #2: 10000100.00101101.01000000.00000000 = 132.45.64.0/19
Subnet #3: 10000100.00101101.01100000.00000000 = 132.45.96.0/19
Subnet #4: 10000100.00101101.10000000.00000000 = 132.45.128.0/19
Subnet #5: 10000100.00101101.10100000.00000000 = 132.45.160.0/19
Subnet #6: 10000100.00101101.11000000.00000000 = 132.45.192.0/19
Subnet #7: 10000100.00101101.11100000.00000000 = 132.45.224.0/19

4. List the range of host addresses that can be assigned to Subnet #3 (132.45.96.0/19).

Subnet #3: 10000100.00101101.01100000.00000000 = 132.45.96.0/19
Host #1: 10000100.00101101.01100000.00000001 = 132.45.96.1/19
Host #2: 10000100.00101101.01100000.00000010 = 132.45.96.2/19
Host #3: 10000100.00101101.01100000.00000011 = 132.45.96.3/19
:
Host #8190: 10000100.00101101.01111111.11111110 = 132.45.127.254/19

4. What is the broadcast address for Subnet #3 (132.45.96.0/19)?

10000100.00101101.01111111.11111111 = 132.45.127.255/19

Solution for Subnetting Exercise #2

1. Assume that you have been assigned the 200.35.1.0/24 network block. Define an extended-network-prefix that allows the creation of 20 hosts on each subnet.

A minimum of five bits are required to define 20 hosts so the extended-network-prefix is a /27 ($2^7 = 32-5$).

2. What is the maximum number of hosts that can be assigned to each subnet?

The maximum number of hosts on each subnet is 2^5-2 , or 30.

3. What is the maximum number of subnets that can be defined?

The maximum number of subnets is 2^3 , or 8.

4. Specify the subnets of 200.35.1.0/24 in binary format and dotted decimal notation.

Subnet #0: 11001000.00100011.00000001.00000000 = 200.35.1.0/27
Subnet #1: 11001000.00100011.00000001.00100000 = 200.35.1.32/27
Subnet #2: 11001000.00100011.00000001.01000000 = 200.35.1.64/27
Subnet #3: 11001000.00100011.00000001.01100000 = 200.35.1.96/27
Subnet #4: 11001000.00100011.00000001.10000000 = 200.35.1.128/27
Subnet #5: 11001000.00100011.00000001.10100000 = 200.35.1.160/27
Subnet #6: 11001000.00100011.00000001.11000000 = 200.35.1.192/27
Subnet #7: 11001000.00100011.00000001.11100000 = 200.35.1.224/27

5. List range of host addresses that can be assigned to Subnet #6 (200.35.1.192/27)

Subnet #6: 11001000.00100011.00000001.11000000 = 200.35.1.192/27
Host #1: 11001000.00100011.00000001.11000001 = 200.35.1.193/27
Host #2: 11001000.00100011.00000001.11000010 = 200.35.1.194/27
Host #3: 11001000.00100011.00000001.11000011 = 200.35.1.195/27
:
Host #29: 11001000.00100011.00000001.11011101 = 200.35.1.221/27
Host #30: 11001000.00100011.00000001.11011110 = 200.35.1.222/27

6. What is the broadcast address for subnet 200.35.1.192/27?

11001000.00100011.00000001.11011111 = 200.35.1.223

Appendix D - VLSM Example

VLSM Exercise

Given

An organization has been assigned the network number 140.25.0.0/16 and it plans to deploy VLSM. Figure C-1 provides a graphic display of the VLSM design for the organization.

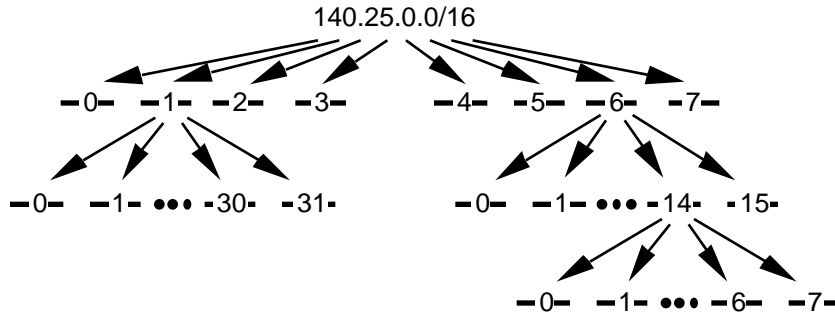


Figure C-1: Address Strategy for VLSM Example

To arrive at this design, the first step of the subnetting process divides the base network address into 8 equal-sized address blocks. Then Subnet #1 is divided it into 32 equal-sized address blocks and Subnet #6 is divided into 16 equal-sized address blocks. Finally, Subnet #6-14 is divided into 8 equal-sized address blocks.

1. Specify the eight subnets of 140.25.0.0/16:

#0 _____

#1 _____

#2 _____

#3 _____

#4 _____

#5 _____

#6 _____

#7 _____

2. List the host addresses that can be assigned to Subnet #3 (140.25.96.0):

3. Identify the broadcast address for Subnet #3 (140.25.96.0):

4. Specify the 16 subnets of Subnet #6 (140.25.192.0/19):

#6-0 _____

#6-1 _____

#6-2 _____

#6-3 _____

#6-4 _____

#6-5 _____

#6-6 _____

#6-7 _____

#6-8 _____

#6-9 _____

#6-10 _____

#6-11 _____

#6-12 _____

#6-13 _____

#6-14 _____

#6-15 _____

5. List the host addresses that can be assigned to Subnet #6-3 (140.25.198.0/23):

6. Identify the broadcast address for Subnet #6-3 (140.25.198.0/23):

7. Specify the eight subnets of Subnet #6-14 (140.25.220.0/23):

#6-14-0 _____

#6-14-1 _____

#6-14-2 _____

#6-14-3 _____

#6-14-4 _____

#6-14-5 _____

#6-14-6 _____

#6-14-7 _____

8. List the host addresses that can be assigned to Subnet #6-14-2 (140.25.220.128/26):

9. Identify the broadcast address for Subnet #6-14-2 (140.25.220.128/26):

Solution for VLSM Exercise

1. Specify the eight subnets of 140.25.0.0/16:

Base Network: 10001100.00011001.00000000.00000000 = 140.25.0.0/16
Subnet #0: 10001100.00011001.00000000.00000000 = 140.25.0.0/19
Subnet #1: 10001100.00011001.00100000.00000000 = 140.25.32.0/19
Subnet #2: 10001100.00011001.01000000.00000000 = 140.25.64.0/19
Subnet #3: 10001100.00011001.01100000.00000000 = 140.25.96.0/19
Subnet #4: 10001100.00011001.10000000.00000000 = 140.25.128.0/19
Subnet #5: 10001100.00011001.10100000.00000000 = 140.25.160.0/19
Subnet #6: 10001100.00011001.11000000.00000000 = 140.25.192.0/19
Subnet #7: 10001100.00011001.11100000.00000000 = 140.25.224.0/19

2. List the host addresses that can be assigned to Subnet #3 (140.25.96.0)

Subnet #3: 10001100.00011001.01100000.00000000 = 140.25.96.0/19
Host #1: 10001100.00011001.01100000.00000001 = 140.25.96.1/19
Host #2: 10001100.00011001.01100000.00000010 = 140.25.96.2/19
Host #3: 10001100.00011001.01100000.00000011 = 140.25.96.3/19
.
.
Host #8189: 10001100.00011001.01111111.11111101 = 140.25.127.253/19
Host #8190: 10001100.00011001.01111111.11111110 = 140.25.127.254/19

3. Identify the broadcast address for Subnet #3 (140.25.96.0)

10001100.00011001.01111111.11111111 = 140.25.127.255

4. Specify the 16 subnets of Subnet #6 (140.25.192.0/19):

Subnet #6: 10001100.00011001.11000000.00000000 = 140.25.192.0/19
Subnet #6-0: 10001100.00011001.11000000.00000000 = 140.25.192.0/23
Subnet #6-1: 10001100.00011001.11000001.00000000 = 140.25.194.0/23
Subnet #6-2: 10001100.00011001.11000010.00000000 = 140.25.196.0/23
Subnet #6-3: 10001100.00011001.11000011.00000000 = 140.25.198.0/23
Subnet #6-4: 10001100.00011001.11000100.00000000 = 140.25.200.0/23
.
.
Subnet #6-14: 10001100.00011001.11011100.00000000 = 140.25.220.0/23
Subnet #6-15: 10001100.00011001.11011110.00000000 = 140.25.222.0/23

5. List the host addresses that can be assigned to Subnet #6-3 (140.25.198.0/23):

Subnet #6-3: 10001100.00011001.11000110.00000000 = 140.25.198.0/23
Host #1 10001100.00011001.11000110.00000001 = 140.25.198.1/23
Host #2 10001100.00011001.11000110.00000010 = 140.25.198.2/23
Host #3 10001100.00011001.11000110.00000011 = 140.25.198.3/23
Host #4 10001100.00011001.11000110.00000100 = 140.25.198.4/23
Host #5 10001100.00011001.11000110.00000110 = 140.25.198.5/23
.
.
Host #509 10001100.00011001.11000111.11111101 = 140.25.199.253/23
Host #510 10001100.00011001.11000111.11111110 = 140.25.199.254/23

6. Identify the broadcast address for Subnet #6-3 (140.25.198.0/23)

10001100.00011001.11000111.11111111 = 140.25.199.255

7. Specify the eight subnets of Subnet #6-14 (140.25.220.0/23):

Subnet #6-14: 10001100.00011001.11011100.00000000 = 140.25.220.0/23
Subnet#6-14-0: 10001100.00011001.11011100.00000000 = 140.25.220.0/26
Subnet#6-14-1: 10001100.00011001.11011100.01000000 = 140.25.220.64/26
Subnet#6-14-2: 10001100.00011001.11011100.10000000 = 140.25.220.128/26
Subnet#6-14-3: 10001100.00011001.11011100.11000000 = 140.25.220.192/26
Subnet#6-14-4: 10001100.00011001.11011101.00000000 = 140.25.221.0/26
Subnet#6-14-5: 10001100.00011001.11011101.01000000 = 140.25.221.64/26
Subnet#6-14-6: 10001100.00011001.11011101.10000000 = 140.25.221.128/26
Subnet#6-14-7: 10001100.00011001.11011101.11000000 = 140.25.221.192/26

8. List the host addresses that can be assigned to Subnet #6-14-2 (140.25.220.128/26):

Subnet#6-14-2: 10001100.00011001.11011100.10000000 = 140.25.220.128/26
Host #1 10001100.00011001.11011100.10000001 = 140.25.220.129/26
Host #2 10001100.00011001.11011100.10000010 = 140.25.220.130/26
Host #3 10001100.00011001.11011100.10000011 = 140.25.220.131/26
Host #4 10001100.00011001.11011100.10000100 = 140.25.220.132/26
Host #5 10001100.00011001.11011100.10000101 = 140.25.220.133/26
.
.
Host #61 10001100.00011001.11011100.10111101 = 140.25.220.189/26
Host #62 10001100.00011001.11011100.10111110 = 140.25.220.190/26

9. Identify the broadcast address for Subnet #6-14-2 (140.25.220.128/26):

10001100.00011001.11011100.10111111 = 140.25.220.191

3. Aggregate the following set of (4) IP /24 network addresses to the highest degree possible.

212.56.132.0/24
212.56.133.0/24
212.56.134.0/24
212.56.135.0/24

4. Aggregate the following set of (4) IP /24 network addresses to the highest degree possible.

212.56.146.0/24
212.56.147.0/24
212.56.148.0/24
212.56.149.0/24

5. Aggregate the following set of (64) IP /24 network addresses to the highest degree possible.

202.1.96.0/24
202.1.97.0/24
202.1.98.0/24
:
202.1.126.0/24
202.1.127.0/24
202.1.128.0/24
202.1.129.0/24
:
202.1.158.0/24
202.1.159.0/24

6. How would you express the entire Class A address space as a single CIDR advertisement?
-

7. How would you express the entire Class B address space as a single CIDR advertisement?
-

8. How would you express the entire Class C address space as a single CIDR advertisement?
-

Solutions for CIDR Practice Exercises

1. List the individual networks numbers defined by the CIDR block 200.56.168.0/21.

- a. Express the CIDR block in binary format:

200.56.168.0/21 11001000.00111000.10101000.00000000

- b. The /21 mask is 3 bits shorter than the natural mask for a traditional /24. This means that the CIDR block identifies a block of 8 (or 2^3) consecutive /24 network numbers.

- c. The range of /24 network numbers defined by the CIDR block 200.56.168.0/21 includes:

```
Net #0: 11001000.00111000.10101000.xxxxxxxx 200.56.168.0
Net #1: 11001000.00111000.10101001.xxxxxxxx 200.56.169.0
Net #2: 11001000.00111000.10101010.xxxxxxxx 200.56.170.0
Net #3: 11001000.00111000.10101011.xxxxxxxx 200.56.171.0
Net #4: 11001000.00111000.10101100.xxxxxxxx 200.56.172.0
Net #5: 11001000.00111000.10101101.xxxxxxxx 200.56.173.0
Net #6: 11001000.00111000.10101110.xxxxxxxx 200.56.174.0
Net #7: 11001000.00111000.10101111.xxxxxxxx 200.56.175.0
```

2. List the individual networks numbers defined by the CIDR block 195.24/13.

- a. Express the CIDR block in binary format:

195.24.0.0/13 11000011.00011000.00000000.00000000

- b. The /13 mask is 11 bits shorter than the natural mask for a traditional /24. This means that the CIDR block identifies a block of 2,048 (or 2^{11}) consecutive /24 network numbers.

- c. The range of /24 network numbers defined by the CIDR block 195.24/13 include:

```

Net #0:      11000011.00011000.00000000.xxxxxxxx 195.24.0.0
Net #1:      11000011.00011000.00000001.xxxxxxxx 195.24.1.0
Net #2:      11000011.00011000.00000010.xxxxxxxx 195.24.2.0
.
.
.
Net #2045:   11000011.00011111.11111101.xxxxxxxx 195.31.253.0
Net #2046:   11000011.00011111.11111110.xxxxxxxx 195.31.254.0
Net #2047:   11000011.00011111.11111111.xxxxxxxx 195.31.255.0

```

3. Aggregate the following set of (4) IP /24 network addresses to the highest degree possible.

```

212.56.132.0/24
212.56.133.0/24
212.56.134.0/24
212.56.135.0/24

```

- a. List each address in binary format and determine the common prefix for all of the addresses:

```

212.56.132.0/24   11010100.00111000.10000100.00000000
212.56.133.0/24   11010100.00111000.10000101.00000000
212.56.134.0/24   11010100.00111000.10000110.00000000
212.56.135.0/24   11010100.00111000.10000111.00000000

Common Prefix:    11010100.00111000.10000100.00000000

```

- b. The CIDR aggregation is:

```

212.56.132.0/22

```

4. Aggregate the following set of (4) IP /24 network addresses to the highest degree possible.

```

212.56.146.0/24
212.56.147.0/24
212.56.148.0/24
212.56.149.0/24

```

- a. List each address in binary format and determine the common prefix for all of the addresses:

```

212.56.146.0/24   11010100.00111000.10010010.00000000
212.56.147.0/24   11010100.00111000.10010011.00000000
212.56.148.0/24   11010100.00111000.10010100.00000000
212.56.148.0/24   11010100.00111000.10010101.00000000

```

b. Note that this set of four /24s cannot be summarized as a single /23!

212.56.146.0/23	<u>11010100.00111000.10010010</u> .00000000
212.56.148.0/23	<u>11010100.00111000.10010100</u> .00000000

c. The CIDR aggregation is:

212.56.146.0/23
212.56.148.0/23

Note that if two /23s are to be aggregated into a /22, then both /23s must fall within a single /22 block! Since each of the two /23s is a member of a different /22 block, they cannot be aggregated into a single /22 (even though they are consecutive!). They could be aggregated into 222.56.144/21, but this aggregation would include four network numbers that were not part of the original allocation. Hence, the smallest possible aggregate is two /23s.

5. Aggregate the following set of (64) IP /24 network addresses to the highest degree possible.

```

202.1.96.0/24
202.1.97.0/24
202.1.98.0/24
:
202.1.126.0/24
202.1.127.0/24
202.1.128.0/24
202.1.129.0/24
:
202.1.158.0/24
202.1.159.0/24

```

a. List each address in binary format and determine the common prefix for all of the addresses:

202.1.96.0/24	<u>11001010.00000001.01100000</u> .00000000
202.1.97.0/24	<u>11001010.00000001.01100001</u> .00000000
202.1.98.0/24	<u>11001010.00000001.01100010</u> .00000000
:	:
202.1.126.0/24	<u>11001010.00000001.01111110</u> .00000000
202.1.127.0/24	<u>11001010.00000001.01111111</u> .00000000
202.1.128.0/24	<u>11001010.00000001.10000000</u> .00000000
202.1.129.0/24	<u>11001010.00000001.10000001</u> .00000000
:	:
202.1.158.0/24	<u>11001010.00000001.10011110</u> .00000000
202.1.159.0/24	<u>11001010.00000001.10011111</u> .00000000

b. Note that this set of 64 /24s cannot be summarized as a single /19!

202.1.96.0/19	<u>11001010.00000001.01100000</u> .00000000
202.1.128.0/19	<u>11001010.00000001.10000000</u> .00000000

c. The CIDR aggregation is:

202.1.96.0/19
202.1.128.0/19

Similar to the previous example, if two /19s are to be aggregated into a /18, the /19s must fall within a single /18 block! Since each of these two /19s is a member of a different /18 block, they cannot be aggregated into a single /18. They could be aggregated into 202.1/16, but this aggregation would include 192 network numbers that were not part of the original allocation. Thus, the smallest possible aggregate is two /19s.

6. How would you express the entire Class A address space as a single CIDR advertisement?

Since the leading bit of all Class A addresses is a "0", the entire Class A address space can be expressed as 0/1.

7. How would you express the entire Class B address space as a single CIDR advertisement?

Since the leading two bits of all Class B addresses are "10", the entire Class B address space can be expressed as 128/2.

8. How would you express the entire Class C address space as a single CIDR advertisement?

Since the leading three bits of all Class C addresses are "110", the entire Class C address space can be expressed as 192/3.