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 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 128+32+8+2 = 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 |

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 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 11011110 |
| 119 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 01110111 |
| 135 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 10000111 |
| 60 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 00111100 |

3. Express 145.32.59.24 in binary format and identify the classful prefix length.

10010001.00100000.00111011.00011000

Class B

4. Express 200.42.129.16 in binary format and identify the classful prefix length.

11001000.00101010.10000001.00010000

Class C

5. Express 14.82.19.54 in binary format and identify the classful prefix length.

00001110.~~01010~~.

.01010010.00010011.00110110

Class A

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

6. 3 binary digits are required to define 8 subnets

7. Specify the extended-network –prefix that allows the creation of 8 subnets.
   132.45.0.0/19
8. Express the subnets in binary format and dotted decimal notation:

#0 132.45.0.0/19

#1 132.45.32.0/19

#2 132.45.64.0/19

#3 132.45.96.0/19

#4 132.45.128.0/19

#5 132.45.160.0/19

#6 132.45.192.0/19

#7 132.45.224.0/19

9. List the range of addresses that can be assigned to subnet #3

   132.45.96.1 - 132.45.127.254

10. What is the broadcast address for subnet #3?

    132.45.127.255

11. 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.

200.35.1.0/27

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

8

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

#0 200.35.1.0/27

#1 200.35.1.32/27

#2 200.35.1.64/27

#3 200.35.1.96/27

#4 200.35.1.128/27

#5 200.35.1.160/27

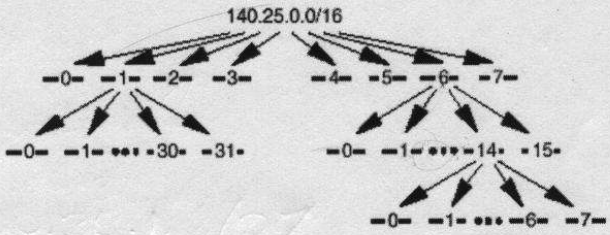
#6 200.35.1.192/27

#7 200.35.1.224/27

14. List the range of host addresses that can be assigned to subnet#6.

200.35.1.193 - 200.35.1.222

An organization has been assigned the network number 140.25.0.0/16 and it plans to deploy VLSM. The following figure provides a graphical representation of the VLSM design for the organization.




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

15. Specify the eight subnets of 140.25.0.0/16:

#0 140.25.0.0/19

#1 140.25.32.0/19

#2 140.25.64.0/19

#3 140.25.96.0/19

#4 140.25.128.0/19

#5 140.25.160.0/19

#6 140.25.192.0/19

#7 140.25.224.0/19

16. List the host addresses that can be assigned to subnet #3.

140.25.96.1 - 140.25.127.254

17. Identify the broadcast address for subnet #3. 140.25.127.255

18. Specify the 16 subnets of subnet #6

#0 140.25.192.0/23

#1 140.25.194.0/23

#2 140.25.196.0/23

#3 140.25.198.0/23

#4 140.25.209.0/23

#5 140.25.202.0/23

#6 140.25.204.0/23

#7 140.25.206.0/23

#8 140.25.208.0/23

#9 140.25.210.0/23

#10 140.25.212.0/23

#11 140.25.214.0/23

#12 140.25.216.0/23

#13 140.25.218.0/23

#14 140.25.220.0/23

#15 140.25.222.0/23

19. List the host addresses that can be assigned to subnet #6-3

140.25.198.1 - 140.25.199.254

20. Identify the broadcast address for subnet #6-3

140.25.199.255

21. Specify the eight subnets of subnet #6-14

#0 140.25.220.0/26

#1 140.25.220.64/26

#2 140.25.220.128/26

#3 140.25.220.192/26

#4 140.25.221.0/26

#5 140.25.221.64/26

#6 140.25.220.128/26

#7 140.25.221.192/26

22. List the host addresses that can be assigned to subnet #6-14-2

140.25.220.129-140.25.220.190

23. Identify the broadcast address for subnet #6-14-2

140.25.220.191

24. List the individual network numbers defined by the CIDR block 200.56.168.0/21.

200.56.168.0/24
200.56.169.0/24
200.56.170.0/24
200.56.171.0/24
200.56.172.0/24
200.56.173.0/24
200.56.174.0/24
200.56.175.0/24

25. List the individual network numbers defined by CIDR block 195.24/13.

195.24.0.0/16
195.25.0.0/16

195.26.0.0/16
195.27.0.0/16
195.28.0.0/16
195.29.0.0/16
195.30.0.0/16
195.31.0.0/16

26. 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

212.56.132.0/22

27. Aggregate the following 4 IP /24 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

212.56.146.0/21

29. Aggregate the following set of 64 IP /24 addresses to the highest degree possible.

202.1.96.0/24
202.1.97.0/24
.
.
202.1.126.0/24
202.1.127.0/24
.
.
202.1.158.0/24
202.1.159.0/24

~~202.1.96.0/16~~

0110 0000
1001 1111

202.1.0.0/16

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

0.0.0.0/1

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

~~192.168.0.0/16~~ 128.0.0.0/R

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

~~10.1.1.0/24~~ 192.0.0.0/3

Notes on CIDR and VLSM:

Three features are required for CIDR:

1 – Multiple IP addresses to be summarized together for routing must share the same high-order bits of their addresses.

2 – The routing tables and routing algorithms must be extended to base their routing decisions on a 32-bit IP address and a 32 bit mask.

3 – The routing protocols being used must be extended to carry a 32-bit mask in addition to a 32-bit address ie. As in OSPF and RIP2 .

VLSM procedure

1 – First subnet your address space completely by using a fixed subnet mask (ie. Divide the network into areas.

2 – Take one big subnet (or area) and further subnet (microsubnet) with an extended mask. If the microsubnets are grouped, routing information can be summarized or aggregated.

3 – Optimal consolidation occurs with contiguous blocks of addresses in powers of 2. ie. 4, 16, 512 addresses can be represented by a single routing entry.

5 – Avoid using more than 2 subnet masks per network (although this isn't always possible)