1. Determine the network and broadcast addresses and number of host bits and hosts for the given IPv4 addresses and prefixes:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| IPv4  Address/Prefix | Network Address | Broadcast Address | Total Number  of Host Bits | Total Number  of Hosts |
| 172.16.104.99/27 | 10101100.00010000.01101000.01100000 | 10101100.00010000.01101000.01111111 | 5 | 32-2=30 |
| 198.133.219.250/24 | 11000110.10000101.11011011.00000000 | 11000110.10000101.11011011.11111111 | 8 | 256-2=254 |
| 10.1.113.75/19 | 0001010.00000001.01100000.00000000 | 00001010.00000001.01111111.11111111 | 13 | 8192-2=8190 |

IP = 172.16.104.99 = 10101100.00010000.01101000.01100011

NM = /27 = 255.255.255.224 = 11111111.11111111.11111111.11100000

IP and NM => 10101100.00010000.01101000.011**00000 Network Address**

10101100.00010000.01101000.011**11111 Broadcast Address**

IP = 198.133.219.250 = 11000110.10000101.11011011.11111010  
NM = /24 = 255.255.255.0 = 11111111.11111111.11111111.00000000

IP and NM => 11000110.10000101.11011011.**00000000 Network Address**

11000110.10000101.11011011.**11111111 Broadcast Address**

IP = 10.1.113.75 = 00001010.00000001.01110001.01001011  
NM = /19 = 255.255.224.0 = 11111111.11111111.11100000.00000000

IP and NM => 00001010.00000001.011**00000.00000000** Network Address

00001010.00000001.011**11111**.**11111111**  **Broadcast Address**

2. Having the following information, compute subnets with the following constrains:

- A number of 62 subnets

Host IP Address: 172.16.0.0

Original Subnet Mask 255.255.0.0 /16

We can compute 64 subnets = 2^6 => 6 bits

Original NM = 11111111.11111111.00000000.00000000 => borrow 6 bits

=> New NM : 11111111.11111111.**111111**00**.** 00000000 **/22**

-10 bits remaining for the host => we can have 2^10 –2 = 1024 – 2 = 1022 hosts/subnet

SN1:

|  |  |
| --- | --- |
| Network bits Subnet Host  bits bits | Conversion to decimal notation |
| 10101100.00010000.00000000. 00000000 | 172.16.0.0 /22 - Network Address for SN1 |
| 10101100.00010000.00000000. 00000001 | 172.16.0.1 /22 |
| 10101100.00010000.00000000. 00000010 | 172.16.0.2 /22 |
| …………. | …………. |
| 10101100.00010000.00000011. 11111111 | 172.16.3.255 /22 - Broadcast Address for SN1 |

SN2:

|  |  |
| --- | --- |
| Network bits Subnet Host  bits bits | Conversion to decimal notation |
| 10101100.00010000. 0000100.00000000 | 172.16.4.0 /22 - Network Address for SN2 |
| 10101100.00010000.00000100. 00000001 | 172.16.4.1 /22 |
| 10101100.00010000.00000100. 00000010 | 172.16.4.2 /22 |
| ………… | …………. |
| 10101100.00010000.00000111. 11111111 | 172.16.7.255 /22 - Broadcast Address for SN2 |

**The same for SN3 to SN64**

3. Having the following information, compute subnets with the following constrains:

- A maximum number of 29 hosts/subnet

Host IP Address: 192.168.200.0

Original Subnet Mask 255.255.255.0

29 hosts/subnet => 29+2=31 closest is 32 => 2^5 => 5 bits for hosts

-original NM: /24 = 255.255.255.0 or 11111111.11111111.11111111.00000000

-new NM : 11111111.11111111.11111111.**111**00000 = /27 or 255.255.255.224 => 3 bits/subnets

-how many subnets can we compute? 2^3= 8 subnets

SN1:

|  |  |
| --- | --- |
| Network bits Subnet Host  bits bits | Conversion to decimal notation |
| 11000000.10101000.11001000. **000** 00000 | 192.168.200.0 /27 - Network Address for SN1 |
| 11000000.10101000.11001000. **000** 00001 | 192.168.200.1 /27 |
| 11000000.10101000.11001000. **000** 00010 | 192.168.200.2 /27 |
| …………. | …………. |
| 11000000.10101000.11001000. **000** 11111 | 192.168.200.31 /27 - Broadcast Address for SN1 |

SN2:

|  |  |
| --- | --- |
| Network bits Subnet Host  bits bits | Conversion to decimal notation |
| 11000000.10101000.11001000. **001** 00000 | 192.168.200.32 /27 - Network Address for SN2 |
| 11000000.10101000.11001000. **001** 00001 | 192.168.200.33 /27 |
| 11000000.10101000.11001000. **001** 00010 | 192.168.200.34 /27 |
| …………. | …………. |
| 11000000.10101000.11001000. **001** 11111 | 192.168.200.61 /27 - Broadcast Address for SN2 |

**The same for SN3 to SN8**

4. Having the following information, compute subnets with the following constrains:

- A number of 250 subnets

Host IP Address: 10.0.0.0

Original Subnet Mask 255.0.0.0

256 subnets = 2^8 = > 8 bits

NM : 11111111.00000000. 00000000.00000000 /8

New NM : borrow 8 bits from host part => 11111111.**11111111**. 00000000.00000000 /16

Bits remaining for host : 16 => we can have 2^16 –2 = 65536-2=65534 hosts/subnet

SN1:

|  |  |
| --- | --- |
| Network bits Subnet Host  bits bits | Conversion to decimal notation |
| 00001010.00000000.00000000.00000000 | 10.0.0.0 /16 - Network Address for SN1 |
| 00001010.00000000.00000000.00000000 | 10.0.0.1 /16 |
| 00001010.00000000.00000000.00000000 | 10.0.0.2 /16 |
| …………. | …………. |
| 00001010.00000000.00000000.00000000 | 10.0.255.255 /16 - Broadcast Address for SN1 |

SN2:

|  |  |
| --- | --- |
| Network bits Subnet Host  bits bits | Conversion to decimal notation |
| 00001010.00000000.00000000.00000000 | 10.1. 0.0 /16 - Network Address for SN2 |
| 00001010.00000000.00000000.00000000 | 10.1. 0.1 /16 |
| 00001010.00000000.00000000.00000000 | 10.1.0.2 /16 |
| …………. | …………. |
| 00001010.00000000.00000000.00000000 | 10.1. 255.255 /16 - Broadcast Address for SN2 |

**The same for SN3 to SN250**