P 13. Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support up to 60 interfaces, Subnet 2 is to support up to 90 interfaces, and Subnet 3 is to support up to 12 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

Solution:

The parent network address is 223.1.17/24.
24 bits are prefix for the network. 8 bits can be used for subnet portions & host portions.
Start with the largest required subnet (Subnet 2)

- Subnet #2 (90 interfaces)

Subnet portion	Host portion						
128	64	32	16	8	4	2	1

With 7 bits, we can get 128 addresses (126 usable host addresses + 1 subnet address + 1 subnet broadcast address), which is > 90.
1 bit is left for the subnet portion (we can have 2 subnets, each with 128 addresses)
223.1.17.0/25 (range 223.1.17.0 to 223.1.17. 127)
223.1.17.128/25 (range 223.1.17.128 to 223.1.17. 255)
We assign one of those subnets to our Subnet #2 and further subnet the other range for out Subnet #1 & Subnet #3.

Subnet #2→ 223.1.17.128/25 , Mask →255.255.255.128

Subnet ID → 223.1.17.128 , Subnet broadcast address → 223.1.17.255

Hosts → 223.1.17.129 to 223.1.17.254

- Subnet #1 (60 interfaces)
The parent network 223.1.17.0/25 (32-25= 7 bits can be used for subnet portions & and host portions)

Prefix to 0	Subnet portion	Host portion					
128	64	32	16	8	4	2	1

We can have 2 subnets, each with 64 addresses:
223.1.17.0/26 (range 223.1.17.0 to 223.1.17. 63)
223.1.17.64/26 (range 223.1.17.64 to 223.1.17. 127)

Subnet #1→ 223.1.17.0/26 , Mask →255.255.255.0

Subnet ID → 223.1.17.0 , Subnet broadcast address → 223.1.17.63

Hosts → 223.1.17.1 to 223.1.17.62

- Subnet #3 (12 interfaces)

  The parent network is 223.1.17.64/26

Prefix to 0	Prefix to 1	Subnet portion		Host portion			
128	64	32	16	8	4	2	1

  We can have 4 subnets, each with 16 addresses:

  223.1.17.64/28 (range 223.1.17.64 to 223.1.17. 79)

  223.1.17.80/28 (range 223.1.17.80 to 223.1.17. 95)

  223.1.17.96/28 (range 223.1.17.96 to 223.1.17. 111)

  223.1.17.112/28 (range 223.1.17.112 to 223.1.17. 127)

  We assign one of these to our Subnet #3

Subnet #3→ 223.1.17.96/28 , Mask →255.255.255.96

Subnet ID → 223.1.17.96 , Subnet broadcast address → 223.1.17.111

Hosts → 223.1.17.97 to 223.1.17.110