1. Q - You are given a network with the IP address 172.16.0.0/16 . You need to divide this network into 8 equal subnets.
   1. What will be the new subnet mask?
   2. List the first and last IP addresses of the first subnet

**Solution -   
  
Part (a): Determine the New Subnet Mask**

1. **Calculate How Many Bits to Borrow for Subnets**:
   * We need 8 subnets. To determine the number of bits needed to create these subnets, use the formula: 2n≥Number of Subnets2^n \geq \text{Number of Subnets}

2n ≥ Number of Subnets

Solving for n: 2n ≥ 8

n=3

Therefore, we need to borrow **3 additional bits** from the host portion to create 8 subnets.

**New Subnet Mask**: **255.255.224.0**

**Part (b): First and Last IP Addresses of the First Subnet**

1. **Calculate the Number of Addresses per Subnet**:
   * With a /19 subnet mask, we have **32 - 19 = 13** bits for host addresses.
   * The number of addresses per subnet is: 8192 addresses [213 = 8192 ]
   * **Usable IP Addresses**: Out of these 8192 addresses, 2 are reserved (one for the network address and one for the broadcast address), leaving 8190 usable IP addresses per subnet.
2. **Determine the IP Range of the First Subnet**:
   * **Network Address of First Subnet**: Since our starting network is 172.16.0.0/16, the first subnet will also start here with the /19 mask.
   * **Range of the First Subnet**:
     + Starting IP (network address): 172.16.0.0
     + Ending IP (last usable address): 172.16.31.255
     + **Broadcast Address**: 172.16.31.255 (since this is the last IP in this range)
3. **Identify the First and Last Usable IP Addresses**:
   * **First Usable IP**: 172.16.0.1 (the first IP after the network address)
   * **Last Usable IP**: 172.16.31.254 (the IP just before the broadcast address)
4. A device has a MAC address represented in hexadecimal as 00:1A:92: D4:BF:86.

Convert this MAC address to binary format.

00:1A:92: D4:BF:86 (hexadecimal)

00000000 00011010 10010010 11010100 10111111 10000110 (binary)