

## Bài 1

### 1. 169.123.3.8/17

|                      |                 |          |          |          |          |
|----------------------|-----------------|----------|----------|----------|----------|
| IP address           | 169.123.3.8     | 10101001 | 01111011 | 00000011 | 00001000 |
| Subnet Mask          | 255.255.128.0   | 11111111 | 11111111 | 10000000 | 00000000 |
| Network address      | 169.123.0.0     | 10101001 | 01111011 | 00000000 | 00000000 |
| First IP address     | 169.123.0.1     | 10101001 | 01111011 | 00000000 | 00000001 |
| Last IP address      | 169.123.127.254 | 10101001 | 01111011 | 01111111 | 11111110 |
| Broadcast IP address | 169.123.127.255 | 10101001 | 01111011 | 01111111 | 11111111 |

### 2. 192.13.110.23/25

|                      |                 |          |          |          |          |
|----------------------|-----------------|----------|----------|----------|----------|
| IP address           | 192.13.110.23   | 11000000 | 00001101 | 01101110 | 00010111 |
| Subnet Mask          | 255.255.255.128 | 11111111 | 11111111 | 11111111 | 10000000 |
| Network address      | 192.13.110.0    | 11000000 | 00001101 | 01101110 | 00000000 |
| First IP address     | 192.13.110.1    | 11000000 | 00001101 | 01101110 | 00000001 |
| Last IP address      | 192.13.110.126  | 11000000 | 00001101 | 01101110 | 01111110 |
| Broadcast IP address | 192.13.110.127  | 11000000 | 00001101 | 01101110 | 01111111 |

### 3. 10.78.21.3/12

|                      |                |          |          |          |          |
|----------------------|----------------|----------|----------|----------|----------|
| IP address           | 10.78.21.3     | 00001010 | 01001110 | 00010101 | 00000011 |
| Subnet Mask          | 255.240.0.0    | 11111111 | 11110000 | 00000000 | 00000000 |
| Network address      | 10.64.0.0      | 00001010 | 01000000 | 00000000 | 00000000 |
| First IP address     | 10.64.0.1      | 00001010 | 01000000 | 00000000 | 00000001 |
| Last IP address      | 10.127.255.254 | 00001010 | 01111111 | 11111111 | 11111110 |
| Broadcast IP address | 10.127.255.255 | 00001010 | 01111111 | 11111111 | 11111111 |

**Bài 2 Chia mạng chứa địa chỉ IP: 172.169.10.23/18 thành 6 mạng con, mỗi mạng chứa 1000 host**

Để biểu diễn 6 mạng con, ta cần ít nhất 3 bit (vì  $2^3 = 8 > 6$ )

⇒ Số bit còn lại:  $14 - 3 = 11$

⇒ Số host:  $2^{11} - 2 = 2046$

|                        |              |          |          |          |          |
|------------------------|--------------|----------|----------|----------|----------|
| <b>IP address</b>      | 10.24.222.21 | 00001010 | 00011000 | 11011110 | 00010101 |
| <b>Subnet Mask</b>     | 255.192.0.0  | 11111111 | 11000000 | 00000000 | 00000000 |
| <b>Network address</b> | 10.0.0.0     | 00001010 | 00000000 | 00000000 | 00000000 |
|                        |              |          |          |          |          |
| <b>Subnet Mask new</b> | 255.252.0.0  | 11111111 | 11111100 | 00000000 | 00000000 |

|                       |                    |                 |                 |                 |                 |
|-----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 1</b>      | <b>172.169.0.0</b> | <b>10101100</b> | <b>10101001</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 1</b>     | 172.169.0.1        | 10101100        | 10101001        | 00000000        | 00000001        |
| <b>Last IP 1</b>      | 172.169.7.254      | 10101100        | 10101001        | 00000111        | 11111110        |
| <b>Broadcast IP 1</b> | 172.169.7.255      | 10101100        | 10101001        | 00000111        | 11111111        |

|                       |                    |                 |                 |                 |                 |
|-----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 2</b>      | <b>172.169.8.0</b> | <b>10101100</b> | <b>10101001</b> | <b>00001000</b> | <b>00000000</b> |
| <b>First IP 2</b>     | 172.169.8.1        | 10101100        | 10101001        | 00001000        | 00000001        |
| <b>Last IP 2</b>      | 172.169.15.254     | 10101100        | 10101001        | 00001111        | 11111110        |
| <b>Broadcast IP 2</b> | 172.169.15.255     | 10101100        | 10101001        | 00001111        | 11111111        |

|                       |                     |                 |                 |                 |                 |
|-----------------------|---------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 3</b>      | <b>172.169.16.0</b> | <b>10101100</b> | <b>10101001</b> | <b>00010000</b> | <b>00000000</b> |
| <b>First IP 3</b>     | 172.169.16.1        | 10101100        | 10101001        | 00010000        | 00000001        |
| <b>Last IP 3</b>      | 172.169.23.254      | 10101100        | 10101001        | 00010111        | 11111110        |
| <b>Broadcast IP 3</b> | 172.169.23.255      | 10101100        | 10101001        | 00010111        | 11111111        |

|                       |                     |                 |                 |                 |                 |
|-----------------------|---------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 4</b>      | <b>172.169.24.0</b> | <b>10101100</b> | <b>10101001</b> | <b>00011000</b> | <b>00000000</b> |
| <b>First IP 4</b>     | 172.169.24.1        | 10101100        | 10101001        | 00011000        | 00000001        |
| <b>Last IP 4</b>      | 172.169.31.254      | 10101100        | 10101001        | 00011111        | 11111110        |
| <b>Broadcast IP 4</b> | 172.169.31.255      | 10101100        | 10101001        | 00011111        | 11111111        |

|                       |                     |                 |                 |                 |                 |
|-----------------------|---------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 5</b>      | <b>172.169.32.0</b> | <b>10101100</b> | <b>10101001</b> | <b>00100000</b> | <b>00000000</b> |
| <b>First IP 5</b>     | 172.169.32.1        | 10101100        | 10101001        | 00100000        | 00000001        |
| <b>Last IP 5</b>      | 172.169.39.254      | 10101100        | 10101001        | 00100111        | 11111110        |
| <b>Broadcast IP 5</b> | 172.169.39.255      | 10101100        | 10101001        | 00100111        | 11111111        |

|                   |                     |                 |                 |                 |                 |
|-------------------|---------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 6</b>  | <b>172.169.40.0</b> | <b>10101100</b> | <b>10101001</b> | <b>00101000</b> | <b>00000000</b> |
| <b>First IP 6</b> | 172.169.40.1        | 10101100        | 10101001        | 00101000        | 00000001        |

|                       |                |          |          |          |          |
|-----------------------|----------------|----------|----------|----------|----------|
| <b>Last IP 6</b>      | 172.169.47.254 | 10101100 | 10101001 | 00101111 | 11111110 |
| <b>Broadcast IP 6</b> | 172.169.47.255 | 10101100 | 10101001 | 00101111 | 11111111 |

### Bài 3: Chia mạng chứa địa chỉ IP: 10.24.222.21/10 thành 11 mạng con, mỗi mạng chứa 10K host

Để biểu diễn 11 mạng con, ta cần ít nhất 4 bit (vì  $2^4 = 16 > 11$ )

⇒ Số bit còn lại:  $22 - 4 = 18$

⇒ Số host:  $2^{18} - 2 = 262142$

|                        |              |          |          |          |          |
|------------------------|--------------|----------|----------|----------|----------|
| <b>IP address</b>      | 10.24.222.21 | 00001010 | 00011000 | 11011110 | 00010101 |
| <b>Subnet Mask</b>     | 255.192.0.0  | 11111111 | 11000000 | 00000000 | 00000000 |
| <b>Network address</b> | 10.0.0.0     | 00001010 | 00000000 | 00000000 | 00000000 |
| <b>Subnet Mask new</b> | 255.252.0.0  | 11111111 | 11111100 | 00000000 | 00000000 |

|                       |                 |                 |                 |                 |                 |
|-----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 1</b>      | <b>10.0.0.0</b> | <b>00001010</b> | <b>00000000</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 1</b>     | 10.0.0.1        | 00001010        | 00000000        | 00000000        | 00000001        |
| <b>Last IP 1</b>      | 10.3.255.254    | 00001010        | 00000011        | 11111111        | 11111110        |
| <b>Broadcast IP 1</b> | 10.3.255.255    | 00001010        | 00000011        | 11111111        | 11111111        |

|                       |                 |                 |                 |                 |                 |
|-----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 2</b>      | <b>10.4.0.0</b> | <b>00001010</b> | <b>00000100</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 2</b>     | 10.4.0.1        | 00001010        | 00000100        | 00000000        | 00000001        |
| <b>Last IP 2</b>      | 10.7.255.254    | 00001010        | 00000111        | 11111111        | 11111110        |
| <b>Broadcast IP 2</b> | 10.7.255.254    | 00001010        | 00000111        | 11111111        | 11111111        |

|                       |                 |                 |                 |                 |                 |
|-----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 3</b>      | <b>10.8.0.0</b> | <b>00001010</b> | <b>00001000</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 3</b>     | 10.8.0.1        | 00001010        | 00001000        | 00000000        | 00000001        |
| <b>Last IP 3</b>      | 10.11.255.254   | 00001010        | 00001011        | 11111111        | 11111110        |
| <b>Broadcast IP 3</b> | 10.11.255.255   | 00001010        | 00001011        | 11111111        | 11111111        |

|                       |                  |                 |                 |                 |                 |
|-----------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 4</b>      | <b>10.12.0.0</b> | <b>00001010</b> | <b>00001100</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 4</b>     | 10.12.0.1        | 00001010        | 00001100        | 00000000        | 00000001        |
| <b>Last IP 4</b>      | 10.15.255.254    | 00001010        | 00001111        | 11111111        | 11111110        |
| <b>Broadcast IP 4</b> | 10.15.255.254    | 00001010        | 00001111        | 11111111        | 11111111        |

|                       |                  |                 |                 |                 |                 |
|-----------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 5</b>      | <b>10.16.0.0</b> | <b>00001010</b> | <b>00010000</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 5</b>     | 10.16.0.1        | 00001010        | 00010000        | 00000000        | 00000001        |
| <b>Last IP 5</b>      | 10.19.255.254    | 00001010        | 00010011        | 11111111        | 11111110        |
| <b>Broadcast IP 5</b> | 10.19.255.255    | 00001010        | 00010011        | 11111111        | 11111111        |

|                       |                  |                 |                 |                 |                 |
|-----------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 6</b>      | <b>10.20.0.0</b> | <b>00001010</b> | <b>00010100</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 6</b>     | 10.20.0.1        | 00001010        | 00010100        | 00000000        | 00000001        |
| <b>Last IP 6</b>      | 10.23.255.254    | 00001010        | 00010111        | 11111111        | 11111110        |
| <b>Broadcast IP 6</b> | 10.23.255.255    | 00001010        | 00010111        | 11111111        | 11111111        |

|                       |                  |                 |                 |                 |                 |
|-----------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 7</b>      | <b>10.24.0.0</b> | <b>00001010</b> | <b>00011000</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 7</b>     | 10.24.0.1        | 00001010        | 00011000        | 00000000        | 00000001        |
| <b>Last IP 7</b>      | 10.27.255.254    | 00001010        | 00011011        | 11111111        | 11111110        |
| <b>Broadcast IP 7</b> | 10.27.255.255    | 00001010        | 00011011        | 11111111        | 11111111        |

|                       |                  |                 |                 |                 |                 |
|-----------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 8</b>      | <b>10.28.0.0</b> | <b>00001010</b> | <b>00011100</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 8</b>     | 10.28.0.1        | 00001010        | 00011100        | 00000000        | 00000001        |
| <b>Last IP 8</b>      | 10.31.255.254    | 00001010        | 00011111        | 11111111        | 11111110        |
| <b>Broadcast IP 8</b> | 10.31.255.255    | 00001010        | 00011111        | 11111111        | 11111111        |

|                       |                  |                 |                 |                 |                 |
|-----------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 9</b>      | <b>10.32.0.0</b> | <b>00001010</b> | <b>00100000</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 9</b>     | 10.32.0.1        | 00001010        | 00100000        | 00000000        | 00000001        |
| <b>Last IP 9</b>      | 10.35.255.254    | 00001010        | 00100011        | 11111111        | 11111110        |
| <b>Broadcast IP 9</b> | 10.35.255.255    | 00001010        | 00100011        | 11111111        | 11111111        |

|                        |                  |                 |                 |                 |                 |
|------------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 10</b>      | <b>10.34.0.0</b> | <b>00001010</b> | <b>00100100</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 10</b>     | 10.34.0.1        | 00001010        | 00100100        | 00000000        | 00000001        |
| <b>Last IP 10</b>      | 10.37.255.254    | 00001010        | 00100111        | 11111111        | 11111110        |
| <b>Broadcast IP 10</b> | 10.37.255.255    | 00001010        | 00100111        | 11111111        | 11111111        |

|                        |                  |                 |                 |                 |                 |
|------------------------|------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 11</b>      | <b>10.38.0.0</b> | <b>00001010</b> | <b>00101000</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 11</b>     | 10.38.0.1        | 00001010        | 00101000        | 00000000        | 00000001        |
| <b>Last IP 11</b>      | 10.41.255.254    | 00001010        | 00101011        | 11111111        | 11111110        |
| <b>Broadcast IP 11</b> | 10.41.255.255    | 00001010        | 00101011        | 11111111        | 11111111        |

**Bài 4: Chia mạng chứa địa chỉ IP: 192.168.22.31/19 thành 10 mạng con, mỗi mạng con chứa 500 host**

Để biểu diễn 10 mạng con, ta cần ít nhất 4 bit (vì  $2^4 = 16 > 10$ )

⇒ Số bit còn lại:  $13 - 4 = 9$

⇒ Số host:  $2^9 - 2 = 510$

|                        |               |          |          |          |          |
|------------------------|---------------|----------|----------|----------|----------|
| <b>IP address</b>      | 192.168.22.31 | 11000000 | 10101000 | 00010110 | 00011111 |
| <b>Subnet Mask</b>     | 255.192.0.0   | 11111111 | 11111111 | 11100000 | 00000000 |
| <b>Network address</b> | 192.168.0.0   | 11000000 | 10101000 | 00000000 | 00000000 |
|                        |               |          |          |          |          |
| <b>Subnet Mask new</b> | 255.254.0.0   | 11111111 | 11111111 | 11111110 | 00000000 |

|                       |                    |                 |                 |                 |                 |
|-----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 1</b>      | <b>192.168.0.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00000000</b> | <b>00000000</b> |
| <b>First IP 1</b>     | 192.168.0.1        | 11000000        | 10101000        | 00000000        | 00000001        |
| <b>Last IP 1</b>      | 192.168.1.254      | 11000000        | 10101000        | 00000001        | 11111110        |
| <b>Broadcast IP 1</b> | 192.168.1.255      | 11000000        | 10101000        | 00000001        | 11111111        |

|                       |                    |                 |                 |                 |                 |
|-----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 2</b>      | <b>192.168.2.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00000010</b> | <b>00000000</b> |
| <b>First IP 2</b>     | 192.168.2.1        | 11000000        | 10101000        | 00000010        | 00000001        |
| <b>Last IP 2</b>      | 192.168.3.254      | 11000000        | 10101000        | 00000011        | 11111110        |
| <b>Broadcast IP 2</b> | 192.168.3.255      | 11000000        | 10101000        | 00000011        | 11111111        |

|                       |                    |                 |                 |                 |                 |
|-----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 3</b>      | <b>192.168.4.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00000100</b> | <b>00000000</b> |
| <b>First IP 3</b>     | 192.168.4.1        | 11000000        | 10101000        | 00000100        | 00000001        |
| <b>Last IP 3</b>      | 192.168.5.254      | 11000000        | 10101000        | 00000101        | 11111110        |
| <b>Broadcast IP 3</b> | 192.168.5.255      | 11000000        | 10101000        | 00000101        | 11111111        |

|                       |                    |                 |                 |                 |                 |
|-----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 4</b>      | <b>192.168.6.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00000110</b> | <b>00000000</b> |
| <b>First IP 4</b>     | 192.168.6.1        | 11000000        | 10101000        | 00000110        | 00000001        |
| <b>Last IP 4</b>      | 192.168.7.254      | 11000000        | 10101000        | 00000111        | 11111110        |
| <b>Broadcast IP 4</b> | 192.168.7.255      | 11000000        | 10101000        | 00000111        | 11111111        |

|                       |                    |                 |                 |                 |                 |
|-----------------------|--------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 5</b>      | <b>192.168.8.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00001000</b> | <b>00000000</b> |
| <b>First IP 5</b>     | 192.168.8.1        | 11000000        | 10101000        | 00001000        | 00000001        |
| <b>Last IP 5</b>      | 192.168.9.254      | 11000000        | 10101000        | 00001001        | 11111110        |
| <b>Broadcast IP 5</b> | 192.168.9.255      | 11000000        | 10101000        | 00001001        | 11111111        |

|                   |                     |                 |                 |                 |                 |
|-------------------|---------------------|-----------------|-----------------|-----------------|-----------------|
| <b>Net Add 6</b>  | <b>192.168.10.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00001010</b> | <b>00000000</b> |
| <b>First IP 6</b> | 192.168.10.1        | 11000000        | 10101000        | 00001010        | 00000001        |

|                       |                |          |          |          |          |  |
|-----------------------|----------------|----------|----------|----------|----------|--|
| <b>Last IP 6</b>      | 192.168.11.254 | 11000000 | 10101000 | 00001011 | 11111110 |  |
| <b>Broadcast IP 6</b> | 192.168.11.255 | 11000000 | 10101000 | 00001011 | 11111111 |  |

|                       |                     |                 |                 |                 |                 |  |
|-----------------------|---------------------|-----------------|-----------------|-----------------|-----------------|--|
| <b>Net Add 7</b>      | <b>192.168.12.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00001100</b> | <b>00000000</b> |  |
| <b>First IP 7</b>     | 192.168.12.1        | 11000000        | 10101000        | 00001100        | 00000001        |  |
| <b>Last IP 7</b>      | 192.168.13.254      | 11000000        | 10101000        | 00001101        | 11111110        |  |
| <b>Broadcast IP 7</b> | 192.168.13.255      | 11000000        | 10101000        | 00001101        | 11111111        |  |

|                       |                     |                 |                 |                 |                 |  |
|-----------------------|---------------------|-----------------|-----------------|-----------------|-----------------|--|
| <b>Net Add 8</b>      | <b>192.168.14.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00001110</b> | <b>00000000</b> |  |
| <b>First IP 8</b>     | 192.168.14.1        | 11000000        | 10101000        | 00001110        | 00000001        |  |
| <b>Last IP 8</b>      | 192.168.15.254      | 11000000        | 10101000        | 00001111        | 11111110        |  |
| <b>Broadcast IP 8</b> | 192.168.15.255      | 11000000        | 10101000        | 00001111        | 11111111        |  |

|                       |                     |                 |                 |                 |                 |  |
|-----------------------|---------------------|-----------------|-----------------|-----------------|-----------------|--|
| <b>Net Add 9</b>      | <b>192.168.16.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00010000</b> | <b>00000000</b> |  |
| <b>First IP 9</b>     | 192.168.16.1        | 11000000        | 10101000        | 00010000        | 00000001        |  |
| <b>Last IP 9</b>      | 192.168.17.254      | 11000000        | 10101000        | 00010001        | 11111110        |  |
| <b>Broadcast IP 9</b> | 192.168.17.255      | 11000000        | 10101000        | 00010001        | 11111111        |  |

|                        |                     |                 |                 |                 |                 |  |
|------------------------|---------------------|-----------------|-----------------|-----------------|-----------------|--|
| <b>Net Add 10</b>      | <b>192.168.18.0</b> | <b>11000000</b> | <b>10101000</b> | <b>00010010</b> | <b>00000000</b> |  |
| <b>First IP 10</b>     | 192.168.18.1        | 11000000        | 10101000        | 00010010        | 00000001        |  |
| <b>Last IP 10</b>      | 192.168.19.254      | 11000000        | 10101000        | 00010011        | 11111110        |  |
| <b>Broadcast IP 10</b> | 192.168.19.255      | 11000000        | 10101000        | 00010011        | 11111111        |  |