**ITT-116 Subnetting Worksheet**

Use the following tables as references for the remainder of the document.

|  |
| --- |
| **IP Address Classes** |
| Class A | 1-127 | N H H H | 11.23.15.6 |
| Class B | 128-191 | N N H H | 173.11.14.21 |
| Class C | 192-223 | N N N H | 193.15.13.22 |
| Class D | 224-230 | Reserved for multicast. |
| Class E | 240-255 | Reserved for experimental, used for research. |

|  |
| --- |
| **Private Addresses** |
| Class A | 10.0.0.0 – 10.255.255.255 |
| Class B | 172.16.0.0 – 172.31.255.255 |
| Class C | 192.168.0.0 – 192.168.255.255 |
| APIPA | 169.254.0.1 – 169.254.255.254 |

Scoring Guide: Be sure to complete all sections as directed by your instructor.

|  |  |
| --- | --- |
| **Section** | **Points Possible** |
| Number System Conversion | 5 |
| Address Identification and Notation  | 10 |
| Custom Subnet Addressing and Masking | 15 |
| IPV6 Conversion and Notation | 5 |
| **Total Possible** | **35** |

**Number System Conversions (5 Points)**

**Binary to Decimal Conversion**

*Example:*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** | **Answers** |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 91 |

**Add corresponding binary values annotated by 0s and 1s across to get decimal value on the right:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** | **Answers** |
| 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |  |
| 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |  |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |  |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |  |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |  |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |  |
| 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 |  |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |  |
| 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |  |

**Decimal to Binary Conversion**

*Example:*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** | **Dec Value** |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 196 |

**Fill in 0s and 1s across to match corresponding decimal values on the right:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **128** | **64** | **32** | **16** | **8** | **4** | **2** | **1** | **Dec Value** |
|  |  |  |  |  |  |  |  | 200 |
|  |  |  |  |  |  |  |  | 255 |
|  |  |  |  |  |  |  |  | 107 |
|  |  |  |  |  |  |  |  | 224 |
|  |  |  |  |  |  |  |  | 192 |
|  |  |  |  |  |  |  |  | 98 |
|  |  |  |  |  |  |  |  | 242 |
|  |  |  |  |  |  |  |  | 224 |
|  |  |  |  |  |  |  |  | 172 |
|  |  |  |  |  |  |  |  | 100 |

**Address Identification and Notation (10 points)**

**Identify the class of IP Address: A, B, or C:**

|  |  |
| --- | --- |
| **Address** | **Class** |
| 148.17.9.1 |  |
| 220.200.23.1 |  |
| 177.100.15.4 |  |
| 218.241.80.78 |  |
| 198.155.72.56 |  |
| 10.0.0.1 |  |
| 192.168.123.42 |  |
| 123.231.132.9 |  |
| 42.42.42.42 |  |
| 221.81.64.3 |  |

**Network Identification**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Highlight the Network Portion:**

|  |  |  |  |
| --- | --- | --- | --- |
| 117. | 89. | 56. | 90 |
| 33. | 0. | 0. | 2 |
| 10. | 252 | 1. | 1 |
| 150. | 15. | 16. | 3 |
| 192. | 168. | 123. | 1 |
| 199. | 155. | 66. | 56 |
| 219. | 200. | 23. | 1 |
| 158. | 200. | 45. | 62 |
| 218. | 155. | 230. | 41 |
| 100. | 25. | 1. | 1 |

 | **Highlight the Host Portion:**

|  |  |  |  |
| --- | --- | --- | --- |
| 117. | 89. | 56. | 90 |
| 33. | 0. | 0. | 2 |
| 10. | 252 | 1. | 1 |
| 150. | 15. | 16. | 3 |
| 192. | 168. | 123. | 1 |
| 199. | 155. | 66. | 56 |
| 220. | 200. | 23. | 1 |
| 158. | 200. | 45. | 62 |
| 218. | 155. | 230. | 41 |
| 100. | 25. | 1. | 1 |

 |

**Network Addressing**

Write the network addresses for the provided IP address/subnet mask. The first two have been provided as examples.

|  |  |
| --- | --- |
| **Address/Mask** | **Answer** |
| 10.10.48.80255.255.255.0

|  |  |  |  |
| --- | --- | --- | --- |
| 10 | 10 | 48 | 80 |
| 255 | 255 | 255 | 0 |
| N | N | N | H |

 | *Network address of any IP Address will have 0 for the host digit*N N N H = 10.10.48.0 |
| 186.31.32.110255.255.0.0

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
| N | N | H | H |

 | 186.31.0.0 |
| 178.10.48.80255.255.0.0 |  |
| 10.10.10.10255.0.0.0 |  |
| 175.125.200.151255.255.0.0 |  |
| 199.203.32.91255.255.255.0 |  |
| 188.21.32.110255.255.0.0 |  |
| 192.168.24.19255.255.0.0 |  |
| 15.30.20.20255.255.255.0 |  |
| 27.0.2.1255.0.0.0 |  |
| 164.42.3.4255.255.255.0 |  |
| 25.25.142.8255.0.0.0 |  |

**Host Addresses**

Using the IP address and subnet mask shown, write the host address. The first two have been provided as examples.

|  |  |  |
| --- | --- | --- |
| **Address** | **Mask** | **Answer** |
| 10.10.48.80 | 255.255.255.0 | 80 |
| 10.10.10.10 | 255.0.0.0 | 10.10.10 |
| 10.10.48.67 | 255.255.255.0 |  |
| 10.10.11.12 | 255.0.0.0 |  |
| 27.125.200.151 | 255.0.0.0 |  |
| 199.203.32.91 | 255.255.255.0 |  |
| 186.31.32.110 | 255.255.0.0 |  |

**Default Subnet Mask and CIDR Notation**

Write the correct default subnet mask for each in CIDR notation (Slash Notation). The first two rows have been provided as examples.

|  |  |  |  |
| --- | --- | --- | --- |
| **Address**  | **Mask** | **Mask Bits** | **Answer (CIDR)**  |
| 10.10.48.80 | 255.255.255.0 | 11111111.11111111.11111111.00000000 | /24 (24 bits on/1) |
| 10.10.10.10 | 255.0.0.0 | 11111111.00000000.00000000.00000000 | /8 (8 bits on/1) |
| 10.10.48.80 | 255.255.255.0 |  |  |
| 10.10.10.10 | 255.255.0.0 |  |  |
| 27.125.200.151 | 255.0.0.0 |  |  |
| 199.203.32.91 | 255.255.255.0 |  |  |
| 186.31.32.110 | 255.255.0.0 |  |  |
| 192.168.24.19 | 255.255.0.0 |  |  |
| 15.30.20.20 | 255.255.255.0 |  |  |

**Custom Subnet Addressing and Masks (15 points)**

Before attempting this portion, be sure to download the Solarwinds' Advanced Subnet Calculator from the Topic Resources.

*Example:*

|  |  |
| --- | --- |
| Network Address | 192.10.10.0 |
| Required Networks | 14 |
| Required Hosts | 14 |
| **Example** | **Answer** |
| What Custom Subnet Mask to use? | 255.255.255.240 |
| Total Number of Subnets | 16 |
| Total Number of Hosts per subnet | 14 |
| Total Number of Usable Addresses | 14x16 = 224 |
| Subnet number for the 2nd Subnet? | 192.10.10.16 |
| Host Range for the 2nd Subnet? | 192.10.10.17 Thru 192.10.10.30 |
| Broadcast address for the 2nd Subnet? | 192.10.10.31 |
| CIDR Notation for the 2nd Subnet? | 192.16.10.16/28 |

**Use the Advanced Subnet calculator to fill in the blanks:**

|  |  |
| --- | --- |
| Network Address | 156.100.0.0 |
| Required Networks | 1000 |
| Required Hosts | 60 |
|  | **Answer** |
| What Custom Subnet Mask to use? |  |
| Total Number of Subnets |  |
| Total Number of Hosts per subnet |  |
| Total Number of Usable Addresses |  |
| Subnet number for the 10th Subnet? |  |
| Host Range for the 10th Subnet? |  |
| Broadcast address for the 10th Subnet? |  |
| CIDR Notation for the 10th subnet? |  |

|  |  |
| --- | --- |
| Network Address | 182.86.7.0 |
| Required Networks | 6 |
| Required Hosts | 28 |
|  | **Answer** |
| What Custom Subnet Mask to use? |  |
| Total Number of Subnets |  |
| Total Number of Hosts per subnet |  |
| Total Number of Usable Addresses |  |
| Subnet number for the 5th Subnet? |  |
| Host Range for the 5th Subnet? |  |
| Broadcast address for the 5th Subnet? |  |
| CIDR Notation for the 5th subnet? |  |

|  |  |
| --- | --- |
| Network Address | 187.112.0.0 |
| Required Networks | 2000 |
| Required Hosts | 15 |
|  | **Answer** |
| What Custom Subnet Mask to use? |  |
| Total Number of Subnets |  |
| Total Number of Hosts per subnet |  |
| Total Number of Usable Addresses |  |
| Subnet number for the 12th Subnet? |  |
| Host Range for the 12th Subnet? |  |
| Broadcast address for the 12th Subnet? |  |
| CIDR Notation for the 12th Subnet? |  |

**Create the subnetting table for two of organizational units required for your corporate network:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Network Address | 217.18.21.0 |  | Network Address | 199.112.6.0 |
| Required Networks | 30 |  | Required Networks | 4 |
| Required Hosts | 100 |  | Required Hosts | 62 |
|  | **Answer** |  |  | **Answer** |
| What Custom Subnet Mask to use? |  |  | What Custom Subnet Mask to use? |  |
| Total Number of Subnets |  |  | Total Number of Subnets |  |
| Total Number of Hosts per subnet |  |  | Total Number of Hosts per subnet |  |
| Total Number of Usable Addresses |  |  | Total Number of Usable Addresses |  |
| Subnet number for the 12th Subnet? |  |  | Subnet number for the 12th Subnet? |  |
| Host Range for the 12th Subnet? |  |  | Host Range for the 12th Subnet? |  |
| Broadcast address for the 12th Subnet? |  |  | Broadcast address for the 12th Subnet? |  |
| CIDR Notation? |  |  | CIDR Notation?  |  |

**IPV6 Address Conversion (5 points)**

Open and refer to the "UltraTools: Convert IPv4 to IPv6" in the Topic Resources.

The first rows for each table have been provided as examples.

**Convert IPV4, combine with Prefix:**

|  |  |  |
| --- | --- | --- |
| **Original** | **Network Prefix** | **Converted Host Address** |
| 192.168.10.10/24 | 2001:0F10:0200:F500 | 2001:0F10:0200:F500: 0:FFFF:C0A8:0A0A |
| 172.28.175.3/18 | 2E00:0001:0010:F006 |  |
| 10.10.10.10/8 | 2000:0100:0F0A:FF01 |  |
| 8.8.8.8 | 2100:1000:0E10:F500 |  |
| Gateway in your first subnet | 2101:1001:0F01:F501 |  |

**Convert IPV4, Combine with Prefix, Apply ‘Zero’ rules where applicable:**

|  |  |  |
| --- | --- | --- |
| **Original** | **Network Prefix** | **Converted Host Address** |
| 192.168.14.10/24 | 2001:0000:0000:F500 | 2001::F500:0:FFFF:C0A8:E0A |
| 172.28.182.3/18 | 2E00:0001:0010:F006 |  |
| 10.10.10.10/8 | 2000:0000:0000:0000 |  |
| Gateway in your 2nd subnet | 2100:1000:0000:F500 |  |

**Convert IPV4, Combine Prefix, Apply Subnet, Rewrite new address:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Original IPv4** | **Network Prefix****(48 bits)** | **Subnet ID****(16)** | **Combined Prefix/Subnet** | **Converted**  |
| Your Address | 2001:FEFE:8001 | 1 | 2001:FEFE:8001:0001 | 2001:FEFE:8001:1:0:FFFF:C0A8:C80A2001:FEFE:8001:1::FFFF:C0A8:C80A |
| Your 12th Custom Subnet | 3000:1235:F100 | 12 |  |  |
| 156.100.10.0 | 2F0A:4444:0100 | 100 |  |  |
| 187.112.0.1 | You decide | 1000 |  |  |

**Company Custom Subnet Address Plan**

Use this template extensively to create your addressing plan and Cisco Packet Tracer configurations.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Hostname** | **Department** | **VLAN** | **Subnet Address****(Subnet ID)** | **Mask (Decimal)** | **Mask****(CIDR)** | **Gateway/****Router** | **Usable Address****Start** | **Usable****Address****End** | **DHCP****Max** | **R: Router Interface****-Connects to-****S: Switch Interface** |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |