**IS HUB Summer Bootcamp Networking Track**

# Assignment 003 – IP Addressing & Subnetting Concepts

## Part A – IP Addressing Basics

1. 1. What is an IP address and why is it important in a network?

An IP address (Internet Protocol address) is a unique identifier assigned to each device connected to a network. It enables devices to locate and communicate with each other over the Internet or local networks.

1. 2. Differentiate between IPv4 and IPv6:

- Address length: IPv4 uses 32-bit addresses, while IPv6 uses 128-bit addresses.  
- Notation format: IPv4 uses dotted decimal notation (e.g., 192.168.0.1), while IPv6 uses hexadecimal colon-separated notation (e.g., 2001:0db8:85a3::8a2e:0370:7334).  
- Number of available addresses: IPv4 supports about 4.3 billion addresses; IPv6 supports approximately 3.4×10^38 addresses.

1. 3. Write the binary equivalent of the IPv4 address 192.168.10.1.

Binary: 11000000.10101000.00001010.00000001

1. 4. Convert the following binary IP address to decimal:  
    11000000.10101000.00000001.00000010

Decimal: 192.168.1.2

1. 5. What are the ranges of Class A, B, and C IPv4 addresses?

Class A: 1.0.0.0 to 126.255.255.255  
Class B: 128.0.0.0 to 191.255.255.255  
Class C: 192.0.0.0 to 223.255.255.255

1. 6. Which IP class does the address 172.16.5.4 belong to?

It belongs to Class B.

1. 7. What is the difference between public IP and private IP? List private IP ranges.

Public IP addresses are routable on the Internet, while private IPs are used within internal networks and not routable on the Internet.  
Private IP ranges:  
- 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

1. 8. What is the role of loopback address in IP networking?

Loopback address (e.g., 127.0.0.1 in IPv4) is used to test the network stack of the local device. It allows a system to communicate with itself.

1. 9. Explain the use of static IP vs dynamic IP with examples.

Static IP is manually assigned and does not change (e.g., for servers), while dynamic IP is assigned by a DHCP server and may change (e.g., for home users' devices).

10. What is the default subnet mask for:  
 - Class A →  
 - Class B →  
 - Class C →

Class A → 255.0.0.0  
Class B → 255.255.0.0  
Class C → 255.255.255.0

## Part B – Subnetting Concepts & Calculations

11. What is subnetting and why is it used?

Subnetting is the process of dividing a network into smaller, more manageable sub-networks (subnets). It improves network performance and security by reducing broadcast traffic and isolating segments.

12. Given the IP address 192.168.1.0/24, how many total IP addresses are available?

Total IPs = 2^(32-24) = 256

13. From question 12, how many usable host IPs are there?

Usable IPs = 256 - 2 = 254 (excluding network and broadcast addresses)

14. How many subnets can be created from a /24 network if you borrow 2 bits?

Number of subnets = 2^2 = 4

15. What will be the new subnet mask if you borrow 3 bits from a /24 network?

New subnet mask = /27 = 255.255.255.224

16. Given IP: 192.168.10.0/26  
 - How many hosts per subnet?

Hosts per subnet = 2^(32-26) - 2 = 64 - 2 = 62   
 - How many subnets can be created?

Subnets = 2^(26-24) = 4

17. Calculate the first and last usable IP address in the subnet 192.168.10.64/26.

Network Address: 192.168.10.64  
Usable Range: 192.168.10.65 – 192.168.10.126  
Broadcast Address: 192.168.10.127

18. Identify the network address and broadcast address of 10.0.0.0/22.

Network Address: 10.0.0.0  
Broadcast Address: 10.0.3.255

19. Fill in the blanks:  
 - CIDR /30 gives \_\_\_\_\_\_ usable IP addresses.

/30: 2 usable IP addresses  
 - CIDR /28 supports \_\_\_\_\_\_ hosts per subnet.

/28: 14 hosts per subnet

20. You are given the address block 172.16.0.0/20.  
 - How many subnets can be created if you want each subnet to support at most 510 hosts?  
 - What will be the subnet mask?

- Required hosts: 510 → Needs 9 host bits (2^9 = 512)  
- New subnet mask: /23  
- Subnets = 2^(23-20) = 8  
Subnet mask = 255.255.254.0