Green University of Bangladesh

Department of Computer Science and Engineering (CSE)
Faculty of Sciences and Engineering
Semester: (Spring,Year:2025),B.Sc.in CSE (Day)

LAB REPORT NO - 03
Course Title: Data Communication Lab
Course Code: CSE307   Section: 223-D1

Lab Experiment Name : Write a java program that prompts the user to enter an IP address belonging to a specific class (A, B, or C) and then offers options to convert it into binary or vice versa

Student Details

	Name	ID
1.	MD.SHAJALAL	223002088

Lab Date	:	06 – 03 - 2025
Submission Date	:	10 – 04 - 2024
Course Teacher's Name	:	Md.Samin Hossain Utsho

1.Experiment Name:

Write a java program that prompts the user to enter an IP address belonging to a specific class (A, B, or C) and then offers options to convert it into binary or vice versa

2.Objective:

To develop a Java program that:

- Accepts an IP address as input and identifies its class (A, B, or C).
- Provides options to:
  - Convert a decimal IP address to its binary equivalent.
  - Convert a binary-form IP address to its decimal equivalent.

3. Introduction:

An **IP (Internet Protocol) address** is a 32-bit unique identifier assigned to devices on a network. It is conventionally expressed in dotted decimal notation (e.g., 192.168.1.1). IP addresses are divided into classes (A, B, C, D, E), primarily used for network classification and addressing.

In networking, conversion between **binary and decimal** forms of IP addresses is essential for low-level configuration, subnetting, and routing. This lab aims to simulate the recognition and conversion process via a Java-based CLI program.

4. Theoretical Background:

4.1 IP Address Structure

- **Format**: Four octets (8 bits each) separated by dots (e.g., 192.168.1.1)
- **Range**: 0.0.0.0 to 255.255.255.255

4.2 IP Address Classes (Relevant to this lab)

Class	First Octet Range	Default Subnet Mask	Use Case
A	1 – 126	255.0.0.0	Large Networks
B	128 – 191	255.255.0.0	Medium Networks
C	192 – 223	255.255.255.0	Small Networks

4.3 Binary Conversion

Each octet is represented as an 8-bit binary number.
Example:
192 → 11000000
168 → 10101000
Full IP: 192.168.0.1 → 11000000.10101000.00000000.00000001

5.Tools and Technologies Used:

☐ Programming Language: Java

☐ IDE: Any Java-supported IDE (e.g., IntelliJ, Eclipse, NetBeans)

☐ JDK Version: 8 or higher

☐ Operating System: Windows/Linux/MacOS

6. Java Program Code:

```java
import java.util.Scanner;

public class  lab {

    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        System.out.println("=== IP Address Utility ===");
        System.out.print("Enter a valid IP address (decimal form): ");
        String ipAddress = scanner.nextLine();

        if (!isValidIP(ipAddress)) {
            System.out.println("Invalid IP format!");
            return;
        }

        String ipClass = getIPClass(ipAddress);
        if (ipClass == null) {
            System.out.println("IP does not belong to Class A, B, or C.");
            return;
        }

        System.out.println("Detected IP Class: " + ipClass);

        System.out.println("Select an option:");
        System.out.println("1. Convert IP to Binary");
        System.out.println("2. Convert Binary to Decimal IP");

        int choice = scanner.nextInt();
        scanner.nextLine(); // consume newline

        switch (choice) {
            case 1:
                System.out.println("Binary Format: " +
decimalToBinary(ipAddress));
                break;
            case 2:
                System.out.print("Enter Binary IP (e.g.
11000000.10101000.00000001.00000001): ");
                String binaryInput = scanner.nextLine();
                if (isValidBinaryIP(binaryInput)) {
```

```java
                System.out.println("Decimal Format: " +
binaryToDecimal(binaryInput));
                } else {
                    System.out.println("Invalid Binary IP Format!");
                }
                break;
            default:
                System.out.println("Invalid option!");
        }

        scanner.close();
    }

    static boolean isValidIP(String ip) {
        String[] octets = ip.split("\\.");
        if (octets.length != 4) return false;

        for (String octet : octets) {
            try {
                int val = Integer.parseInt(octet);
                if (val < 0 || val > 255) return false;
            } catch (NumberFormatException e) {
                return false;
            }
        }
        return true;
    }

    static boolean isValidBinaryIP(String binaryIP) {
        String[] parts = binaryIP.split("\\.");
        if (parts.length != 4) return false;
        for (String part : parts) {
            if (part.length() != 8 || !part.matches("[01]{8}")) return false;
        }
        return true;
    }

    static String getIPClass(String ip) {
        int firstOctet = Integer.parseInt(ip.split("\\.")[0]);
        if (firstOctet >= 1 && firstOctet <= 126) return "A";
        else if (firstOctet >= 128 && firstOctet <= 191) return "B";
        else if (firstOctet >= 192 && firstOctet <= 223) return "C";
        else return null;
    }
```

```java
    static String decimalToBinary(String ip) {
        StringBuilder binary = new StringBuilder();
        for (String part : ip.split("\\.")) {
            int val = Integer.parseInt(part);
            binary.append(String.format("%8s",
Integer.toBinaryString(val)).replace(' ', '0')).append(".");
        }
        return binary.substring(0, binary.length() - 1);
    }

    static String binaryToDecimal(String binaryIP) {
        StringBuilder decimal = new StringBuilder();
        for (String part : binaryIP.split("\\.")) {
            decimal.append(Integer.parseInt(part, 2)).append(".");
        }
        return decimal.substring(0, decimal.length() - 1);
    }
}
```

7.Output:

```
=== IP Address Utility ===
Enter a valid IP address (decimal form): 192.168.0.1
Detected IP Class: C
Select an option:
1. Convert IP to Binary
2. Convert Binary to Decimal IP
1
Binary Format: 11000000.10101000.00000000.00000001
PS E:\6th Semester\Data-Communication lab\code>
```

```
=== IP Address Utility ===
Enter a valid IP address (decimal form): 192.168.0.1
Detected IP Class: C
Select an option:
1. Convert IP to Binary
2. Convert Binary to Decimal IP
2
Enter Binary IP (e.g. 11000000.10101000.00000001.00000001):
```

8. Conclusion:

This experiment provided hands-on experience with IP address classification and binary-decimal conversion logic. The program models how networks distinguish and represent IP addresses internally. Understanding such representation is critical in network addressing, routing, and subnetting.