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: CSE 308 Section: 223 D1

Student Details

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Submission Date: 15/03/2025

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Lab Report Status

Marks: …… **Signature:.....**

Comments:..... **Date:.....**

1. Title of the Experiment:

IP Address Conversion: Binary and Decimal Representation

2. Objectives/Aim

- To understand the structure of IP addresses in different classes (A, B, and C).
- Implement a Java program for IP address conversion between decimal and binary forms.
- To enhance problem-solving and programming skills related to networking concepts.

3. Procedure / Analysis / Design

Procedure:

1. Start by designing a Java program that accepts user input for an IP address.
2. Determine the class of the given IP address based on the first octet.
3. Provide the user with two options:
    - Convert the decimal IP address to binary.
    - Convert the binary IP address to decimal.
4. Implement methods for both conversion processes.
5. Display the result based on the user's choice.
6. Validate the input to ensure correctness.

Design:

- The program follows a structured approach using Java methods.
- It employs string manipulation and bitwise operations for conversion.
- A menu-driven approach enhances user interaction.

3.1 Java Implementation

```
import java.util.Scanner;

public class IPAddressConverter {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter an IP address (decimal or binary):");
        String ip = scanner.nextLine();

        if (isValidDecimalIP(ip)) {
            // Convert Decimal to Binary
            System.out.println("Binary Representation: " +
```

```
decimalToBinary(ip));
        } else if (isValidBinaryIP(ip)) {
            // Convert Binary to Decimal
            System.out.println("Decimal Representation: " +
binaryToDecimal(ip));
        } else {
            System.out.println("Invalid IP address format. Please enter a
valid decimal or binary IP.");
        }
        scanner.close();
    }

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

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

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

        for (String octet : octets) {
            if (!octet.matches("[01]{8}")) return false;
        }
        return true;
    }

    private static String decimalToBinary(String ip) {
        String[] octets = ip.split("\\.");
        StringBuilder binaryIP = new StringBuilder();

        for (String octet : octets) {
            int num = Integer.parseInt(octet);
            binaryIP.append(String.format("%08d",
Integer.parseInt(Integer.toBinaryString(num)))).append(".");
        }
        return binaryIP.substring(0, binaryIP.length() - 1);
    }

    private static String binaryToDecimal(String ip) {
        String[] octets = ip.split("\\.");
        StringBuilder decimalIP = new StringBuilder();

        for (String octet : octets) {
            decimalIP.append(Integer.parseInt(octet, 2)).append(".");
        }
```

```
        return decimalIP.substring(0, decimalIP.length() - 1); }}
```

4. Output

Input 1 (Decimal to Binary Conversion):

```
run:
Enter an IP address (decimal or binary):
192.168.1.1
Binary Representation: 11000000.10101000.00000001.00000001
BUILD SUCCESSFUL (total time: 57 seconds)
```

Input 2 (Binary to Decimal Conversion):

```
run:
Enter an IP address (decimal or binary):
11000000.10101000.00000001.00000001
Decimal Representation: 192.168.1.1
BUILD SUCCESSFUL (total time: 23 seconds)
```

Input 3 (Invalid IP Address):

```
run:
Enter an IP address (decimal or binary):
999.999.999.999
Invalid IP address format. Please enter a valid decimal or binary IP.
BUILD SUCCESSFUL (total time: 2 seconds)
```

5. Discussion

- The program correctly identifies whether the input is in decimal or binary format and converts it accordingly.
- It effectively uses string manipulation and parsing techniques for conversion.
- The program ensures IP validity by checking format constraints.
- Future improvements could include handling Class D and E addresses or integrating a GUI.

6. Conclusion

This experiment successfully demonstrates the conversion of an IP address between decimal and binary formats. The implementation provides insights into networking concepts and improves Java programming skills. The program can be further extended with additional functionalities like subnetting calculations.