Template Week 6 – Networking

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Assignment 6.1: Working from home

Screenshot installation openssh-server:

Screenshot successful SSH command execution:

Screenshot successful execution SCP command:

Screenshot remmina:

Assignment 6.2: IP addresses websites

Relevant screenshots nslookup command:

Screenshot website visit via IP address:

Assignment 6.3: subnetting

How many IP addresses are in this network configuration 192.168.110.128/25?

128 IP addresses

What is the usable IP range to hand out to the connected computers?

192.168.110.129 – 192.168.110.254

Check your two previous answers with this Linux command: `ipcalc 192.168.110.128/25`

Network: 192.168.110.128

Broadcast: 192.168.110.255

HostMin: 192.168.110.129

HostMax: 192.168.110.254

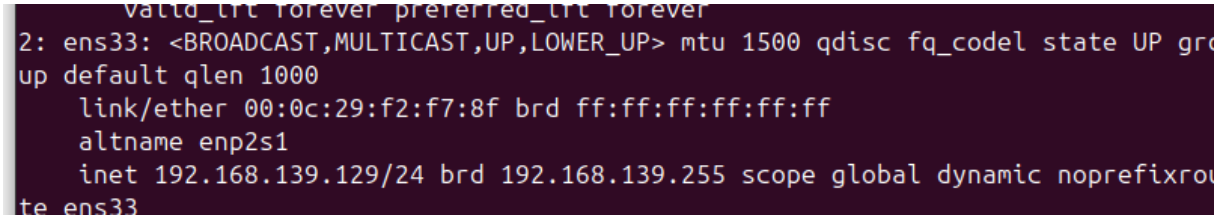
Hosts/Net: 126

Explain the above calculation in your own words.

A /25 subnet has 7 host bits, giving $2^7 = 128$total IPs. The first IP is the network address and the last IP is the broadcast, leaving 126 usable addresses (192.168.110.129 to 192.168.110.254) for devices.@

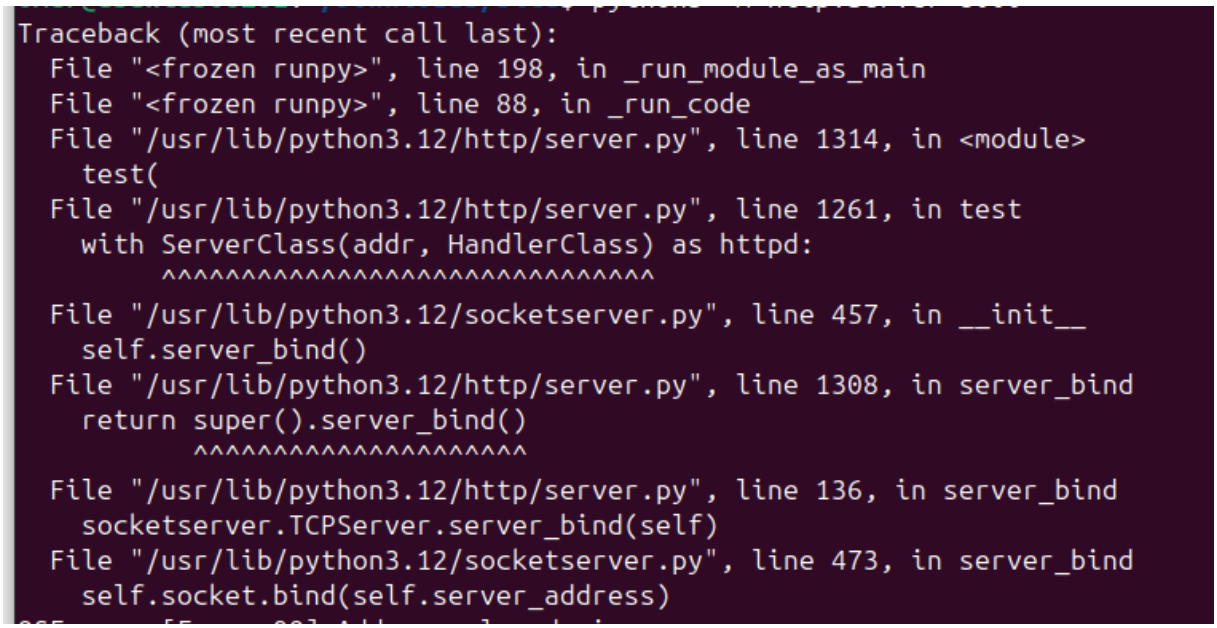
Assignment 6.4: HTML

Screenshot IP address Ubuntu VM:

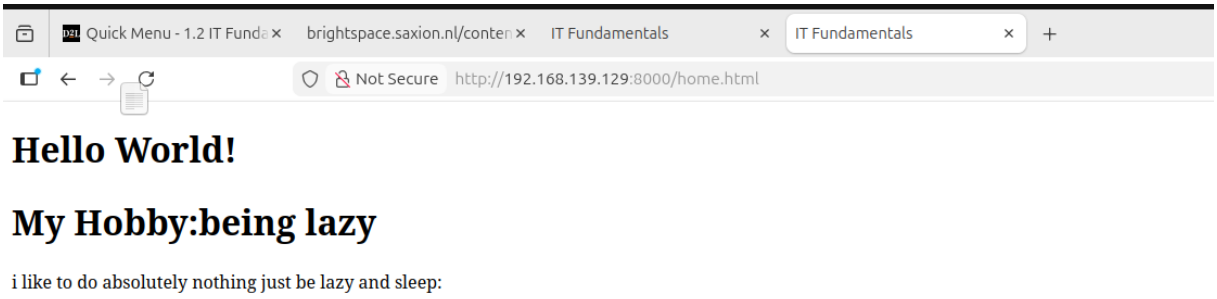


Screenshot of Site directory contents:

Screenshot python3 webserver command:



Screenshot web browser visits your site



Assignment 6.5: Network segment

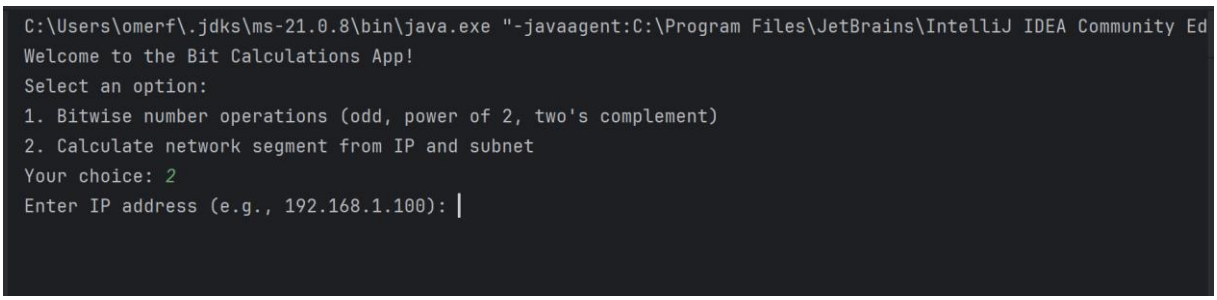
Remember that bitwise java application you've made in week 2? Expand that application so that you can also calculate a network segment as explained in the PowerPoint slides of week 6. Use the bitwise & AND operator. You need to be able to input two Strings. An IP address and a subnet.

IP: 192.168.1.100 and subnet: 255.255.255.224 for /27

```
Example: 192.168.1.100/27
Calculate the network segment
IP Address:   11000000.10101000.00000001.01100100
Subnet Mask:  11111111.11111111.11111111.11100000
-----------------------------------------------
Network Addr: 11000000.10101000.00000001.01100000

This gives 192.168.1.96 in decimal as the network address.
For a /27 subnet, each segment (or subnet) has 32 IP addresses (2⁵).
The range of this network segment is from 192.168.1.96 to 192.168.1.127.
```

Paste source code here, with a screenshot of a working application.



```
import java.util.Scanner;

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

        System.out.println("Welcome to the Bit Calculations App!");

        System.out.println("Select an option:");
        System.out.println("1. Bitwise number operations (odd, power of 2, two's complement)");
        System.out.println("2. Calculate network segment from IP and subnet");
        System.out.print("Your choice: ");

        int choice = 0;
        if (scanner.hasNextInt()) {
            choice = scanner.nextInt();
            scanner.nextLine(); // consume newline
        } else {
            System.out.println("Invalid input! Please enter 1 or 2.");
            scanner.close();
            return;
        }

        switch (choice) {
            case 1:
                performNumberOperations(scanner);
                break;
            case 2:
                calculateNetworkSegment(scanner);
                break;
            default:
                System.out.println("Invalid choice! Please select 1 or 2.");
        }

        scanner.close();
    }

    // ----------------------------
    // Bitwise number operations
    // ----------------------------
    public static void performNumberOperations(Scanner scanner) {
        System.out.print("Enter an integer number: ");
        int number;
        if (scanner.hasNextInt()) {
            number = scanner.nextInt();
        } else {
            System.out.println("Invalid input! Please enter an integer.");
            return;
```

```
        }

        System.out.println("Select an operation:");
        System.out.println("1. Is the number odd?");
        System.out.println("2. Is the number a power of 2?");
        System.out.println("3. Two's complement of the number");
        System.out.print("Your choice: ");

        int choice = scanner.nextInt();

        switch (choice) {
            case 1:
                System.out.println(number + (isOdd(number) ? " is odd." : " is even."));
                break;
            case 2:
                System.out.println(number + (isPowerOfTwo(number) ? " is a power of 2." : " is NOT a power
of 2."));
                break;
            case 3:
                System.out.println("Two's complement of " + number + " is: " + twosComplement(number));
                break;
            default:
                System.out.println("Invalid option! Please choose 1, 2, or 3.");
        }
    }

    public static boolean isOdd(int number) {
        return (number & 1) == 1;
    }

    public static boolean isPowerOfTwo(int number) {
        return number > 0 && (number & (number - 1)) == 0;
    }

    public static int twosComplement(int number) {
        return ~number + 1;
    }

    // ---------------------------
    // Network segment calculation
    // ---------------------------
    public static void calculateNetworkSegment(Scanner scanner) {
        System.out.print("Enter IP address (e.g., 192.168.1.100): ");
        String ipStr = scanner.nextLine();

        System.out.print("Enter subnet mask (e.g., 255.255.255.224): ");
        String subnetStr = scanner.nextLine();
```

```
        int[] ip = parseIP(ipStr);
        int[] subnet = parseIP(subnetStr);

        if (ip == null || subnet == null) {
            System.out.println("Invalid IP or subnet format!");
            return;
        }

        int[] network = new int[4];
        for (int i = 0; i < 4; i++) {
            network[i] = ip[i] & subnet[i];
        }

        System.out.println("\nIP Address:   " + toBinaryString(ip));
        System.out.println("Subnet Mask:  " + toBinaryString(subnet));
        System.out.println("-----------------------------------------------");
        System.out.println("Network Addr: " + toBinaryString(network));
        System.out.println("\nNetwork Address in decimal: " + network[0] + "." + network[1] + "." +
network[2] + "." + network[3]);

        int hostBits = 0;
        for (int i = 0; i < 4; i++) {
            hostBits += Integer.bitCount(~subnet[i] & 0xFF);
        }

        int numberOfHosts = (int) Math.pow(2, hostBits);
        int[] broadcast = network.clone();
        broadcast[3] += numberOfHosts - 1;

        System.out.println("Usable IP range: " + network[0] + "." + network[1] + "." + network[2] + "." +
(network[3]+1)
                + " - " + broadcast[0] + "." + broadcast[1] + "." + broadcast[2] + "." + (broadcast[3]-1));
    }

    public static int[] parseIP(String ipStr) {
        String[] parts = ipStr.split("\\.");
        if (parts.length != 4) return null;
        int[] ip = new int[4];
        try {
            for (int i = 0; i < 4; i++) {
                ip[i] = Integer.parseInt(parts[i]);
            }
        } catch (NumberFormatException e) {
            return null;
        }
        return ip;
    }
```

```
    public static String toBinaryString(int[] ip) {
        StringBuilder sb = new StringBuilder();
        for (int i = 0; i < ip.length; i++) {
            sb.append(String.format("%8s", Integer.toBinaryString(ip[i])).replace(' ', '0'));
            if (i < ip.length - 1) sb.append(".");
        }
        return sb.toString();
    }
}
```

Ready? Save this file and export it as a pdf file with the name: **week6.pdf**