Batch: SY-IT(B3) **Experiment Number: 5**

Roll Number: 16010423076 **Name: Ritesh Jha**

Aim of the Experiment: To write a program to identify the class to which a given IP Address belong to.

Program/ Steps:

```
import re


def validate_ip(ip_address):
    # defined a pattern to match the basic structure of an IP address so that invalid formats are not entered
    pattern = re.compile(r'^(\d{1,3}\.){3}\d{1,3}$')

    if not pattern.match(ip_address):
        return False

    octets = ip_address.split('.')
    return all(0 <= int(octet) <= 255 for octet in octets)

def convert_ip_to_binary(ip_address):
    return '.join([f'{int(octet):08b}' for octet in ip_address.split('.')])


def determine_ip_class(ip_address):
    # validate the IP address first
    if not validate_ip(ip_address):
        return "Invalid IP address", None

    binary_ip_address = convert_ip_to_binary(ip_address)

    first_octet_binary = binary_ip_address.split('.')[0]

    if first_octet_binary.startswith('0'):
        ipclass = 'A'
    elif first_octet_binary.startswith('10'):
```

```
        ipclass = 'B'
    elif first_octet_binary.startswith('110'):
        ipclass = 'C'
    elif first_octet_binary.startswith('1110'):
        ipclass = 'D'
    elif first_octet_binary.startswith('1111'):
        ipclass = 'E'
    else:
        ip_class = 'Unknown'

    return ipclass, binary_ip_address

ip_address = input("Please enter an IP address: ")
ipclass, binary_ip = determine_ip_class(ip_address)

if ipclass == "Invalid IP address":
    print("The IP address provided is invalid.")
else:
    print(f"IP address {ip_address} converts to binary as {binary_ip}")
    print(f"It falls under Class {ipclass}.")
```

Output/Result:

Output

```
Please enter an IP address: 192.168.0.100
IP address 192.168.0.100 converts to binary as
    11000000101010000000000001100100.
It falls under Class C.

=== Code Execution Successful ===
```

Output

```
Please enter an IP address: 256.300.888.1
The IP address provided is invalid.

=== Code Execution Successful ===
```

Output

```
Please enter an IP address: 10.52.36.11
IP address 10.52.36.11 converts to binary as
    00001010001101000010010000001011
It falls under Class A.

=== Code Execution Successful ===
```

Post Lab Question-Answers:

1. Which OSI layer corresponds to IP Layer?

Ans. Network Layer

2. Compare IPv4 and IPv6 header

Ans. **IPv4 Header:**

- IPv4 uses a 32-bit address, allowing for about 4.3 billion unique addresses.
- The IPv4 header is typically 20 bytes long.

IPv6 Header:

- IPv6 uses a 128-bit address, allowing for a vastly larger number of unique addresses.
- The IPv6 header is 40 bytes long.
- It has fewer fields than IPv4, making it simpler and more efficient.

3. What is fragmentation?

Ans. Fragmentation is the process of breaking down a large data packet into smaller pieces so it can be transmitted over networks that have a smaller maximum transmission unit (MTU) size. Each fragment is then sent separately and reassembled at the destination. This is necessary because different networks can have different MTU sizes and not all packets can pass through in one piece.

4. Explain Subnetting and Supernetting with examples ?

Ans.

Subnetting:
Subnetting is the process of dividing a large network into smaller, more manageable subnetworks (subnets). This helps organize the network and improve security and performance. For example, if you have a network with IP range 192.168.1.0/24, you can subnet it into two smaller networks: 192.168.1.0/25 and 192.168.1.128/25, each supporting 128 IP addresses.

Supernetting:
Supernetting is the opposite of subnetting. It involves combining multiple smaller networks into a larger network. This is often done to simplify routing. For example, if you have two networks 192.168.1.0/24 and 192.168.2.0/24, you can supernet them into one larger network 192.168.0.0/23, which includes all the IP addresses from both networks.

Outcomes:

CO2. Enumerate the layers of the OSI model and TCP/IP model, their functions and Protocols
CO3. Build the skills of sub-netting and routing mechanisms

Conclusion (based on the Results and outcomes achieved):

From the experiment number 5, I learned about IP addresses and their classifications in detail. I also understood the classification algorithm for classful IP Addresses. In the end I implemented a Python code for conversion of the IP Addresses from decimal to binary system and then their classification based on the algorithm which was taught previously.

References:

References:

Books/ Journals/ Websites:

- Behrouz A Forouzan, Data Communication and Networking, Tata Mc Graw hill, India, 4th Edition
- S. Tanenbaum," Computer Networks", 4th edition, Prentice Hall

Experiment No. 5

Title: Classification of IP addressing.

Batch: **Roll No.:** **Experiment No.:**

Aim: To write a program to identify the class to which a given IP Address belong to.

Resources Used: Java/C/Python

Theory:

A Computer at one place in the world needs to communicate with another computer somewhere else in the world. Usually computers communicate through the Internet. The packet transmitted by the sending computer may pass through several LANs and WANs before reaching the destination computer. For this level of communication, we need a global addressing scheme called as Logical addressing. Today we use the term IP Address to mean a logical address in the network layer of the TCP/IP protocol suite.

IP address is 32 bit long. The IP addresses are unique and universal. There are two prevalent notations: Binary notation and Dotted –Decimal notation. In binary notation ,the IP address is displayed as 32 bits..Each octet is often referred to as a byte. So it is referred to as 32 bit addressor 4-byte address.. To make it more compact and easier to read, Internet addresses are usually written in decimal form with a decimal point separating the byte

Number of IP Addresses per Device: Any device that has data sent to it at the network layer will have at least one IP address: one per network interface. This means that normal hosts such as computers and network-capable printers usually get one IP address, while routers get more than one IP address. Some special hosts may have more than one IP address if they are multihomed - connected to more than one network. Lower-level network interconnection devices such as repeaters, bridges and switches don't require an IP address because they pass traffic based on layer two (data link layer) addresses. Network segments connected by bridges and switches form a single broadcast domain and any devices on them can send data to each other directly without routing. To the Internet Protocol, these devices are “invisible”, they are no more significant than the wires that connect devices together (with a couple of exceptions).

"CLASSFUL" IP Address Classification:
In Classful addressing, the address space is split into five classes: A, B, C, D, E. Each class occupies some part of the address space.as shown in Table 1. Looking at only the first few bits of any IP address

would tell the router where to “draw the line” between the network ID and host ID., and thus what to do with the datagram. The number of bits the router needs to look at may be as few as one or as many as four, depending on what it finds when it starts looking.

Netid and Hostid

In classful addressing, an IP address in Class A, B, or C is divided into netid and host id. These parts are of varying lengths, depending on the class of the address. In class A, one byte defines the netid and three bytes define the host id. In class B, two bytes define the netid and two bytes define the host id. In class C, three bytes define the netid and one byte defines the host id.

Class A addresses were designed for large scale organizations with a large number of attached hosts or routers.
Class B addresses were designed for mid size organizations with tens of thousands of attached hosts or routers.
Class C addresses were designed for small organizations with a small number of attached hosts or routers.
Class D network addresses are used by multicasting. Multicasting is a method of reducing network traffic. Rather than send a separate datagram to each host if multiple host require the same information, a special multicast address can be used where one datagram is read by many hosts.
Class E Addresses were reserved for future use.

Table 1

Network Class	IP Address Range	Net mask
A	0.0.0.0 to 127.255.255.255	255.0.0.0
B	128.0.0.0 to 191.255.255.255	255.255.0.0
C	192.0.0.0 to 223.255.255.255	255.255.255.0
D	224.0.0.0 to 239.255.255.255	-
E	240.0.0.0 to 255.255.255.255	-

Algorithm

The algorithm used corresponds to the system used to divide the address space; it involves four very basic steps (see Figure 1 below)

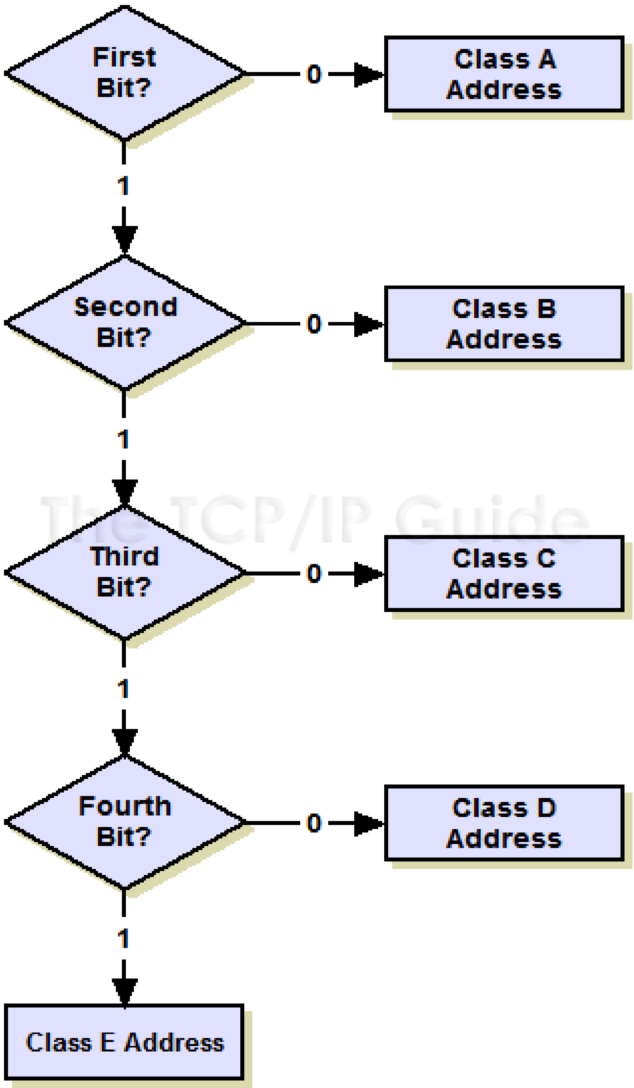

Figure 1: Class determination algorithm for “Classful” IP addresses

The algorithm takes as input the first byte of the IP address in binary form

1. If the first bit is a “0”, it's a class A address and we're done. (Half the address space has a “0” for the first bit, so this is why class A takes up half the address space.) If it's a “1”, continue to step two.

2. If the second bit is a “0”, it's a class B address and we're done. (Half of the remaining non-class-A addresses, or one quarter of the total.) If it's a “1”, continue to step three.

3. If the third bit is a “0”, it's a class C address and we're done. (Half again of what's left, or one eighth of the total.) If it's a “1”, continue to step four.

4. If the fourth bit is a “0”, it's a class D address. (Half of the remainder, or one sixteenth of the address space.) If it's a “1”, it's a class E address. (The other half, one sixteenth.)

Activity:

1. The program should accept the input IP address in dotted decimal form.
2. Convert this address into binary form and apply the classification algorithm.
3. Display the class of IP address as the output.

Program:

Output:

Questions:

1) Which OSI layer corresponds to IP Layer?
Ans.

2) Compare IPv4 and IPv6 header
Ans.

3) What is fragmentation?
Ans

4) Explain Subnetting and Supernetting with examples ?
Ans

Outcomes:

Conclusion:

Grade: AA / AB / BB / BC / CC / CD /DD

Signature of faculty in-charge with date

References:

Books/ Journals/ Websites:

- Behrouz A Forouzan, Data Communication and Networking, Tata Mc Graw hill, India, 4th Edition
- S. Tanenbaum," Computer Networks", 4th edition, Prentice Hall