Experiment No. 7

SEMESTER: V(2016-17) **DATE OF DECLARATION:** 21/9/17

SUBJECT: CN **DATE OF SUBMISSION:** 28/9/17

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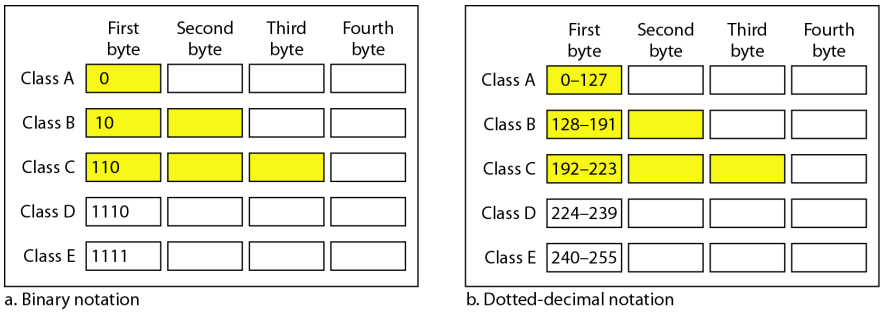
Aim	To write a program to find out class of a given IP address, subnet mask and first and last IP address of that block.
Learning Objective	The student will differentiate between the different classes of IP and calculate subnet mask for the IP address. Student will calculate of first address and last address of the network based on the mask.
Learning Outcome	The student will be identify class of a given IP address and calculate its default subnet mask. The student will calculate first and last IP address of the block.
Course Outcome	C304.1 : Coceptualize all the OSI layers. C304.3 : Analyze, compare and test datalink,network and transport layer protocol, algorithms, techniques in laboratory scenario.
Program Outcome	PO1: Apply the knowledge of mathematics, science, engineering, fundamentals, and an engineering specialization to the solution of complex engineering problem. PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Bloom's Taxonomy Level	Remember Apply
Theory	A **classful network** is a network addressing architecture used in the Internet until the introduction of Classless Inter-Domain Routing. The method divides the address space for Internet Protocol Version 4 (IPv4) into five address classes. Each class, coded in the first four bits of the address, defines either a different network size, i.e. number of hosts for unicast addresses (classes A,

B, C), or a multicast network (class D). The fifth class (E) address range is reserved for future or experimental purposes.

The following is the range of addresses of each class:



a. Binary notation

b. Dotted-decimal notation

A 32-bit IPv4 address was logically subdivided into the network number field, the most-significant 8 bits of an address, which specified the particular network a host was attached to, and the local address, also called host field (the rest of the address), which uniquely identifies a host connected to that network.

This format was sufficient at a time when only a few large networks existed, such as the ARPANET which was assigned the network number 10.As a consequence of this architecture, the address space supported only a low number (254) of independent networks IP addresses are associated with a subnet mask.

Class	*Binary*	*Dotted-Decimal*	*CIDR*
A	**11111111** 00000000 00000000 00000000	**255**.0.0.0	/8
B	**11111111 11111111** 00000000 00000000	**255.255**.0.0	/16
C	**11111111 11111111 11111111** 00000000	**255.255.255**.0	/24

Figure 7.1 : Default mask for classful addressing

These masks when applied to the IP addresses after identification of the classes give the network address. Each network address is defined by the following set of rules:

- All host bytes are zero.
- It defines the internet to the rest of the Internet.
- These are used by routers
- It is the first address in the block
- Given the network address, we can find the class of the address.

	Mask: A better way to define a block of addresses is to select any address in the block and the mask. A mask is a 32-bit number in which the n leftmost bits are 1s and the 32 - n rightmost bits are 0s. However, in classless addressing the mask for a block can take any value from 0 to 32. It is very convenient to give just the value of n preceded by a slash (CIDR notation). In 1Pv4 addressing, a block of addresses can be defined as **x.y.z.t/n** in which **x.y.z.t** defines one of the addresses and the **/n** defines the mask. The address and the **/n** notation completely define the whole block (the first address, the last address, and the number of addresses). **First Address:** The first address in the block can be found by setting the 32 - n rightmost bits in the binary notation of the address to 0s. **Last Address:** The last address in the block can be found by setting the rightmost 32 - n bits to 1s.

Lab Activities	1. Develop a java program to find out class of a given IP address, subnet mask and first and last IP address of that block.
	
	import java.util.Scanner;
	
	class Subnet{
	
	public static void main(String args[]){
	
	Scanner sc = new Scanner(System.in);
	
	System.out.print("Enter the ip address: ");
	
	String ip = sc.nextLine();
	
	String split_ip[] = ip.split("\\."); //SPlit the string after every .
	
	String split_bip[] = new String[4]; //split binary ip
	
	String bip = "";
	
	for(int i=0;i<4;i++){
	
	split_bip[i] = appendZeros(Integer.toBinaryString(Integer.parseInt(split_ip[i])));
	// "18" => 18 => 10010 => 00010010

```
bip += split_bip[i];
}
System.out.println("IP in binary is "+bip);
System.out.print("Enter the number of addresses: ");
int n = sc.nextInt();


//Calculation of mask
int bits = (int)Math.ceil(Math.log(n)/Math.log(2)); /*eg if address = 120, log 120/log 2 gives log to the base 2 => 6.9068, ceil gives us upper integer */
//System.out.println("Number of bits required for address = "+bits);
int mask = 32-bits;




String[] ipAddrParts=ip.split("\\.");
                        String masks="";


                        int firstoctet = Integer.parseInt(ipAddrParts[0]);
                        if(firstoctet<=127)
                        {
                                masks = "255.0.0.0";
                                System.out.println("Class A IP Address");
                                System.out.println("The Subnet mask is: "+masks);
                        }
                        else if(firstoctet>=128 && firstoctet<=191)
```

```
                {
                        masks = "255.255.0.0";
                        System.out.println("Class B IP Address");
                        System.out.println("The Subnet mask is: "+masks);
                }
                else if(firstoctet>=192 && firstoctet<=223)
                {
                        masks = "255.255.255.0";
                        System.out.println("Class C IP Address");
                        System.out.println("The Subnet mask is: "+masks);
                }
                else if(firstoctet>=224 && firstoctet<=239)
                {
                        masks = "255.0.0.0";
                        System.out.println("Class D IP Address; Used for
multicasting");
                }
                else if(firstoctet>=240 && firstoctet<=254)
                {
                        masks = "255.0.0.0";
                        System.out.println("Class D IP Address;
Experimental Use");
                }
//System.out.println("The subnet mask is = "+mask);
```

```
//Calculation of first address and last address

int fbip[] = new int[32];

for(int i=0; i<32;i++) fbip[i] = (int)bip.charAt(i)-48; //convert cahracter 0,1 to integer 0,1

for(int i=31;i>31-bits;i--)//Get first address by ANDing last n bits with 0

fbip[i] &= 0;

String fip[] = {"","","",""};

for(int i=0;i<32;i++)

fip[i/8] = new String(fip[i/8]+fbip[i]);

System.out.print("First address is = ");

for(int i=0;i<4;i++){

System.out.print(Integer.parseInt(fip[i],2));

if(i!=3) System.out.print(".");

}

System.out.println();


int lbip[] = new int[32];

for(int i=0; i<32;i++) lbip[i] = (int)bip.charAt(i)-48; //convert cahracter 0,1 to integer 0,1

for(int i=31;i>31-bits;i--)//Get last address by ORing last n bits with 1

lbip[i] |= 1;

String lip[] = {"","","",""};

for(int i=0;i<32;i++)

lip[i/8] = new String(lip[i/8]+lbip[i]);

System.out.print("Last address is = ");
```

```
for(int i=0;i<4;i++){
System.out.print(Integer.parseInt(lip[i],2));
if(i!=3) System.out.print(".");
}
System.out.println();
}
static String appendZeros(String s){
String temp = new String("00000000");
return temp.substring(s.length())+ s;
}
}
```

2. Attach output for the program with each class identification.

```
C:\Users\mitchelle\Desktop>
C:\Users\mitchelle\Desktop>
C:\Users\mitchelle\Desktop>javac Subnet.java

C:\Users\mitchelle\Desktop>java Subnet
Enter the ip address: 205.16.37.39
IP in binary is 11001101000100000010010100100111
Enter the number of addresses: 8
Class C IP Address
The Subnet mask is: 255.255.255.0
First address is = 205.16.37.32
Last address is = 205.16.37.39
```

CONCLUSION:

The different class of ip address and the first and last block is studied in detail and found out pratically.

References:	1. B.A. Forouzan, “Data Communications and Networking”, TMH, Fourth Edition