

# Lab Assignment 2

## Network and Communication

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### **Question 1:**

Implement the following Flow control mechanisms

- a) Stop and Wait ARQ
- b) Go back N ARQ
- c) Selective Repeat ARQ

### **Aim :**

To implement and execute the flow control mechanisms of stop and wait arq, go back n arq and selective repeat arq algorithms in any programming language. To display the out of the same implementation

### **Stop and Wait(ARQ)**

### **Algorithm :**

Sender A sends a data frame or packet with sequence number 0. Receiver B, after receiving data frame, sends an acknowledgement with sequence number 1 (sequence number of next expected data frame or packet). There is only one bit sequence number that implies that both sender and receiver have buffer for one frame or packet only.

### **Code Text :**

```
#include<stdio.h>
#include <time.h>
#include<stdlib.h>
#include<unistd.h>
#define MAX_DELAY 5
void main()
{

    printf("\nKulvir Singh\n19BCE2074\n");
    printf("=====STOP AND WAIT ARQ =====\n");
```

```
int seed = time(NULL);
srand(seed);
int i=0>window_size,noframes,frame_no,ack_no,frame_delay,ack_delay,timer,time_left;
printf("Enter number of frames: ");
scanf("%d",&noframes);
int seq_no[noframes],receiver_buffer[noframes];
printf("Enter timer duration: ");
scanf("%d",&timer);
printf("SENDER\t\t\tDELAY\t\t\tCASE\t\t\tRECEIVER\n");

for(i=0;i<noframes;i++)
{
    seq_no[i]=i%2;
    receiver_buffer[i]=i%2;
}
//Window Size Allocation
window_size=1;
i=0;
while(1)
{
    frame_no = seq_no[i];
    if (i<noframes-1)
        ack_no = receiver_buffer[i+1];
    else
        ack_no = (receiver_buffer[i]+1)%2;
    printf("\nSending Frame %d",frame_no);
    frame_delay = rand()%(MAX_DELAY+1);
    printf("\t\tFrame Delay %d",frame_delay);
    fflush(stdout);
    sleep(frame_delay);
    if(frame_delay>timer && frame_delay<=MAX_DELAY)
    {
        printf("\t\tFrame Lost");
        continue;
    }
    printf("\t\tNormal");
    printf("\t\tSending Ack %d",ack_no);
    ack_delay = rand()%(MAX_DELAY+1);
    printf("\n\t\tAck Delay %d",ack_delay);
    fflush(stdout);
    sleep(ack_delay);
    if(ack_delay>timer && ack_delay<=MAX_DELAY)
    {
        printf("\t\tAck Lost");
        continue;
    }
    else if(frame_delay+ack_delay>timer)
    {
```

```

        printf("\t\tDelayed Ack");
        continue;
    }
    printf("\t\tNormal");
    printf("\nReceived Ack %d\n",ack_no);
    i+=window_size;
    printf("-----\n");
    if(i==noframes)
        break;
}
printf("\nFrames sent\n");
}

```

## Code Screenshots :

```

1  #include<stdio.h>
2  #include <time.h>
3  #include<stdlib.h>
4  #include<unistd.h>
5  #define MAX_DELAY 5
6  void main()
7  {
8
9      printf("\nKulvir Singh\n19BCE2074\n");
10     printf("=====STOP AND WAIT ARQ =====\n");
11     int seed = time(NULL);
12     srand(seed);
13     int i=0,window_size,noframes,frame_no,ack_no,frame_delay,ack_delay,timer,time_left;
14     printf("Enter number of frames: ");
15     scanf("%d",&noframes);
16     int seq_no[noframes],receiver_buffer[noframes];
17     printf("Enter timer duration: ");
18     scanf("%d",&timer);
19     printf("SENDER\t\t\t\t\tDELAY\t\t\t\t\tCASE\t\t\t\t\tRECEIVER\n");
20
21     for(i=0;i<noframes;i++)
22     {
23         seq_no[i]=i%2;
24         receiver_buffer[i]=i%2;
25     }
26     //Window Size Allocation
27     window_size=1;
28     i=0;
29     while(1)
30     {
31         frame_no = seq_no[i];
32         if (i<noframes-1)
33             ack_no = receiver_buffer[i+1];
34         else
35             ack_no = (receiver_buffer[i]+1)%2;
36         printf("\nSending Frame %d",frame_no);
37         frame_delay = rand()% (MAX_DELAY+1);
38         printf("\t\tFrame Delay %d",frame_delay);

```

```

37     frame_delay = rand() % (MAX_DELAY+1);
38     printf("\t\tFrame Delay %d", frame_delay);
39     fflush(stdout);
40     sleep(frame_delay);
41     if(frame_delay > timer && frame_delay <= MAX_DELAY)
42     {
43         printf("\t\tFrame Lost");
44         continue;
45     }
46     printf("\t\tNormal");
47     printf("\t\tSending Ack %d", ack_no);
48     ack_delay = rand() % (MAX_DELAY+1);
49     printf("\n\t\t\tAck Delay %d", ack_delay);
50     fflush(stdout);
51     sleep(ack_delay);
52     if(ack_delay > timer && ack_delay <= MAX_DELAY)
53     {
54         printf("\t\tAck Lost");
55         continue;
56     }
57     else if(frame_delay + ack_delay > timer)
58     {
59         printf("\t\tDelayed Ack");
60         continue;
61     }
62     printf("\t\tNormal");
63     printf("\nReceived Ack %d\n", ack_no);
64     i += window_size;
65     printf("-----\n");
66     if(i == noframes)
67         break;
68 }
69 printf("\nFrames sent\n");
70 }

```

## Output Screenshots :

```
Kulvir Singh
19BCE2074
=====STOP AND WAIT ARQ =====
Enter number of frames: 3
Enter timer duration: 20
SENDER          DELAY          CASE          RECEIVER

Sending Frame 0   Frame Delay 0   Normal        Sending Ack 1
                  Ack Delay 1   Normal

Received Ack 1
-----

Sending Frame 1   Frame Delay 4   Normal        Sending Ack 0
                  Ack Delay 3   Normal

Received Ack 0
-----

Sending Frame 0   Frame Delay 3   Normal        Sending Ack 1
                  Ack Delay 5   Normal

Received Ack 1
-----

Frames sent

...Program finished with exit code 0
Press ENTER to exit console.
```

## **Go Back N ARQ**

### **Algorithm :**

Suppose there are a sender and a receiver, and let's assume that there are 11 frames to be sent. These frames are represented as 0,1,2,3,4,5,6,7,8,9,10, and these are the sequence numbers of the frames. Mainly, the sequence number is decided by the sender's window size. But, for the better understanding, we took the running sequence numbers, i.e., 0,1,2,3,4,5,6,7,8,9,10. Let's consider the window size as 4, which means that the four frames can be sent at a time before expecting the acknowledgment of the first frame.

### **Code Text :**

```
#include<stdio.h>
#include<math.h>
int main()
{
    printf("\nKulvir Singh\n19BCE2074\n");
    printf("=====GO BACK N ARQ =====\n");
    int noframes,windowsize,sent=0,ack,m,i,j=0;
    printf("Enter number of frames: ");
    scanf("%d",&noframes);
    printf("Enter m: ");
    scanf("%d",&m);
    windowsize=(int)pow(2,m)-1;
    printf("Window Size: %d\n",windowsize);
    int seq_no[noframes];
    for(i=0;i<noframes;i++)
    {
        seq_no[i]=i%(int)pow(2,m);
    }
    while(1)
    {
        for( i = 0; i < windowsize; i++)
        {
            printf("Sending Frame: %d Sequence Number:
%d\n",sent,seq_no[sent]);
            sent++;
            if(sent==noframes)
                break;
        }

        printf("\nEnter last ack received: ");
        scanf("%d",&ack);

        if(ack != windowsize)
            sent = ack;
    }
}
```

```

        if(ack==noframes)
            break;
    }
    printf("Frames sent\n");
return 0;
}

```

## Code Screenshots :

```

1  #include<stdio.h>
2  #include<math.h>
3  int main()
4  {
5      printf("\nKulvir Singh\n19BCE2074\n");
6      printf("=====GO BACK N ARQ =====\n");
7      int noframes,windowsize,sent=0,ack,m,i,j=0;
8      printf("Enter number of frames: ");
9      scanf("%d",&noframes);
10     printf("Enter m: ");
11     scanf("%d",&m);
12     windowsize=(int)pow(2,m)-1;
13     printf("Window Size: %d\n",windowsize);
14     int seq_no[noframes];
15     for(i=0;i<noframes;i++)
16     {
17         seq_no[i]=i%(int)pow(2,m);
18     }
19     while(1)
20     {
21         for( i = 0; i < windowsize; i++)
22         {
23             printf("Sending Frame: %d Sequence Number: %d\n",sent,seq_no[sent]);
24             sent++;
25             if(sent==noframes)
26                 break;
27         }
28
29         printf("\nEnter last ack received: ");
30         scanf("%d",&ack);
31
32         if(ack != windowsize)
33             sent = ack;
34         if(ack==noframes)
35             break;
36     }
37     printf("Frames sent\n");
38     return 0;
39 }

```

## Output Screenshots :

```
Kulvir Singh
19BCE2074
=====GO BACK N ARQ =====
Enter number of frames: 3
Enter m: 10
Window Size: 1023
Sending Frame: 0 Sequence Number: 0
Sending Frame: 1 Sequence Number: 1
Sending Frame: 2 Sequence Number: 2

Enter last ack received: 3
Frames sent

...Program finished with exit code 0
Press ENTER to exit console.
```



## **Selective Repeat ARQ**

### **Algorithm :**

Selective Repeat ARQ is also known as the Selective Repeat Automatic Repeat Request. It is a data link layer protocol that uses a sliding window method. The Go-back-N ARQ protocol works well if it has fewer errors. But if there is a lot of error in the frame, lots of bandwidth loss in sending the frames again. So, we use the Selective Repeat ARQ protocol. In this protocol, the size of the sender window is always equal to the size of the receiver window. The size of the sliding window is always greater than 1. If the receiver receives a corrupt frame, it does not directly discard it. It sends a negative acknowledgment to the sender. The sender sends that frame again as soon as on the receiving negative acknowledgment. There is no waiting for any time-out to send that frame.

### **Code Text :**

```
#include<stdio.h>
#include<math.h>
int main()
{
    printf("\nKulvir Singh\n19BCE2074\n");
    printf("=====SELECTIVE REPEAT ARQ =====\n");
    int noframes,windowsize,sent=0,nak,m,i,j=0;
    printf("Enter number of frames: ");
    scanf("%d",&noframes);
    printf("Enter m: ");
    scanf("%d",&m);
    windowsize=(int)pow(2,m-1);
    printf("Window Size: %d\n",windowsize);
    int seq_no[noframes];
    for(i=0;i<noframes;i++)
    {
        seq_no[i]=i%(int)pow(2,m);
    }
    int ch;
    while(1)
    {
        for( i = 0; i < windowsize; i++)
        {
            printf("Sending Frame: %d Sequence Number:%d\n",sent,seq_no[sent]);
            sent++;
            if(sent==noframes)
                break;
        }
        ch=1;
        while(ch==1)
        {
            printf("Error occurred? 1/0: ");
            scanf("%d",&ch);
        }
    }
}
```

```

        if (ch==0)
            break;
        printf("Enter nak received: ");
        scanf("%d",&nak);
        printf("Sending Frame: %d Sequence Number: %d\n",nak,seq_no[nak]);
    }
    if(sent==noframes)
        break;
}
printf("Frames sent\n");
return 0;
}

```

## Code Screenshots :

```

#include<stdio.h>
#include<math.h>
int main()
{
    printf("\nKulvir Singh\n19BCE2074\n");
    printf("=====SELECTIVE REPEAT ARQ =====\n");
    int noframes,windowsize,sent=0,nak,m,i,j=0;
    printf("Enter number of frames: ");
    scanf("%d",&noframes);
    printf("Enter m: ");
    scanf("%d",&m);
    windowsize=(int)pow(2,m-1);
    printf("Window Size: %d\n",windowsize);
    int seq_no[noframes];
    for(i=0;i<noframes;i++)
    {
        seq_no[i]=i%(int)pow(2,m);
    }
    int ch;
    while(1)
    {
        for( i = 0; i < windowsize; i++)
        {
            printf("Sending Frame: %d Sequence Number: %d\n",sent,seq_no[sent]);
            sent++;
            if(sent==noframes)
                break;
        }
        ch=1;
        while(ch==1)
        {
            printf("Error occured? 1/0: ");
            scanf("%d",&ch);
            if (ch==0)
                break;
            printf("Enter nak received: ");
            scanf("%d",&nak);
            printf("Sending Frame: %d Sequence Number: %d\n",nak,seq_no[nak]);
        }
        if(sent==noframes)
            break;
    }
    printf("Frames sent\n");
    return 0;
}

```

## Output Screenshots :

```
Kulvir Singh
19BCE2074
=====SELECTIVE REPEAT ARQ =====
Enter number of frames: 3
Enter m: 10
Window Size: 512
Sending Frame: 0 Sequence Number: 0
Sending Frame: 1 Sequence Number: 1
Sending Frame: 2 Sequence Number: 2
Error occurred? 1/0: 0
Frames sent

...Program finished with exit code 0
Press ENTER to exit console.█
```

## Question 2:

Implement the following

- a) Dotted decimal IP address format to Binary notation
- b) Binary to Dotted decimal IP address notation

### Aim :

To find the dotted decimal IP address format from a given binary notation and vice versa using a program written in any language and display the output for the same.

### a)Dotted decimal IP address format to Binary Notation

### Algorithm :

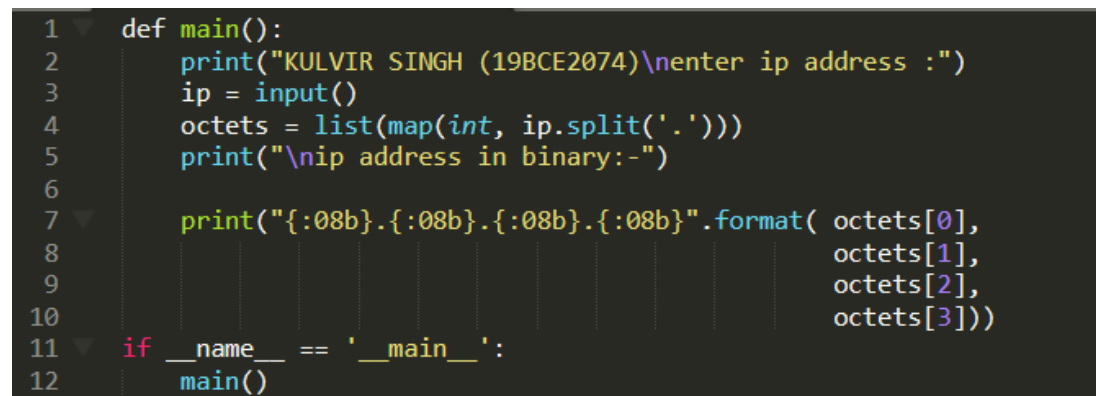
Get input in the form of a string. Split the string and create set of four integers. Convert the four integers to binary and concatenate the answer with a dot between them.

### Code Text :

```
def main():
    print("KULVIR SINGH (19BCE2074)\nenter ip address :")
    ip = input()
    octets = list(map(int, ip.split('.')))
    print("\nip address in binary:-")

    print("{:08b}.{:08b}.{:08b}.{:08b}".format( octets[0],
                                                octets[1],
                                                octets[2],
                                                octets[3]))
if __name__ == '__main__':
    main()
```

### Code Screenshots :



```
1  def main():
2      print("KULVIR SINGH (19BCE2074)\nenter ip address :")
3      ip = input()
4      octets = list(map(int, ip.split('.')))
5      print("\nip address in binary:-")
6
7      print("{:08b}.{:08b}.{:08b}.{:08b}".format( octets[0],
8                                                  octets[1],
9                                                  octets[2],
10                                                 octets[3]))
11  if __name__ == '__main__':
12      main()
```

## Output Screenshots :

```
KULVIR SINGH (19BCE2074)
enter ip address :
190.100.9.1

ip address in binary:-
10111110.01100100.00001001.00000001

...Program finished with exit code 0
Press ENTER to exit console.
```

### **b)Binary to dotted decimal IP address notation**

#### **Algorithm :**

Get an input from the user. Split the string into 4 from the dot character. Convert the 4 strings to decimal and concatenate the answer to be displayed as output.

#### **Code Text :**

```
def BinaryToDecimal(binary):
    decimal = 0
    for digit in binary:
        decimal = decimal*2 + int(digit)
    return decimal
print("KULVIR SINGH (19BCE2074)\nenter ip address:")
ip = input()
octets = ip.split('.')
a = str(BinaryToDecimal((octets[0])))
b = str(BinaryToDecimal((octets[1])))
c = str(BinaryToDecimal((octets[2])))
d = str(BinaryToDecimal((octets[3])))
print('result = ')
print(a+'.'+b+'.'+c+'.'+d)
```

### Code Screenshots :

```
1  def BinaryToDecimal(binary):
2      decimal = 0
3      for digit in binary:
4          decimal = decimal*2 + int(digit)
5      return decimal
6  print("KULVIR SINGH (19BCE2074)\nenter ip address:")
7  ip = input()
8  octets = ip.split('.')
9  a = str(BinaryToDecimal((octets[0])))
10 b = str(BinaryToDecimal((octets[1])))
11 c = str(BinaryToDecimal((octets[2])))
12 d = str(BinaryToDecimal((octets[3])))
13 print('result = ')
14 print(a+'.'+b+'.'+c+'.'+d)
15
```

### Output Screenshots :

```
KULVIR SINGH (19BCE2074)
enter ip address:
10111110.01100100.00001001.00000001
result =
190.100.9.1

...Program finished with exit code 0
Press ENTER to exit console.
```

### Question 3:

Write a program to find the First address ,Last address and number of address from the given IP address/mask

#### Aim :

To find the First address ,Last address and number of address from the given IP address/mask and implement the same in a programming language to display the output accordingly.

#### Algorithm :

Number of subnets : Given bits for mask – No. of bits in default mask

Subnet address : AND result of subnet mask and the given IP address

Broadcast address : By putting the host bits as 1 and retaining the network bits as in the IP address

Number of hosts per subnet :  $2^{(32 - \text{Given bits for mask})} - 2$

First Host ID : Subnet address + 1 (adding one to the binary representation of the subnet address)

Last Host ID : Subnet address + Number of Hosts

#### Code Text :

```
import java.util.*;
import java.io.*;
import java.net.*;
import java.lang.Math;

public class Main {
    public static int[] bina(String[] str)
    {
        int re[] = new int[32];
        int a, b, c, d, i, rem;
        a = b = c = d = 1;
        Stack<Integer> st = new Stack<Integer>();
        if (str != null)
        {
            a = Integer.parseInt(str[0]);
            b = Integer.parseInt(str[1]);
            c = Integer.parseInt(str[2]);
            d = Integer.parseInt(str[3]);
        }
        for (i = 0; i <= 7; i++)
        {
            rem = a % 2;
            st.push(rem);
            a = a / 2;
        }
        for (i = 0; i <= 7; i++) {
            re[i] = st.pop();
        }
    }
}
```

```

    }
    for (i = 8; i <= 15; i++) {
        rem = b % 2;
        st.push(rem);
        b = b / 2;
    }
    for (i = 8; i <= 15; i++) {
        re[i] = st.pop();
    }
    for (i = 16; i <= 23; i++) {
        rem = c % 2;
        st.push(rem);
        c = c / 2;
    }
    for (i = 16; i <= 23; i++) {
        re[i] = st.pop();
    }
    for (i = 24; i <= 31; i++) {
        rem = d % 2;
        st.push(rem);
        d = d / 2;
    }
    for (i = 24; i <= 31; i++) {
        re[i] = st.pop();
    }

    return (re);
}

public static char cls(String[] str)
{
    int a = Integer.parseInt(str[0]);
    if (a >= 0 && a <= 127)
        return ('A');
    else if (a >= 128 && a <= 191)
        return ('B');
    else if (a >= 192 && a <= 223)
        return ('C');
    else if (a >= 224 && a <= 239)
        return ('D');
    else
        return ('E');
}

public static int[] deci(int[] bi)
{
    int[] arr = new int[4];
    int a, b, c, d, i, j;

```



```

a = b = c = d = 0;
j = 7;

for (i = 0; i < 8; i++) {

    a = a + (int)(Math.pow(2, j)) * bi[i];
    j--;
}

j = 7;
for (i = 8; i < 16; i++) {

    b = b + bi[i] * (int)(Math.pow(2, j));
    j--;
}

j = 7;
for (i = 16; i < 24; i++) {

    c = c + bi[i] * (int)(Math.pow(2, j));
    j--;
}

j = 7;
for (i = 24; i < 32; i++) {

    d = d + bi[i] * (int)(Math.pow(2, j));
    j--;
}

arr[0] = a;
arr[1] = b;
arr[2] = c;
arr[3] = d;
return arr;
}

public static void main(String args[])
{

    int i;
    String[] str = new String[4];
    String ipr = "192.168.1.1/24";

    System.out.println();
    String str5 = "";
    int num5,num6;
    double num7;

```

```

for(int l=0;l<ipr.length();l++){
    if(ipr.charAt(l) == ('/')){
        str5 = ipr.substring(l+1);
    }
}
num5 = Integer.parseInt(str5);
num6 = 32-num5;
num7 = Math.pow(2,(num6));
System.out.println("Number of Addresses: " + num7 );
System.out.println("IP address CIDR format is:" + ipr);
String[] str1 = ipr.split("/");
String tr = str1[0];
str = tr.split("\\.");

int[] b = new int[32];

System.out.println();
b = bina(str);

int n = Integer.parseInt(str1[1]);
int[] ntwk = new int[32];
int[] brd = new int[32];
int t = 32 - n;
for (i = 0; i <= (31 - t); i++) {

    ntwk[i] = b[i];
    brd[i] = b[i];
}
for (i = 31; i > (31 - t); i--) {

    ntwk[i] = 0;
}
for (i = 31; i > (31 - t); i--) {

    brd[i] = 1;
}

System.out.println();
char c = cls(str);
System.out.println("Class : " + c);
int[] nt = deci(ntwk);
int[] br = deci(brd);
System.out.println("Network Address : " + nt[0]
    + "." + nt[1] + "." + nt[2] + "." + nt[3]);
System.out.println("Broadcast Address : "
    + br[0] + "." + br[1] + "." + br[2] + "." + br[3]);
}
}

```

## Code Screenshots :

```
1  import java.util.*;
2  import java.io.*;
3  import java.net.*;
4  import java.lang.Math;
5
6  public class Main {
7      public static int[] bina(String[] str)
8      {
9          int re[] = new int[32];
10         int a, b, c, d, i, rem;
11         a = b = c = d = 1;
12         Stack<Integer> st = new Stack<Integer>();
13         if (str != null)
14         {
15             a = Integer.parseInt(str[0]);
16             b = Integer.parseInt(str[1]);
17             c = Integer.parseInt(str[2]);
18             d = Integer.parseInt(str[3]);
19         }
20         for (i = 0; i <= 7; i++)
21         {
22             rem = a % 2;
23             st.push(rem);
24             a = a / 2;
25         }
26         for (i = 0; i <= 7; i++) {
27             re[i] = st.pop();
28         }
29         for (i = 8; i <= 15; i++) {
30             rem = b % 2;
31             st.push(rem);
32             b = b / 2;
33         }
34         for (i = 8; i <= 15; i++) {
35             re[i] = st.pop();
36         }
37         for (i = 16; i <= 23; i++) {
38             rem = c % 2;
39             st.push(rem);
40             c = c / 2;
41         }
42         for (i = 16; i <= 23; i++) {
43             re[i] = st.pop();
44         }
```

```

44     }
45     for (i = 24; i <= 31; i++) {
46         rem = d % 2;
47         st.push(rem);
48         d = d / 2;
49     }
50     for (i = 24; i <= 31; i++) {
51         re[i] = st.pop();
52     }
53
54     return (re);
55 }
56 public static char cls(String[] str)
57 {
58     int a = Integer.parseInt(str[0]);
59     if (a >= 0 && a <= 127)
60         return ('A');
61     else if (a >= 128 && a <= 191)
62         return ('B');
63     else if (a >= 192 && a <= 223)
64         return ('C');
65     else if (a >= 224 && a <= 239)
66         return ('D');
67     else
68         return ('E');
69 }
70
71 public static int[] deci(int[] bi)
72 {
73
74     int[] arr = new int[4];
75     int a, b, c, d, i, j;
76     a = b = c = d = 0;
77     j = 7;
78
79     for (i = 0; i < 8; i++) {
80
81         a = a + (int)(Math.pow(2, j)) * bi[i];
82         j--;
83     }
84
85     j = 7;
86     for (i = 8; i < 16; i++) {

```

```

86 ▼    for (i = 8; i < 16; i++) {
87
88        b = b + bi[i] * (int)(Math.pow(2, j));
89        j--;
90    }
91
92    j = 7;
93 ▼    for (i = 16; i < 24; i++) {
94
95        c = c + bi[i] * (int)(Math.pow(2, j));
96        j--;
97    }
98
99    j = 7;
100 ▼   for (i = 24; i < 32; i++) {
101
102        d = d + bi[i] * (int)(Math.pow(2, j));
103        j--;
104    }
105
106    arr[0] = a;
107    arr[1] = b;
108    arr[2] = c;
109    arr[3] = d;
110    return arr;
111 }
112
113 public static void main(String args[])
114 {
115
116     int i;
117     String[] str = new String[4];
118     String ipr = "192.168.1.1/24";
119
120     System.out.println();
121     String str5 = "";
122     int num5, num6;
123     double num7;
124 ▼   for(int l=0;l<ipr.length();l++){
125       if(ipr.charAt(l) == ('/')){
126           str5 = ipr.substring(l+1);
127       }
128   }
129

```

```

128     }
129     num5 = Integer.parseInt(str5);
130     num6 = 32-num5;
131     num7 = Math.pow(2,(num6));
132     System.out.println("Number of Addresses: " + num7 );
133     System.out.println("IP address CIDR format is:" + ipr);
134     String[] str1 = ipr.split("/");
135     String tr = str1[0];
136     str = tr.split("\\.");
137
138     int[] b = new int[32];
139
140     System.out.println();
141     b = bina(str);
142
143     int n = Integer.parseInt(str1[1]);
144     int[] ntwk = new int[32];
145     int[] brd = new int[32];
146     int t = 32 - n;
147     for (i = 0; i <= (31 - t); i++) {
148
149         ntwk[i] = b[i];
150         brd[i] = b[i];
151     }
152     for (i = 31; i > (31 - t); i--) {
153
154         ntwk[i] = 0;
155     }
156     for (i = 31; i > (31 - t); i--) {
157
158         brd[i] = 1;
159     }
160
161     System.out.println();
162     char c = cls(str);
163     System.out.println("Class : " + c);
164     int[] nt = deci(ntwk);
165     int[] br = deci(brd);
166     System.out.println("Network Address : " + nt[0]
167         + "." + nt[1] + "." + nt[2] + "." + nt[3]);
168     System.out.println("Broadcast Address : "
169         + br[0] + "." + br[1] + "." + br[2] + "." + br[3]);
170 }
171 }

```

### Output Screenshots :

```
Number of Addresses: 256.0
IP address CIDR format is:192.168.1.1/24

Class : C
Network Address : 192.168.1.0
Broadcast Address : 192.168.1.255

...Program finished with exit code 0
Press ENTER to exit console.█
```

### Question 3:

Implement the following scenario:

An ISP is granted a block of addresses starting with 190.100.0.0/16 (65,536 addresses). The ISP needs to distribute these addresses to three groups of customers as follows:

- a. The first group has 64 customers; each need 256 addresses.
- b. The second group has 128 customers; each need 128 addresses.
- c. The third group has 128 customers; each need 64 addresses.

Design and Implement the subblocks and find out how many addresses are still available after these allocations.

### Aim :

To design and implement the subblocks and find out how many addresses are still available after these allocations in any programming language and display the output for the same.

### Code Text :

```
#include <stdio.h>
#include <math.h>
int main()
{
    printf("KULVIR SINGH (19BCE2074)\n");
    int i,subnets;
    int ip1,ip2,ip3,ip4;
    // Network Address
    printf("Enter network address in dotted decimal: ");
    scanf("%d",&ip1);
    scanf("%d",&ip2);
    scanf("%d",&ip3);
    scanf("%d",&ip4);
    // Number of subnets
    printf("Enter number of subnets: ");
    scanf("%d",&subnets);
    int extra_ones = (int)(log(subnets)/log(2));
    int no_of_ones; // Number of ones in default mask
    char class;
    if(ip1<=170)
    {class='A';
    no_of_ones = 8;
    }
    else if(ip1<=190)
    {class='B';
    no_of_ones = 16;
```



```

}
else
{class='C';
no_of_ones = 24;
}
// Subnet Mask
char default_mask[32],subnet_mask[32];
int j=0;
for(i=0;i<32;i++)
{
    if (i<no_of_ones)
    {subnet_mask[i] = '1';
    default_mask[i]='1';}
    else if (j<extra_ones)
    {
        default_mask[i]='0';
        subnet_mask[i] = '1';
        j+=1;
    }
    else
    {default_mask[i]='0';
    subnet_mask[i]='0';}
}
printf("Default Mask: ");
for(i=0;i<32;i++)
{
    printf("%c",default_mask[i]);
    if(i%8==7)
        printf(" ");
}
printf("\nSubnet Mask: ");
for(i=0;i<32;i++)
{
    printf("%c",subnet_mask[i]);
    if(i%8==7)
        printf(" ");
}
// Addressess per subnet
int addresses_per_subnet = pow(2,32 - (no_of_ones + extra_ones));
printf("\nNumber of address per subnet: %d",addresses_per_subnet);
// Range of addressess
printf("\nRange of Addressess\n");
while(subnets>0)
{
    subnets-=1;
    printf("%d %d %d %d --->",ip1,ip2,ip3,ip4);
    ip4+=addresses_per_subnet-1;
    printf("%d %d %d %d \n",ip1,ip2,ip3,ip4);
}

```

```

        ip4+=1;
        if (ip4==256)
        {
            ip4=0;
            ip3+=1;
            if(ip3==256)
            {
                ip3=0;
                ip2+=1;
                if(ip2==256)
                {
                    ip2=0;
                    ip1+=1;
                }
            }
        }
    }
    return 0;
}

```

## Code Screenshots :

```

1  #include <stdio.h>
2  #include <math.h>
3  int main()
4  {
5      printf("KULVIR SINGH (19BCE2074)\n");
6      int i,subnets;
7      int ip1,ip2,ip3,ip4;
8      // Network Address
9      printf("Enter network address in dotted decimal: ");
10     scanf("%d",&ip1);
11     scanf("%d",&ip2);
12     scanf("%d",&ip3);
13     scanf("%d",&ip4);
14     // Number of subnets
15     printf("Enter number of subnets: ");
16     scanf("%d",&subnets);
17     int extra_ones = (int)(log(subnets)/log(2));
18     int no_of_ones; // Number of ones in default mask
19     char class;
20     if(ip1<=170)
21     {class='A';
22     no_of_ones = 8;
23     }
24     else if(ip1<=190)
25     {class='B';
26     no_of_ones = 16;
27     }
28     else
29     {class='C';
30     no_of_ones = 24;
31     }
32     // Subnet Mask
33     char default_mask[32],subnet_mask[32];
34     int j=0;
35     for(i=0;i<32;i++)
36     {
37         if (i<no_of_ones)
38         {subnet_mask[i] = '1';
39         default_mask[i]='1';}
40         else if (j<extra_ones)
41         {
42             default_mask[i]='0';
43             subnet_mask[i] = '1';
44             j+=1;

```

```

44         j++;
45     }
46     else
47     {default_mask[i]='0';
48       subnet_mask[i]='0';}
49 }
50 printf("Default Mask: ");
51 for(i=0;i<32;i++)
52 {
53     printf("%c",default_mask[i]);
54     if(i%8==7)
55         printf(" ");
56 }
57 printf("\nSubnet Mask: ");
58 for(i=0;i<32;i++)
59 {
60     printf("%c",subnet_mask[i]);
61     if(i%8==7)
62         printf(" ");
63 }
64 // Addressess per subnet
65 int addresses_per_subnet = pow(2,32 - (no_of_ones + extra_ones));
66 printf("\nNumber of address per subnet: %d",addresses_per_subnet);
67 // Range of addressess
68 printf("\nRange of Addressess\n");
69 while(subnets>0)
70 {
71     subnets--;
72     printf("%d %d %d %d --->",ip1,ip2,ip3,ip4);
73     ip4+=addresses_per_subnet-1;
74     printf("%d %d %d %d \n",ip1,ip2,ip3,ip4);
75     ip4+=1;
76     if (ip4==256)
77     {
78         ip4=0;
79         ip3+=1;
80         if(ip3==256)

```

```

80     if(ip3==256)
81     {
82         ip3=0;
83         ip2+=1;
84         if(ip2==256)
85         {
86             ip2=0;
87             ip1+=1;
88         }
89     }
90 }
91 }
92 return 0;
93 }

```

[illegible]