Experiment 9

CRC and Hamming Code

A. Write a C/C++ program to generate codeword at the sender using CRC method

```
#include<stdio.h>

#include<string.h>

#define N strlen(g)

char t[28],cs[28],g[30];

int a,e,c;

voidexor()

{

        for(c = 1;c < N; c++)

        cs[c] = (( cs[c] == g[c])?'0':'1');

}


voidcrc()

{

        for(e=0;e<N;e++)    cs[e]=t[e];

        do{

                if(cs[0]=='1')  exor();

                for(c=0;c<N-1;c++)

        cs[c]=cs[c+1];

                cs[c]=t[e++];
        }while(e<=a+N-1);
}


int main()
{
        printf("\nEnter data : ");
        scanf("%s",t);
        printf("\n----------------------------------------");
        printf("\nEnterGenerating polynomial in binary : ");
        scanf("%s",g);
        a=strlen(t);
        for(e=a;e<a+N-1;e++)    t[e]='0';
        printf("\n----------------------------------------");
        printf("\nAugmenteddataword : %s",t);
        printf("\n----------------------------------------");
        crc();
        printf("\nChecksum is : %s",cs);
        for(e=a;e<a+N-1;e++)    t[e]=cs[e-a];
        printf("\n----------------------------------------");
        printf("\nFinalcodeword is : %s",t);
        printf("\n----------------------------------------\n\n");
        return 0;
}
```

B. Write a C/C++ program to generate Hamming code at the sender

```
#include<stdio.h>

#include<stdlib.h>

#include<conio.h>

#include <string.h>

#include <math.h>

#include<iostream>


int main(void)

{

        unsignedint m=0,r=0,l=0,x1=1,x2=1,x0=0;

        char d[1024]= {0};

        int d1[1024],d2[1024];

        printf("Enter the message to be encoded, in binary format: ");

        scanf ("%s",&d);

        //Message Length

         m=strlen(d);


        //Check bits (r)

        for (inti=0; i<20; i++)

        {

                r=i;

                if(m+1+i <= pow(2,i))
                break;
        }

        //Codeword length (l)
        l =m+r;

        //Testing the input in binary
        for (inti=0; i<m; i++)
        {
                while (!( d[i]=='0' || d[i]=='1'))
                {
                printf("\nPlease enter the input message in binary only.\n");
                exit(0);
                }
        }

        printf ("\nMessage length (m) = %d\n",m);
        printf ("Redundancy bits (r) = %d\n",r);
        printf("Codewordlength (l) = %d\n",l);

        //Initialization to zero
        for (inti=m; i<1024;i++)
                d[i]='0';
        for (inti=0; i<1024; i++)
```

```
    {   d1[i]=0;    d2[i]=0; }

    //Copying string array to intarray, also shifting start index from 0 to 1
    for (inti=0; i<m+1; i++)
    {
    if (d[i]=='1')  d1[i+1]=1;
    else            d1[i+1]=0;
    }

    //Shifting message bits into non parity positions
    for (int x2=1; x2<m+r+1; x2++)
    {
        float x = (log(x2)/log(2))-(int(log(x2)/log(2)));
        if(x==0 || x==1)
        {   d2[x2]=0; x0=x0+1;  }
        else    d2[x2]=d1[x2-x0];
    }

//Finding parity bits
    for(int x2=1; x2<m+r+1; x2++)
    {
        int x2t=x2;
        for(inti=0; i<r; i++)
        {
                intipow=pow(2,i);

                if (x2t%2==1)

                d2[ipow]=d2[ipow] ^ d2[x2];

                x2t=x2t/2;

                }

        }


        printf("Code word: ");

        for (intI =1; i<m+r+1; i++)

                printf ("%d",d2[i]);

        printf("\n\n");

}
```

Exercise: Write a C/C++ program to decode the code words at the receiver using CRC and Hamming code.