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Class	**: Third Year (2015 Course)**
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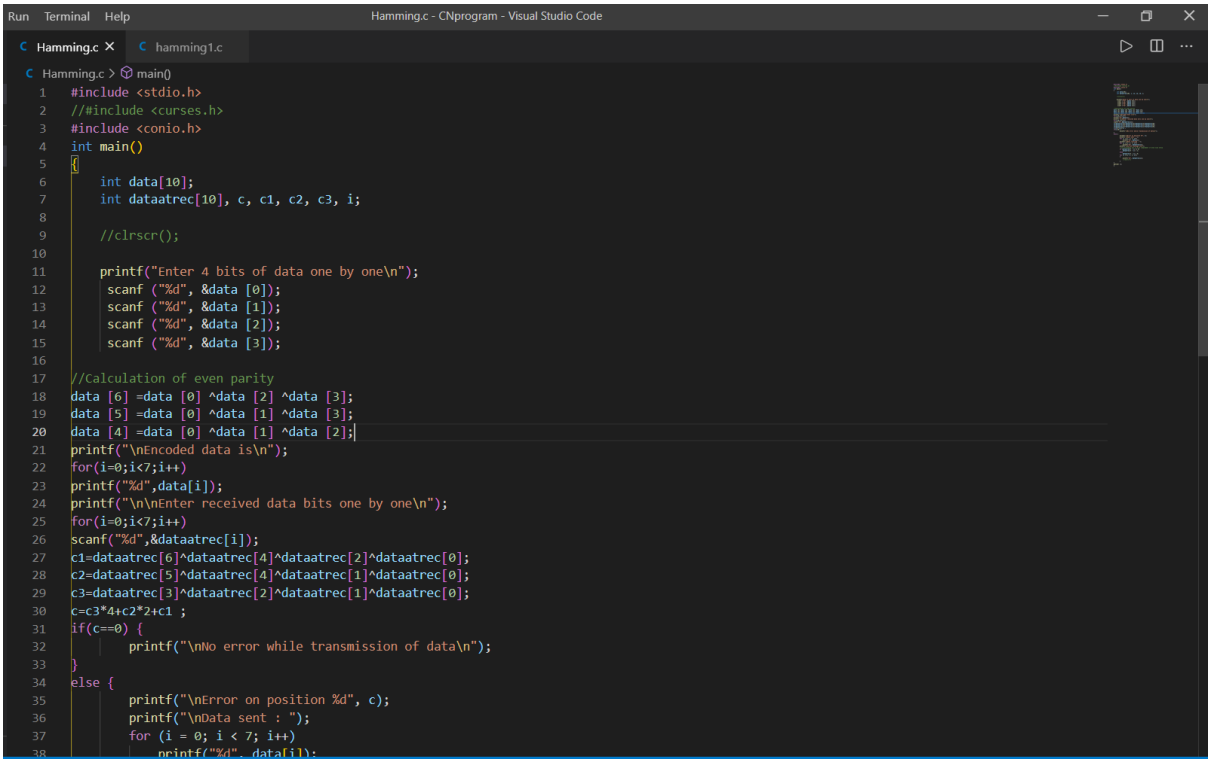
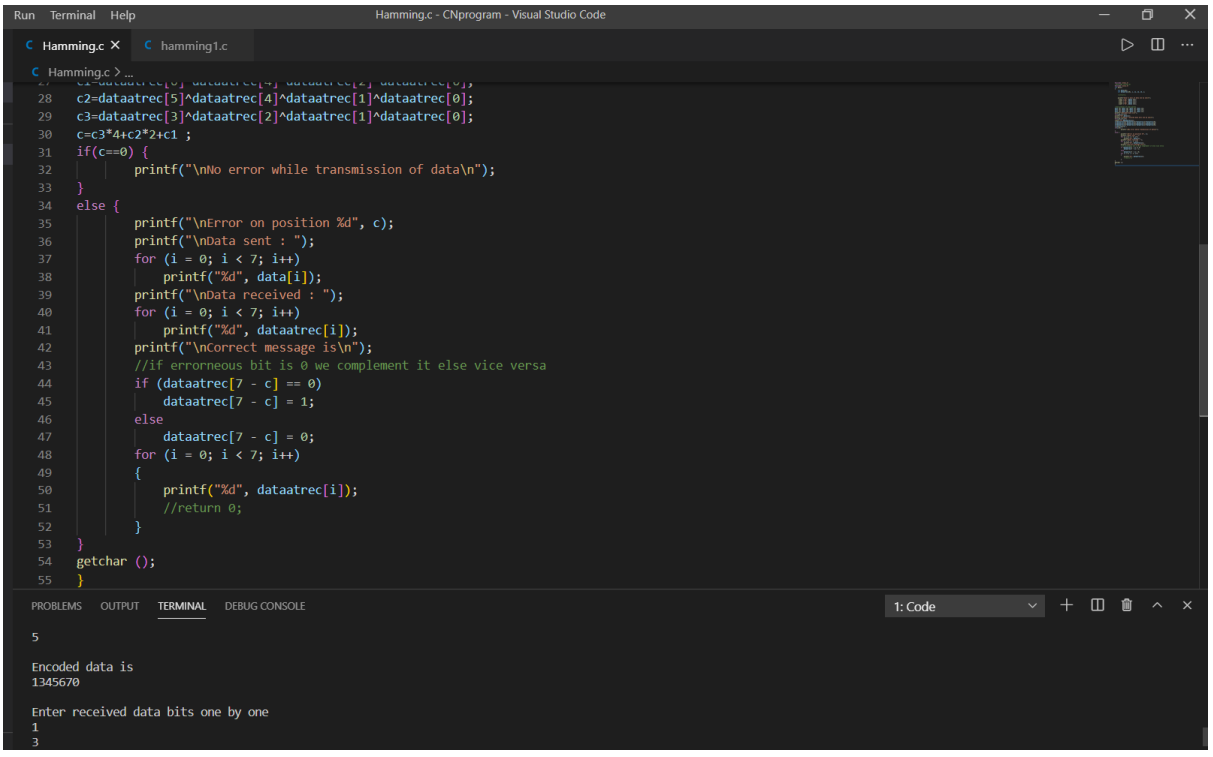
1. A) Program name: Hamming

```
#include <stdio.h>
//#include <curses.h>
#include <conio.h>
int main()
{
   int data[10];
   int dataatrec[10], c, c1, c2, c3, i;

   //clrscr();

   printf("Enter 4 bits of data one by one\n");
    scanf ("%d", &data [0]);
    scanf ("%d", &data [1]);
    scanf ("%d", &data [2]);
    scanf ("%d", &data [3]);

//Calculation of even parity
data [6] =data [0] ^data [2] ^data [3];
data [5] =data [0] ^data [1] ^data [3];
data [4] =data [0] ^data [1] ^data [2];
printf("\nEncoded data is\n");
for(i=0;i<7;i++)
printf("%d",data[i]);
printf("\n\nEnter received data bits one by one\n");
for(i=0;i<7;i++)
scanf("%d",&dataatrec[i]);
c1=dataatrec[6]^dataatrec[4]^dataatrec[2]^dataatrec[0];
c2=dataatrec[5]^dataatrec[4]^dataatrec[1]^dataatrec[0];
c3=dataatrec[3]^dataatrec[2]^dataatrec[1]^dataatrec[0];
c=c3*4+c2*2+c1 ;
if(c==0) {
```

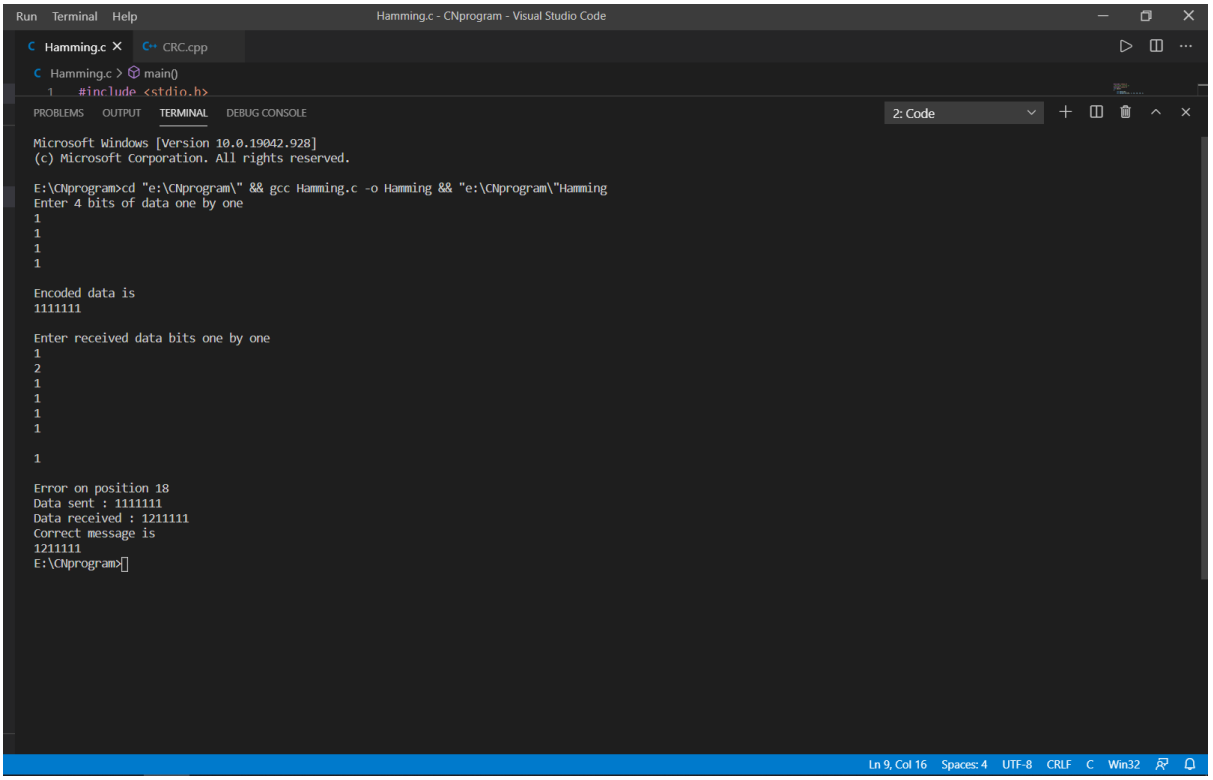
```
        printf("\nNo error while transmission of data\n");
}
else {
        printf("\nError on position %d", c);
        printf("\nData sent : ");
        for (i = 0; i < 7; i++)
            printf("%d", data[i]);
        printf("\nData received : ");
        for (i = 0; i < 7; i++)
            printf("%d", dataatrec[i]);
        printf("\nCorrect message is\n");
        //if errorneous bit is 0 we complement it else vice versa
        if (dataatrec[7 - c] == 0)
            dataatrec[7 - c] = 1;
        else
            dataatrec[7 - c] = 0;
        for (i = 0; i < 7; i++)
        {
            printf("%d", dataatrec[i]);
            //return 0;
        }
}
getchar ();
}
```

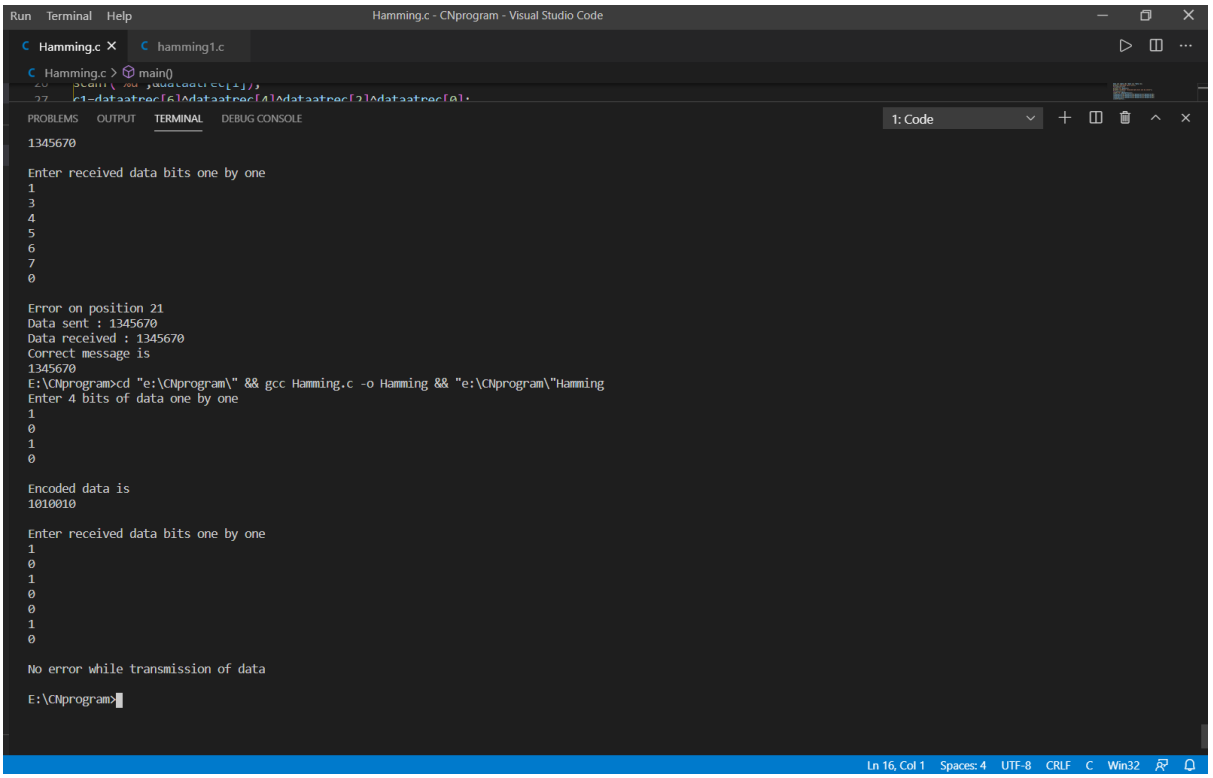
Code:


Run Terminal Help
Hamming.c - CNprogram - Visual Studio Code
Hamming.c
hamming1.c
Hamming.c > main()
#include <stdio.h>
//#include <curses.h>
#include <conio.h>
int main()
{
int data[10];
int dataatrec[10], c, c1, c2, c3, i;
//clrscr();
printf("Enter 4 bits of data one by one\n");
scanf ("%d", &data [0]);
scanf ("%d", &data [1]);
scanf ("%d", &data [2]);
scanf ("%d", &data [3]);
//Calculation of even parity
data [6] =data [0] ^data [2] ^data [3];
data [5] =data [0] ^data [1] ^data [3];
data [4] =data [0] ^data [1] ^data [2];
printf("\nEncoded data is\n");
for(i=0;i<7;i++)
printf("%d",data[i]);
printf("\n\nEnter received data bits one by one\n");
for(i=0;i<7;i++)
scanf("%d",&dataatrec[i]);
c1=dataatrec[6]^dataatrec[4]^dataatrec[2]^dataatrec[0];
c2=dataatrec[5]^dataatrec[4]^dataatrec[1]^dataatrec[0];
c3=dataatrec[3]^dataatrec[2]^dataatrec[1]^dataatrec[0];
c=c3*4+c2*2+c1 ;
if(c==0) {
printf("\nNo error while transmission of data\n");
}
else {
printf("\nError on position %d", c);
printf("\nData sent : ");
for (i = 0; i < 7; i++)


Run Terminal Help
Hamming.c - CNprogram - Visual Studio Code
Hamming.c
hamming1.c
c2=dataatrec[5]^dataatrec[4]^dataatrec[1]^dataatrec[0];
c3=dataatrec[3]^dataatrec[2]^dataatrec[1]^dataatrec[0];
c=c3*4+c2*2+c1 ;
if(c==0) {
printf("\nNo error while transmission of data\n");
}
else {
printf("\nError on position %d", c);
printf("\nData sent : ");
for (i = 0; i < 7; i++)
printf("%d", data[i]);
printf("\nData received : ");
for (i = 0; i < 7; i++)
printf("%d", dataatrec[i]);
printf("\nCorrect message is\n");
//if errorneous bit is 0 we complement it else vice versa
if (dataatrec[7 - c] == 0)
dataatrec[7 - c] = 1;
else
dataatrec[7 - c] = 0;
for (i = 0; i < 7; i++)
{
printf("%d", dataatrec[i]);
//return 0;
}
}
getchar ();
}
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
1: Code
5
Encoded data is
1345670
Enter received data bits one by one
1
3

OUTPUT:


Run Terminal Help
Hamming.c - CNprogram - Visual Studio Code
Hamming.c
CRC.cpp
Hamming.c > main()
#include <stdio.h>
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
2: Code
Microsoft Windows [Version 10.0.19042.928]
(c) Microsoft Corporation. All rights reserved.
E:\CNprogram>cd "e:\CNprogram\" && gcc Hamming.c -o Hamming && "e:\CNprogram\"Hamming
Enter 4 bits of data one by one
1
1
1
1
Encoded data is
1111111
Enter received data bits one by one
1
2
1
1
1
1
1
Error on position 18
Data sent : 1111111
Data received : 1211111
Correct message is
1211111
E:\CNprogram>
Ln 9, Col 16 Spaces: 4 UTF-8 CRLF C Win32


Run Terminal Help
Hamming.c - CNprogram - Visual Studio Code
Hamming.c
hamming1.c
Hamming.c > main()
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
1: Code
1345670
Enter received data bits one by one
1
3
4
5
6
7
0
Error on position 21
Data sent : 1345670
Data received : 1345670
Correct message is
1345670
E:\CNprogram>cd "e:\CNprogram\" && gcc Hamming.c -o Hamming && "e:\CNprogram\"Hamming
Enter 4 bits of data one by one
1
0
1
0
Encoded data is
1010010
Enter received data bits one by one
1
0
1
0
0
1
0
No error while transmission of data
E:\CNprogram>
Ln 16, Col 1 Spaces: 4 UTF-8 CRLF C Win32

B) CRC CODE

```
#include <iostream>
using namespace std;
int main()
{
   int i, j, k, l;
   //Get Frame
   int fs;
   cout << "\n Enter Size of data: ";
   cin >> fs;
   int f[20];
   cout << " Enter data:";
   for (i = 0; i < fs; i++)
   {
      cin >> f[i];
   }
   //Get Generator
   int gs;
   cout << "\n Enter key size: ";
   cin >> gs;
   int g[20];
   cout << "\n Enter key:";
   for (i = 0; i < gs; i++)
   {
      cin >> g[i];
   }
   cout << "\n Sender Side:";
   cout << "\n data: ";
   for (i = 0; i < fs; i++)
   {
      cout << f[i];
   }
   cout << "\n key :";
   for (i = 0; i < gs; i++)
```

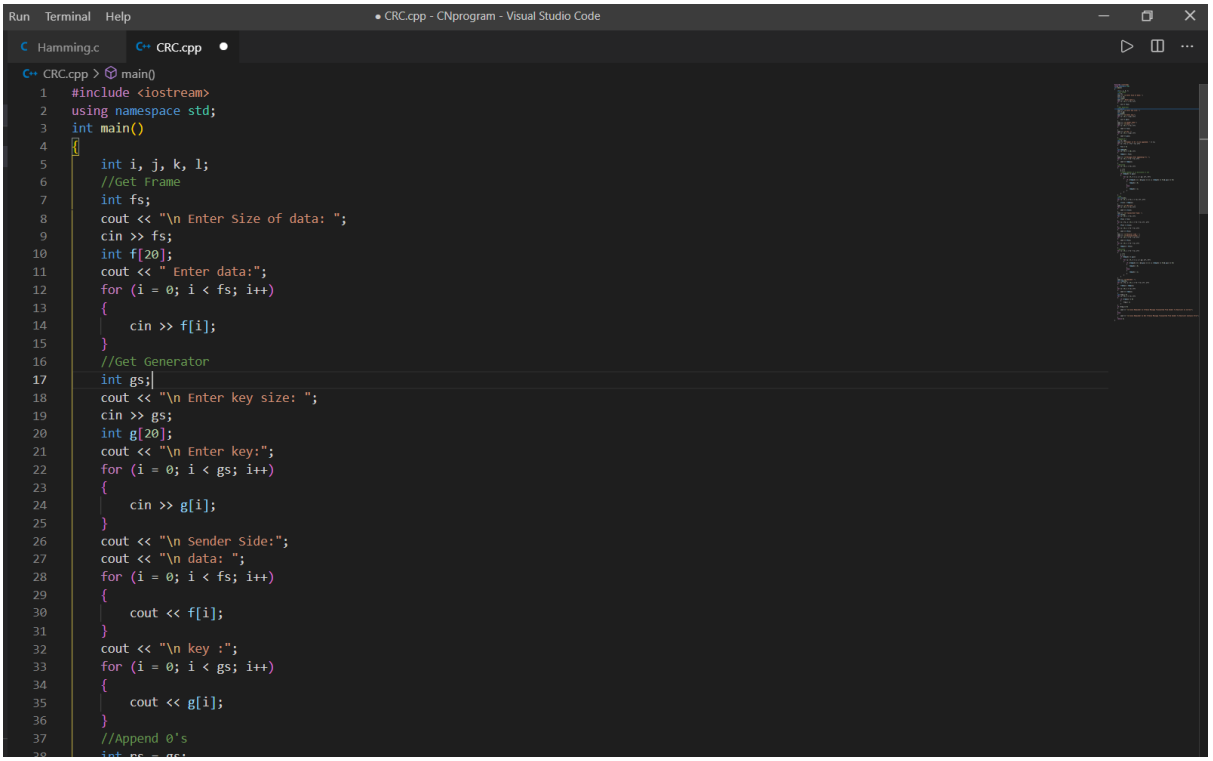
```
    {
        cout << g[i];
    }
    //Append 0's
    int rs = gs;
    cout << "\n Number of 0's to be appended: " << rs;
    for (i = fs; i < fs + rs; i++)
    {
        f[i] = 0;
    }
    int temp[20];
    for (i = 0; i < 20; i++)
    {
        temp[i] = f[i];
    }
    cout << "\n Message after appending 0's :";
    for (i = 0; i < fs + rs; i++)
    {
        cout << temp[i];
    }
    //Division
    for (i = 0; i < fs; i++)
    {
        j = 0;
        k = i;
        //check whether it is divisible or not
        if (temp[k] >= g[j])
        {
            for (j = 0, k = i; j < gs; j++, k++)
            {
                if ((temp[k] == 1 && g[j] == 1) || (temp[k] == 0 && g[j]
== 0))
                {
                    temp[k] = 0;
                }
```

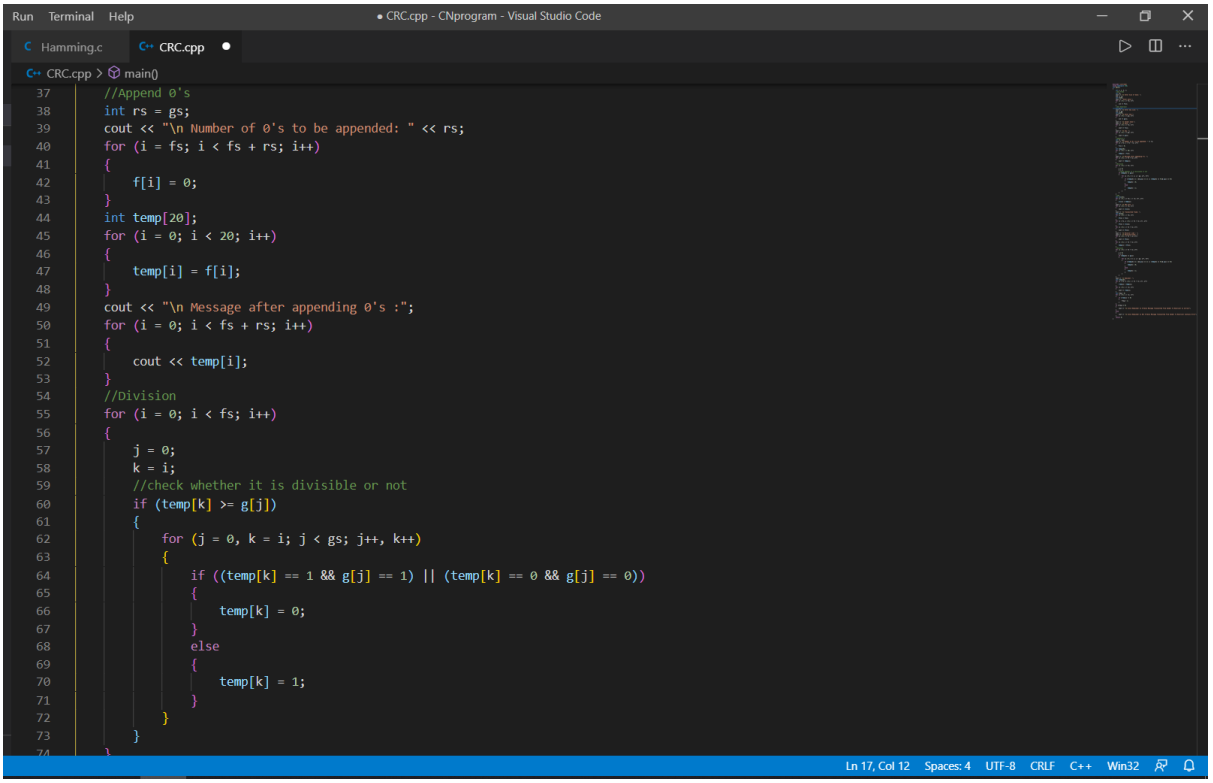
```
            else
            {
                temp[k] = 1;
            }
        }
    }
}
//CRC
int crc[15];
for (i = 0, j = fs; i < rs; i++, j++)
{
    crc[i] = temp[j];
}
cout << "\n CRC bits: ";
for (i = 0; i < rs; i++)
{
    cout << crc[i];
}
cout << "\n Transmitted Frame: ";
int tf[15];
for (i = 0; i < fs; i++)
{
    tf[i] = f[i];
}
for (i = fs, j = 0; i < fs + rs; i++, j++)
{
    tf[i] = crc[j];
}
for (i = 0; i < fs + rs; i++)
{
    cout << tf[i];
}
cout << "\n Receiver side : ";
cout << "\n Received Frame: ";
for (i = 0; i < fs + rs; i++)
```

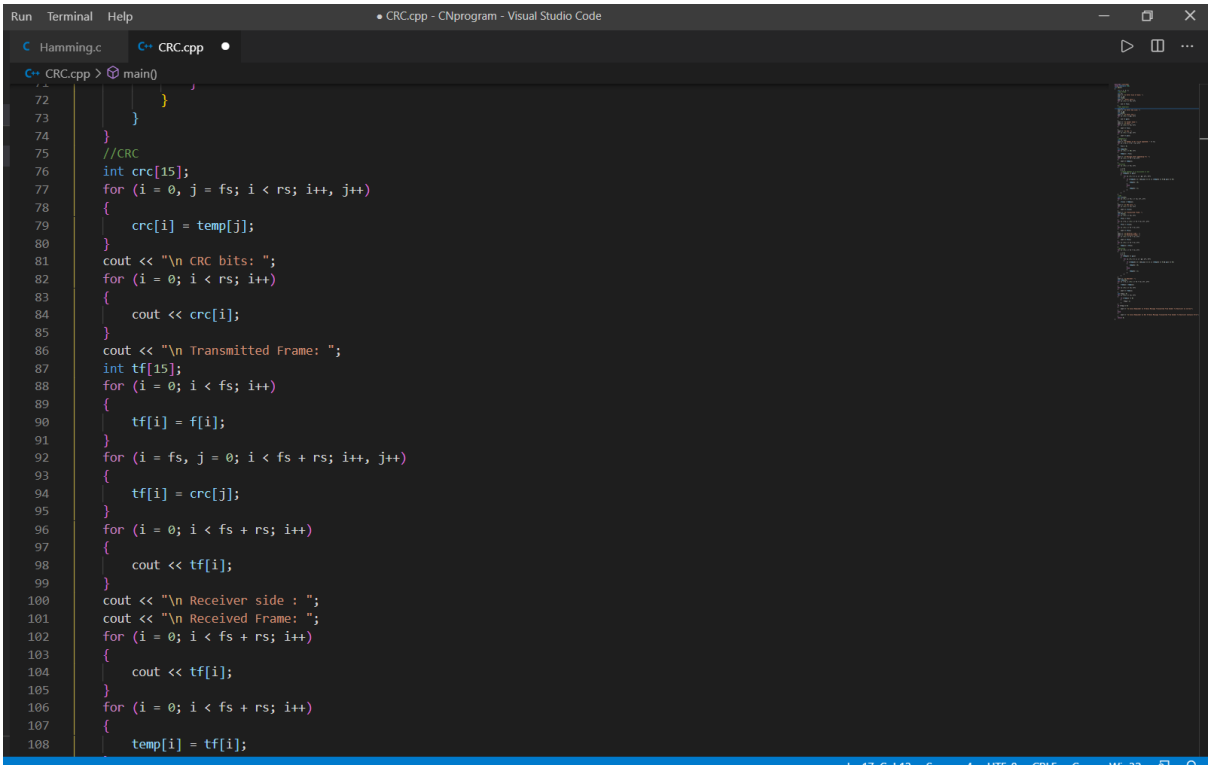
```
    {
        cout << tf[i];
    }
    for (i = 0; i < fs + rs; i++)
    {
        temp[i] = tf[i];
    }
    //Division
    for (i = 0; i < fs + rs; i++)
    {
        j = 0;
        k = i;
        if (temp[k] >= g[j])
        {
            for (j = 0, k = i; j < gs; j++, k++)
            {
                if ((temp[k] == 1 && g[j] == 1) || (temp[k] == 0 && g[j]
== 0))
                {
                    temp[k] = 0;
                }
                else
                {
                    temp[k] = 1;
                }
            }
        }
    }
    cout << "\n Reminder: ";
    int rrem[15];
    for (i = fs, j = 0; i < fs + rs; i++, j++)
    {
        rrem[j] = temp[i];
    }
    for (i = 0; i < rs; i++)
```

```
    {
        cout << rrem[i];
    }
    int flag = 0;
    for (i = 0; i < rs; i++)
    {
        if (rrem[i] != 0)
        {
            flag = 1;
        }
    }
    if (flag == 0)
    {
        cout << "\n Since Remainder Is 0 Hence Message
Transmitted From Sender To Receriver Is Correct";
    }
    else
    {
        cout << "\n Since Remainder Is Not 0 Hence Message
Transmitted From Sender To Receriver Contains Error";
    }
    return 0;
}
```

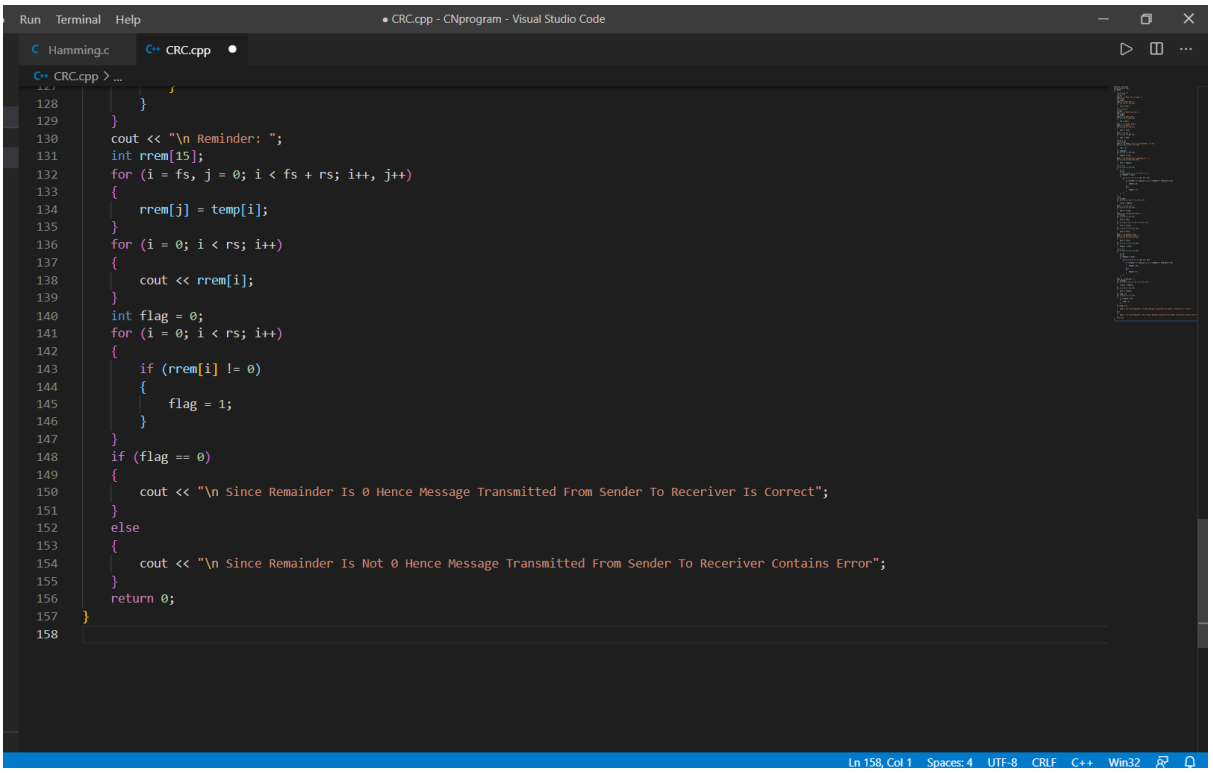
CODE:


Run Terminal Help
• CRC.cpp - CNprogram - Visual Studio Code
Hamming.c
CRC.cpp
CRC.cpp > main()
#include <iostream>
using namespace std;
int main()
{
int i, j, k, l;
//Get Frame
int fs;
cout << "\n Enter Size of data: ";
cin >> fs;
int f[20];
cout << " Enter data:";
for (i = 0; i < fs; i++)
{
cin >> f[i];
}
//Get Generator
int gs;
cout << "\n Enter key size: ";
cin >> gs;
int g[20];
cout << "\n Enter key:";
for (i = 0; i < gs; i++)
{
cin >> g[i];
}
cout << "\n Sender Side:";
cout << "\n data: ";
for (i = 0; i < fs; i++)
{
cout << f[i];
}
cout << "\n key :";
for (i = 0; i < gs; i++)
{
cout << g[i];
}
//Append 0's


Run Terminal Help
• CRC.cpp - CNprogram - Visual Studio Code
Hamming.c
CRC.cpp
CRC.cpp > main()
//Append 0's
int rs = gs;
cout << "\n Number of 0's to be appended: " << rs;
for (i = fs; i < fs + rs; i++)
{
f[i] = 0;
}
int temp[20];
for (i = 0; i < 20; i++)
{
temp[i] = f[i];
}
cout << "\n Message after appending 0's :";
for (i = 0; i < fs + rs; i++)
{
cout << temp[i];
}
//Division
for (i = 0; i < fs; i++)
{
j = 0;
k = i;
//check whether it is divisible or not
if (temp[k] >= g[j])
{
for (j = 0, k = i; j < gs; j++, k++)
{
if ((temp[k] == 1 && g[j] == 1) || (temp[k] == 0 && g[j] == 0))
{
temp[k] = 0;
}
else
{
temp[k] = 1;
}
}
}
}
Ln 17, Col 12 Spaces: 4 UTF-8 CRLF C++ Win32

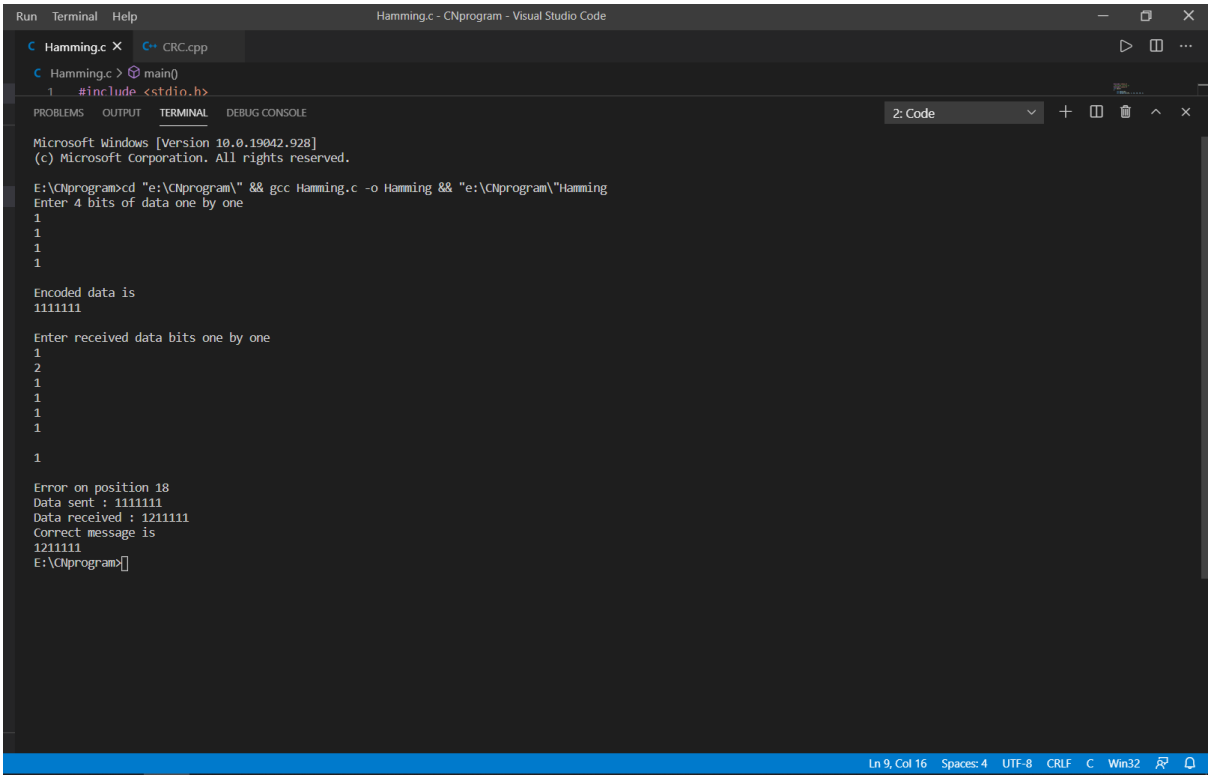


```
Run Terminal Help • CRC.cpp - CNprogram - Visual Studio Code
Hamming.c CRC.cpp
CRC.cpp > main()
72              }
73          }
74      }
75      //CRC
76      int crc[15];
77      for (i = 0, j = fs; i < rs; i++, j++)
78      {
79          crc[i] = temp[j];
80      }
81      cout << "\n CRC bits: ";
82      for (i = 0; i < rs; i++)
83      {
84          cout << crc[i];
85      }
86      cout << "\n Transmitted Frame: ";
87      int tf[15];
88      for (i = 0; i < fs; i++)
89      {
90          tf[i] = f[i];
91      }
92      for (i = fs, j = 0; i < fs + rs; i++, j++)
93      {
94          tf[i] = crc[j];
95      }
96      for (i = 0; i < fs + rs; i++)
97      {
98          cout << tf[i];
99      }
100     cout << "\n Receiver side : ";
101     cout << "\n Received Frame: ";
102     for (i = 0; i < fs + rs; i++)
103     {
104         cout << tf[i];
105     }
106     for (i = 0; i < fs + rs; i++)
107     {
108         temp[i] = tf[i];
```



```
Run Terminal Help • CRC.cpp - CNprogram - Visual Studio Code
Hamming.c CRC.cpp
CRC.cpp > ...
128             }
129         }
130         cout << "\n Reminder: ";
131         int rrem[15];
132         for (i = fs, j = 0; i < fs + rs; i++, j++)
133         {
134             rrem[j] = temp[i];
135         }
136         for (i = 0; i < rs; i++)
137         {
138             cout << rrem[i];
139         }
140         int flag = 0;
141         for (i = 0; i < rs; i++)
142         {
143             if (rrem[i] != 0)
144             {
145                 flag = 1;
146             }
147         }
148         if (flag == 0)
149         {
150             cout << "\n Since Remainder Is 0 Hence Message Transmitted From Sender To Receiver Is Correct";
151         }
152         else
153         {
154             cout << "\n Since Remainder Is Not 0 Hence Message Transmitted From Sender To Receiver Contains Error";
155         }
156         return 0;
157     }
158
Ln 158, Col 1 Spaces: 4 UTF-8 CRLF C++ Win32
```

OUTPUT:


Run Terminal Help
Hamming.c - CNprogram - Visual Studio Code
Hamming.c
CRC.cpp
Hamming.c > main()
#include <stdio.h>
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
2: Code
Microsoft Windows [Version 10.0.19042.928]
(c) Microsoft Corporation. All rights reserved.
E:\CNprogram>cd "e:\CNprogram\" && gcc Hamming.c -o Hamming && "e:\CNprogram\"Hamming
Enter 4 bits of data one by one
1
1
1
1
Encoded data is
1111111
Enter received data bits one by one
1
2
1
1
1
1
1
Error on position 18
Data sent : 1111111
Data received : 1211111
Correct message is
1211111
E:\CNprogram>
Ln 9, Col 16 Spaces: 4 UTF-8 CRLF C Win32