

MODERN OPERATING SYSTEM AND COMPUTER NETWORK

ASSIGNMENT -3

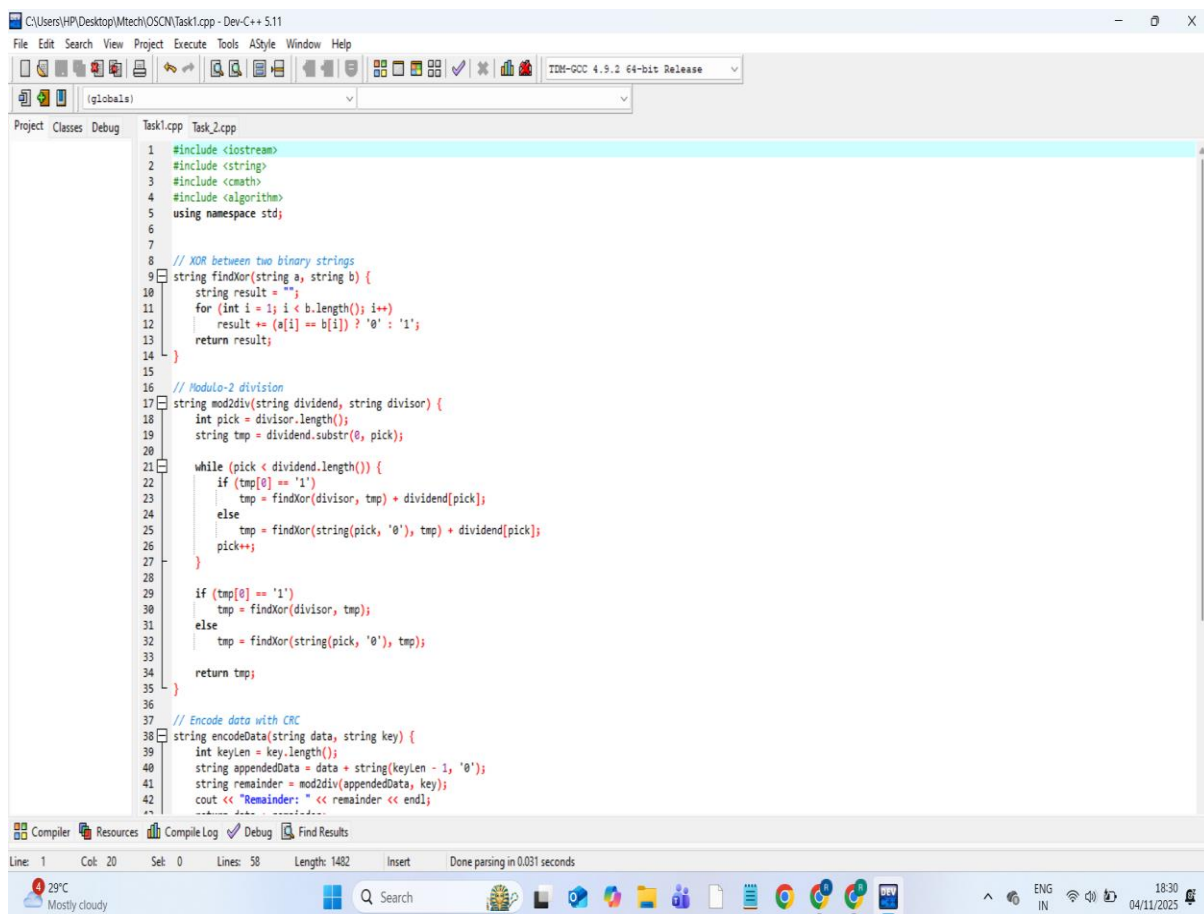
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Task:1

Problem-01:

A bit stream 1101011011 is transmitted using the standard CRC method. The generator polynomial is $x^4 + x + 1$. What is the actual bit string transmitted?

CODE AND COMPILATION RESULTS:



```
1 #include <iostream>
2 #include <string>
3 #include <cmath>
4 #include <algorithm>
5 using namespace std;
6
7 // XOR between two binary strings
8 string findXor(string a, string b) {
9     string result = "";
10    for (int i = 0; i < b.length(); i++)
11        result += (a[i] == b[i]) ? '0' : '1';
12    return result;
13 }
14
15 // Modulo-2 division
16 string mod2div(string dividend, string divisor) {
17     int pick = divisor.length();
18     string tmp = dividend.substr(0, pick);
19
20     while (pick < dividend.length()) {
21         if (tmp[0] == '1')
22             tmp = findXor(divisor, tmp) + dividend[pick];
23         else
24             tmp = findXor(string(pick, '0'), tmp) + dividend[pick];
25         pick++;
26     }
27
28     if (tmp[0] == '1')
29         tmp = findXor(divisor, tmp);
30     else
31         tmp = findXor(string(pick, '0'), tmp);
32
33     return tmp;
34 }
35
36 // Encode data with CRC
37 string encodeData(string data, string key) {
38     int keylen = key.length();
39     string appendedData = data + string(keylen - 1, '0');
40     string remainder = mod2div(appendedData, key);
41     cout << "Remainder: " << remainder << endl;
42     return data + remainder;
43 }
```

Compiler Resources Compile Log Debug Find Results

Line: 1 Col: 20 Sel: 0 Lines: 58 Length: 1482 Insert Done parsing in 0.031 seconds

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The screenshot shows a C++ IDE with the following code in `Task1.cpp`:

```

27 }
28
29 if (tmp[0] == '1')
30     tmp = findKor(divisor, tmp);
31 else
32     tmp = findKor(string(pick, '0'), tmp);
33
34 return tmp;
35 }
36
37 // Encode data with CRC
38 string encodeData(string data, string key) {
39     int keylen = key.length();
40     string appendedData = data + string(keylen - 1, '0');
41     string remainder = mod2div(appendedData, key);
42     cout << "Remainder: " << remainder << endl;
43     return data + remainder;
44 }
45
46 int main() {
47     string data = "1101011011";
48     string key = "10011"; // x^4 + x + 1
49
50     cout << "=== TASK 1 ===" << endl;
51     cout << "Data: " << data << endl;
52     cout << "Key: " << key << endl;
53
54     string codeword = encodeData(data, key);
55     cout << "Transmitted Codeword: " << codeword << endl;
56
57     return 0;
58 }

```

The compilation results window shows:

```

Compilation results...
-----
- Errors: 0
- Warnings: 0
- Output Filename: C:\Users\HP\Desktop\Mtech\OSCN\Task1.exe
- Output Size: 1.83922386169434 MiB
- Compilation Time: 0.77s

```

OUTPUT:

```

C:\Users\HP\Desktop\Mtech\ >
=== TASK 1 ===
Data: 1101011011
Key: 10011
Remainder: 1110
Transmitted Codeword: 1101011011110

-----
Process exited after 0.2776 seconds with return value 0
Press any key to continue . . .

```

Task:2

Problem-02:

A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is x^3+1 . 1. What is the actual bit string transmitted? 2. Suppose the third bit from the left is inverted during transmission. How will receiver detect this error?

CODE AND COMPILATION RESULTS:

C:\Users\HP\Desktop\Mtech\OSCN\Task_2.cpp - [Executing] - Dev-C++ 5.11

File Edit Search View Project Execute Tools AStyle Window Help

(globals)

Project Classes Debug Task1.cpp Task_2.cpp

```
1 #include <iostream>
2 #include <string>
3 #include <cmath>
4 #include <algorithm>
5 using namespace std;
6
7
8 // XOR between two binary strings
9 string findXor(string a, string b) {
10     string result = "";
11     for (int i = 1; i < b.length(); i++)
12         result += (a[i] == b[i]) ? '0' : '1';
13     return result;
14 }
15
16 // Modulo-2 division
17 string mod2div(string dividend, string divisor) {
18     int pick = divisor.length();
19     string tmp = dividend.substr(0, pick);
20
21     while (pick < dividend.length()) {
22         if (tmp[0] == '1')
23             tmp = findXor(divisor, tmp) + dividend[pick];
24         else
25             tmp = findXor(string(pick, '0'), tmp) + dividend[pick];
26         pick++;
27     }
28
29     if (tmp[0] == '1')
30         tmp = findXor(divisor, tmp);
31     else
32         tmp = findXor(string(pick, '0'), tmp);
33
34     return tmp;
35 }
36
37 // Encode data with CRC
38 string encodeData(string data, string key) {
39     int keyLen = key.length();
40     string appendedData = data + string(keyLen - 1, '0');
41     string remainder = mod2div(appendedData, key);
42     cout << "Remainder: " << remainder << endl;
43 }
```

Compiler Resources Compile Log Debug Find Results

Line: 1 Col: 20 Set: 0 Lines: 75 Length: 1998 Insert Done parsing in 0.031 seconds

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C:\Users\HP\Desktop\Mtech\OSCN\Task_2.cpp - Dev-C++ 5.11

File Edit Search View Project Execute Tools AStyle Window Help

(globals)

Project Classes Debug Task1.cpp Task_2.cpp

```
44 }
45
46 // Receiver check
47 bool receiverCheck(string codeword, string key) {
48     string remainder = mod2div(codeword, key);
49     return (remainder.find('1') == string::npos);
50 }
51
52 int main() {
53     string data = "10011101";
54     string key = "1001"; // x^3 + 1
55
56     cout << "=== TASK 2 ===" << endl;
57     cout << "Data: " << data << endl;
58     cout << "Key: " << key << endl;
59
60     string codeword = encodeData(data, key);
61     cout << "Transmitted Codeword: " << codeword << endl;
62
63     // Introduce error at 3rd bit
64     string received = codeword;
65     received[2] = (received[2] == '0') ? '1' : '0';
66     cout << "Received (error at bit 3): " << received << endl;
67
68     if (receiverCheck(received, key))
69         cout << "Receiver: No Error Detected" << endl;
70     else
71         cout << "Receiver: Error Detected" << endl;
72
73     return 0;
74 }
75
```

Compiler Resources Compile Log Debug Find Results Close

Compilation results...

Abort Compilation

Shorten compiler paths

- Errors: 0
- Warnings: 0
- Output Filename: C:\Users\HP\Desktop\Mtech\OSCN\Task_2.exe
- Output Size: 1.83975028991699 MiB
- Compilation Time: 0.78s

Line: 1 Col: 20 Set: 0 Lines: 75 Length: 1998 Insert Done parsing in 0.031 seconds

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OUTPUT:

```
=== TASK 2 ===  
Data: 10011101  
Key: 1001  
Remainder: 100  
Transmitted Codeword: 10011101100  
Received (error at bit 3): 10111101100  
Receiver: Error Detected  
  
-----  
Process exited after 0.2642 seconds with return value 0  
Press any key to continue . . .
```