

Computer Networks  
Assignment 4

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Implement the following datalink layer framing methods:

- 1) Bit stuffing
- 2) Character stuffing

1. Bit Stuffing:

```
/*
    Author : KRHero
    IDE: VSCode
*/

#include <bits/stdc++.h>

using namespace std;

bool validateData(string& s){
    if(!s.size()) return false;
    for(int i = 0;i<s.size();i++){
        if(s[i]!='1' && s[i]!='0') return false;
    }
    return true;
}

string frame(string& s){
    string res = "";
    int cnt = 0;
    for(int i = 0;i<s.size();i++){
        res += s[i];
        if(s[i]=='1'){
            cnt++;
        }else{
            cnt = 0;
        }
        if(cnt==5){
            res += '0';
            cnt = 0;
        }
    }
}
```

```

        return res;
    }

string deframe(string& s){
    string res = "";
    int cnt = 0;
    for(int i = 0;i<s.size();i++){
        res += s[i];
        if(s[i]=='0'){
            cnt = 0;
        }else{
            cnt++;
        }
        if(cnt==5){
            if(i+1<s.size() && s[i+1]!='0') return NULL;
            i++;
            cnt = 0;
        }
    }
    return res;
}

int main(){
    string s;
    cout<<"Enter Data to be Framed:- ";
    cin >> s;
    if(!validateData(s)){
        cout<<"Data is not valid! Please enter valid Data!";
        return 0;
    }

    string framedData = frame(s);

    cout<<"Framed Data:- "<<framedData<<endl;

    string deframedData = deframe(framedData);

    if(!deframedData){
        cout<<"Invalid Framed Data!"<<endl;
        return;
    }

    cout<<"Deframed Data:- "<<deframedData<<endl;

```

```

    if(!s.compare(deframedData)){
        cout<<"Original Data and Deframed Data matched Successfully!"<<endl;
    }else{
        cout<<"Original Data and Deframed Data did not match!"<<endl;
    }

    return 0;

}

```

## Output:

```

krhero@hellblazer:/mnt/0FB81290FB81290/BTech/Assignments/3rd_Year/CN/Assignment_5$ g++ BitStuffing.cpp
krhero@hellblazer:/mnt/0FB81290FB81290/BTech/Assignments/3rd_Year/CN/Assignment_5$ ./a.out
Enter Data to be Framed:- 011011111110011111011111111111100000
Framed Data:- 01101111101100111110011111011111000000
Deframed Data:- 0110111111001111101111111111100000
Original Data and Deframed Data matched Successfully!

```

## 2. Character Stuffing:

```
/*
    Author : KRHero
    IDE: VSCode
*/

#include <bits/stdc++.h>

#define DLE 10
#define STX 2
#define ETX 3
using namespace std;

bool validateData(string& s){
    if(!s.size()) return false;
    return true;
}

string frame(string& s){
    string res;
    res += DLE;
    res += STX;

    for(int i = 0;i<s.size();i++){
        res += s[i];
        if(s[i]==DLE) res += DLE;
    }

    res += DLE;
    res += ETX;
    return res;
}

string deframe(string& s){
    string res = "";
    if(s.size()<4) return NULL;

    if(s[0]!=DLE && s[1]!=STX) return NULL;
    if(s[s.size()-2]!=DLE && s[s.size()-1]!=ETX) return NULL;
    for(int i = 2;i<s.size()-2;i++){
        res += s[i];
    }
}
```

```

        if(s[i]==DLE){
            if(i+1<s.size() && s[i]!=DLE) return NULL;
            else{
                i++;
                continue;
            }
        }
    }

    return res;
}

void print(string& s){

    for(auto i: s) cout<<(int)i<<" ";
    cout<<endl;
}

int main(){
    string s;
    cout<<"Enter Data to be Framed:- ";
    cin >> s;
    if(!validateData(s)){
        cout<<"Data is not valid! Please enter valid Data!";
        return 0;
    }

    string framedData = frame(s);

    cout<<"Framed Data:- "<<endl;
    cout<<framedData<<endl;
    print(framedData);
    cout<<endl;

    string deframedData = deframe(framedData);

    if(deframedData.empty()){
        cout<<"Invalid Framed Data!"<<endl;
        return 0;
    }
}

```

```

cout<<"Deframed Data:- "<<endl;
cout<<deframedData<<endl;
print(deframedData);
cout<<endl;

if(!s.compare(deframedData)){
    cout<<"Original Data and Deframed Data matched Successfully!"<<endl;
}else{
    cout<<"Original Data and Deframed Data did not match!"<<endl;
}

return 0;
}

```

## Output:

```

krhero@hellblazer:/mnt/0FB81290FB81290/BTech/Assignments/3rd_Year/CN/Assignment_5$ ./a.out
Enter Data to be Framed:- asdwqewqe
Framed Data:-

asdwqewqe

10 2 97 115 100 119 113 101 119 113 101 10 3

Deframed Data:-
asdwqewqe
97 115 100 119 113 101 119 113 101

Original Data and Deframed Data matched Successfully!

```