# Cryptography and Network Security

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# Prime Factorization

```
//code by :- Piyush Mhaske
#include <bits/stdc++.h>
#define ll long long
#define ul unsigned long long
#define pb emplace_back
#define po pop_back
#define vi vector<ll>
#define vii vector<vector<ll>>
using namespace std;
void file(){
    ios_base::sync_with_stdio(false);
    cin.tie(NULL);}
ll M = 1e9 + 7;
string rsanum;
int rem;
string longDivision(string number, int divisor)
{
    string ans;

    int idx = 0;
    int temp = number[idx] - '0';
    while (temp < divisor)
        temp = temp * 10 + (number[++idx] - '0');

    while (number.size() > idx) {
        rem = temp % divisor;
        ans += (temp / divisor) + '0';
        temp = (temp % divisor) * 10 + number[++idx] - '0';
    }
    cout<<rem;

    if (ans.length() == 0)
        return "0";
    if(rem==0)
    return ans;
    else return number;
}
void solve(){
    string num;
```

```cpp
        rem=0;
        cin>>num;
        unordered_map<int,int> mp;
        rsanum = num;

        int len = num.size();
        int lastDigit = num[len-1] - '0';
        // cout<<num;
      string ans = longDivision(num,2);
        // cout<<rem;
        while(rem == 0){
            mp[2]++;
            num =  ans;
            // cout<<ans;
            ans = longDivision(num,2);
            cout<<rem<<" ";
        }

          for (int i = 3; i <= 1000000; i = i + 2)
        {   string ans = longDivision(num,i);
            while (ans!="0" && rem==0)
            {   mp[i]++;
                num =  ans;
                ans = longDivision(num,i);
                //cout<<rem<<" ";
            }
        }

        cout<<"\n";
        for(auto x:mp) cout<<x.first<<"-"<<x.second<<"\n";
    }
    int main()
    {   file();

        int t=1;

        while(t--)
        solve();

        return 0;
    }
```

Output:

```
PS D:\Academics\Fourth Year\CNS Lab\cns lab> cd "d:\Academics\Fourth Year\CNS Lab\cns lab"
PS D:\Academics\Fourth Year\CNS Lab\cns lab> & .\"primefactorization.exe"
123456

643-1
2-6
3-1
PS D:\Academics\Fourth Year\CNS Lab\cns lab> cd "d:\Academics\Fourth Year\CNS Lab\cns lab"
PS D:\Academics\Fourth Year\CNS Lab\cns lab> & .\"primefactorization.exe"
765432198

281-1
41-1
3691-1
2-1
3-2
PS D:\Academics\Fourth Year\CNS Lab\cns lab> 756894321098
756894321098
PS D:\Academics\Fourth Year\CNS Lab\cns lab> cd "d:\Academics\Fourth Year\CNS Lab\cns lab"
PS D:\Academics\Fourth Year\CNS Lab\cns lab> & .\"primefactorization.exe"
49825234590243

6571-1
1283-1
281431-1
3-1
7-1
PS D:\Academics\Fourth Year\CNS Lab\cns lab>
```