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Batch: B4
Subject: CNS Lab
PRN: 2020BTECS00068

Aim: Prime Factorization of large numbers

Theory: We have to factorize a number such that its factors are prime and their product equals a given number.

Code:

```
#include <bits/stdc++.h>
using namespace std;
typedef long long ll;

ll gcd(ll a, ll b) {
    if (b == 0) return a;
    return gcd(b, a % b);
}

ll pollard_rho(ll n) {
    ll x = 2, y = 2, d = 1;
    while (d == 1) {
        x = (x * x + 1) % n;
        y = (y * y + 1) % n;
        y = (y * y + 1) % n;
        d = gcd(abs(x - y), n);
    }
    return d;
}

void factorize(ll n) {
    if (n <= 1) return;

    if (n % 2 == 0) {
        cout << 2 << " ";
        while (n % 2 == 0) n /= 2;
    }

    while (n > 1) {
```

```

        ll factor = pollard_rho(n);
        cout << factor << " ";
        while (n % factor == 0) n /= factor;
    }
}

int main() {
    ll n;
    cin >> n;
    factorize(n);
    return 0;
}

```

Output:

```

PS E:\CNS\Euclidean_PrimeFactors> cd "e:\CNS\Euclidean_PrimeFactors\"; if ($?) { g++ prime_factors.cpp -o prime_factors }; if ($?) { .\prime_factors }
977312669
31013 31513
PS E:\CNS\Euclidean_PrimeFactors>

```

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