Rajshahi University of Engineering & Technology

CSE 2102: Sessional Based on CSE 2101

Lab Report 07

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Submitted to

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Experiment No. 3

Name of the Experiment: Algorithms, Number Theory and Cryptography.

1. EXPERIMENT [20]

Given two positive integers, find their greatest common divisor using the Euclidean algorithm.

SOLUTION:

```
#include <iostream>

using namespace std;

int main() {
    int a, b, r;
    cout << "Enter the two numbers: ";
    cin >> a >> b;
    while(b) {
        r = a % b;
        a = b;
        b = r;
    }
    cout << "GCD = " << a;
}
```

OUTPUT:

```
Enter the two numbers: 36 12
GCD = 12
```

```
Enter the two numbers: 55 11
GCD = 11
```

Discussion: GCD can also be determined by other algorithms rather than the Euclidean algorithm, but this algorithm is much efficient.

2. EXPERIMENT [21]

Given two positive integers, find their least common multiple.

SOLUTION:

```
#include <iostream>

using namespace std;

int main() {
    int a, b, temp, i;
    cin >> a >> b;

    if(b < a) {
        temp = a;
        a = b;
        b = temp;
    }
    for(i = b; i < b * b; i++) {
        if(!(i % a) && !(i % b)) {
            cout << "LCM = " << i << endl;
            break;
        }
    }
}
```

OUTPUT:

```
55 11
LCM = 55
```

```
123 6
LCM = 246
```

3. EXPERIMENT [22]

Given a positive integer, find the prime factorization of this integer.

SOLUTION:

```
#include <iostream>

using namespace std;

bool isPrime(long long p) {
    int flag = 1;
    for(int i = 2; i * i <= p; i++) {
        if(p % i == 0) {
            flag = 0;
            break;
        }
    }
    if(1 == flag) {
        return true;
    } else return false;
}

int main() {
    long long a, j = 2;
    cin >> a;
    int i, k, counter = 0;

    int prime[100];

    for(i = 2; i < 550;) {
        if(isPrime(i) && a % i == 0) {
            counter++;
            a /= i;
            continue;
        }
        if(counter) {
            cout << "i = " << i << ", counter = " << counter << endl;
        }
        counter = 0;
        i++;
    }
}
```

OUTPUT:

```
123
i = 3, counter = 1
i = 41, counter = 1
```

```
567
i = 3, counter = 4
i = 7, counter = 1.
```

Discussion: Prime factors are determined as 567 = 3 X 3 X 3 X 3 X 7 as it is shown by counter in the second output.