

RSA

Aim:To implement an encryption algorithm using Rsa.

Algorithm:

- Step 1: Select two large prime numbers, p and q.
- Step 2: Calculate the modulus, $n = p * q$.
- Step 3: Compute Euler's totient function, $\phi(n) = (p - 1) * (q - 1)$.
- Step 4: Choose a public exponent, e, such that $1 < e < \phi(n)$ and $\gcd(e, \phi(n)) = 1$.
- Step 5: Compute the private exponent, d, such that $(d * e) \bmod \phi(n) = 1$.
- Step 6: Convert the plaintext message into a numerical representation, usually using ASCII values or Unicode.
- Step 7: Encrypt the message by computing ciphertext, c, using the formula $c = (\text{msg}^e) \bmod n$.
- Step 8: Print the encrypted data.
- Step 9: Decrypt the ciphertext by computing the original message, m, using the formula $m = (c^d) \bmod n$.
- Step 10: Print the original message.
- Step 11: Return 0 for successful execution and program termination.

Program:

```
import java.io.*;
import java.math.*;
import java.util.*;
public class GFG {
    public static double gcd(double a, double h)
    {
        double temp;
        while (true) {
            temp = a % h;
            if (temp == 0)
```

```
        return h;
        a = h;
        h = temp;
    }
}
public static void main(String[] args)
{
    double p = 9;
    double q = 5;

    double n = p * q;

    double e = 2;
    double phi = (p - 1) * (q - 1);
    while (e < phi) {

        if (gcd(e, phi) == 1)
            break;
        else
            e++;
    }

    int k = 2;
    double d = (1 + (k * phi)) / e;

    double msg = 12;

    System.out.println("Message data = " + msg);

    double c = Math.pow(msg, e);
    c = c % n;
    System.out.println("Encrypted data = " + c);
```

```
        double m = Math.pow(c, d);  
        m = m % n;  
        System.out.println("Original Message Sent = " + m);  
    }  
}
```

Output:

```
java -cp /tmp/RgOMJoXiEh/GFG  
Message data = 12.0  
Encrypted data = 18.0  
Original Message Sent = 29.0  
  
=== Code Execution Successful ===
```

Result:

Thus the C program to implement an encryption algorithm using RSA was executed successfully.