

Program 9: Develop a program for a simple RSA algorithm to encrypt and decrypt the data.

```
import java.util.*;
import java.math.BigInteger;

public class RSAExample {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.println("Enter two prime numbers:");
        int p = sc.nextInt();
        int q = sc.nextInt();

        int n = p * q;
        int phi = (p - 1) * (q - 1);

        System.out.println("Enter the value for e:");
        int e = sc.nextInt();

        // Check gcd(e, phi) == 1; if not, auto-adjust
        while (gcd(e, phi) != 1) {
            e++;
        }

        // Find d such that (d * e) % phi == 1
        int d = 0;
        for (int i = 1; i < phi; i++) {
            if ((i * e) % phi == 1) {
                d = i;
                break;
            }
        }

        System.out.println("d value is: " + d);

        System.out.println("Enter plain text (number):");
        int msg = sc.nextInt();

        BigInteger M = BigInteger.valueOf(msg);
        BigInteger N = BigInteger.valueOf(n);

        // Encryption: C = (M^e) mod n
        BigInteger C = M.modPow(BigInteger.valueOf(e), N);
        System.out.println("Cipher text is: " + C);

        // Decryption: M = (C^d) mod n
        BigInteger dec = C.modPow(BigInteger.valueOf(d), N);
        System.out.println("Decrypted text is: " + dec);
    }

    static int gcd(int a, int b) {
        return b == 0 ? a : gcd(b, a % b);
    }
}
```