Experiment 12

AIM: Program to Implementation and analysis Digital signature scheme using RSA

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LO Mapped	LO6: Demonstrate the network security system using open source tools.

AIM: Program to Implementation and analysis Digital signature scheme using RSA

THEORY:

- RSA algorithm is an asymmetric cryptography algorithm. Asymmetric actually means that it works on two different keys i.e. Public Key and Private Key. As the name describes, the Public Key is given to everyone and the Private key is kept private.

- **An example of asymmetric cryptography :**
  - A client (for example browser) sends its public key to the server and requests for some data.
  - The server encrypts the data using the client's public key and sends the encrypted data.
  - Client receives this data and decrypts it.
- Since this is asymmetric, nobody else except the browser can decrypt the data even if a third party has the public key of the browser.
- Digital signatures are used to verify the authenticity of the message sent electronically. A digital signature algorithm uses a public key system. The intended transmitter signs his/her message with his/her private key and the intended receiver verifies it with the transmitter's public key. A digital signature can provide message authentication, message integrity and non-repudiation services.

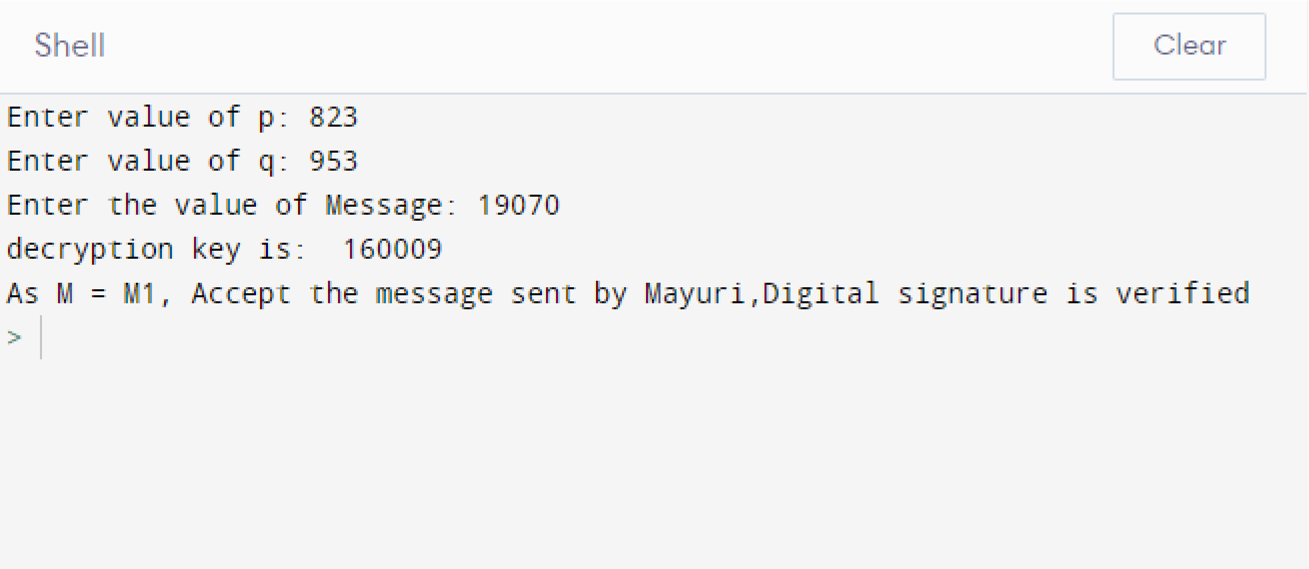
- **RSA Key Generation:**
  - Choose two large prime numbers p and q
  - Calculate n=p*q
  - Select public key e such that it is not a factor of (p-1)*(q-1)
  - Select private key d such that the following equation is true (d*e)mod(p-1)(q-1)=1 or d is inverse of E in modulo (p-1)*(q-1)
- **RSA Digital Signature Scheme:**
- For example:-
- In RSA, d is private; e and n are public.
  - Alice creates her digital signature using S=M^d mod n where M is the message
  - Alice sends Message M and Signature S to Bob
  - Bob computes M1=S^e mod n
  - If M1=M then Bob accepts the data sent by Alice.

IMPLEMENTATION:

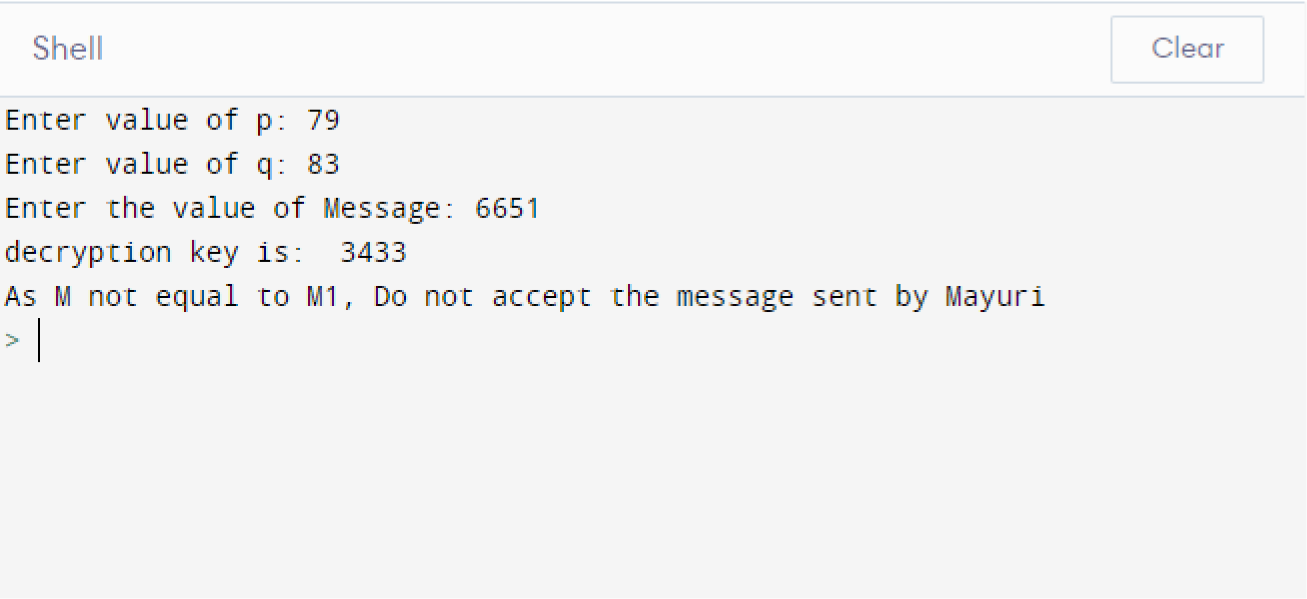
CODE:

```
def euclid(m, n):

    if n == 0:
        return m
    else:
        r = m % n
        return euclid(n, r)


def exteuclid(a, b):

    r1 = a
    r2 = b
    s1 = int(1)
    s2 = int(0)
    t1 = int(0)
    t2 = int(1)

    while r2 > 0:

        q = r1//r2
        r = r1-q * r2
        r1 = r2
        r2 = r
        s = s1-q * s2
        s1 = s2
        s2 = s
        t = t1-q * t2
        t1 = t2
        t2 = t

    if t1 < 0:
        t1 = t1 % a

    return (r1, t1)


p = int(input("Enter value of p: "))
q = int(input("Enter value of q: "))
n = p * q
Pn = (p-1)*(q-1)

M = int(input("Enter the value of Message: "))
key = []

for i in range(2, Pn):
    gcd = euclid(Pn, i)

    if gcd == 1:
        key.append(i)


e = int(313)


r, d = exteuclid(Pn, e)
if r == 1:
    d = int(d)
    print("decryption key is: ", d)

else:
    print("Multiplicative inverse for\
    the given encryption key does not \
    exist. Choose a different encryption key ")




# Signature is created by Mayuri
S = (M**d) % n

# Mayuri sends M and S both to receiver
# receiver generates message M1 using the
# signature S, Mayuri's public key e
# and product n.
M1 = (S**e) % n

# If M = M1 only then receiver accepts
# the message sent by Mayuri.

if M == M1:
    print("As M = M1, Accept the message sent by Mayuri,Digital signature is verified")
else:
    print("As M not equal to M1, Do not accept the message sent by Mayuri")
```

OUTPUT:



```
Enter value of p: 823
Enter value of q: 953
Enter the value of Message: 19070
decryption key is:  160009
As M = M1, Accept the message sent by Mayuri,Digital signature is verified
>
```



```
Enter value of p: 79
Enter value of q: 83
Enter the value of Message: 6651
decryption key is:  3433
As M not equal to M1, Do not accept the message sent by Mayuri
>
```

CONCLUSION: We have successfully implemented and analyzed the Digital signature scheme using RSA