```
'''
Public Key is (e,n)
Private Key is (d,n)
'''
def generate_keys():

  from random import randint
  from math import gcd
  from sympy import mod_inverse

  # Generate Two unequal Large Primes of comparable size
  p, q = 877, 751
  #p, q = 6971, 6299

  # For large p and q, n will take centuries to factorize
  n = p*q

  # phi function
  fi_n = (p-1)*(q-1)

  # e and fi_n are relatively prime if their gcd is 1
  while True:
    e = randint(1, fi_n)
    if gcd(fi_n, e) == 1:
      break

  # inverse modulo exists iff e and fi_n are relatively prime
  # Modular Inverse
  d = mod_inverse(e, fi_n)

  return (e,n), (d,n)


public_key, private_key = generate_keys()


def encryption(m, public_key):
  e, n = public_key
  c = m**e % n
  return c

c = encryption(ord('A'), public_key)
c
```

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    446298
```

```
def decryption(c, private_key):
  d, n = private_key
  p = c**d % n
  return p

p = decryption(c, private_key)
chr(p)
```

```
     'A'
```

```
def encrypt_text(plain_text, public_key):
  cipher_text = ''
  for character in plain_text:
    cipher_text += chr(encryption(ord(character), public_key))
  return cipher_text

cipher_text = encrypt_text('hi colaboratory', public_key)
cipher_text
```

```
     '\U00043930\U0003ddec⥆\U000785b1\ue293\U0006569a\U0003d6a4\U00078cb6\ue293ې
     \U0003d6a4\U00097d00\ue293篸'
```

```
def decrypt_text(cipher_text, private_key):
  decrypted_text = ''
  for character in cipher_text:
    decrypted_text += chr(encryption(ord(character), private_key))
  return decrypted_text

decrypted_text = decrypt_text(cipher_text, private_key)
decrypted_text
```

```
     'hi colaboratory'
```

Test Cases

```
plain_text = 'Hi Google Colab'
cipher_text = encrypt_text(plain_text, public_key)
decrypted_text = decrypt_text(cipher_text, private_key)

print('Plain Text = ', plain_text)
print('Decryption Text = ', decrypted_text)
```

```
     Plain Text =  Hi Google Colab
     Decryption Text =  Hi Google Colab
```

```
plain_text = 'This is fourth assignment of ICS'
cipher_text = encrypt_text(plain_text, public_key)
decrypted_text = decrypt_text(cipher_text, private_key)

print('Plain Text = ', plain_text)
print('Decryption Text = ', decrypted_text)
```

```
     Plain Text =  This is fourth assignment of ICS
     Decryption Text =  This is fourth assignment of ICS
```

```
plain_text = ''
cipher_text = encrypt_text(plain_text, public_key)
decrypted_text = decrypt_text(cipher_text, private_key)
```

```
print('Plain Text = ', plain_text)
print('Cipher Text = ', cipher_text)
print('Decryption Text = ', decrypted_text)
```

```
    Plain Text =
    Cipher Text =
    Decryption Text =
```

✓ 4s completed at 10:54 PM ● ✕