Ex. No.: 4 **Date:**

RSA

Aim:

To implement RSA asymmetric key cryptosystem using C.

Algorithm:

1. Select two large prime numbers p and q
2. Compute n=pxq
3. Choose system modulus: Ø(n)=(p-1)x(q-1)
4. Select a random encryption key e such that gcd(e,Ø(n)=1
5. Decrypt by computing d=1 mod Ø(n)
6. Print the public key{e,n}
7. Print the private key{d,n}

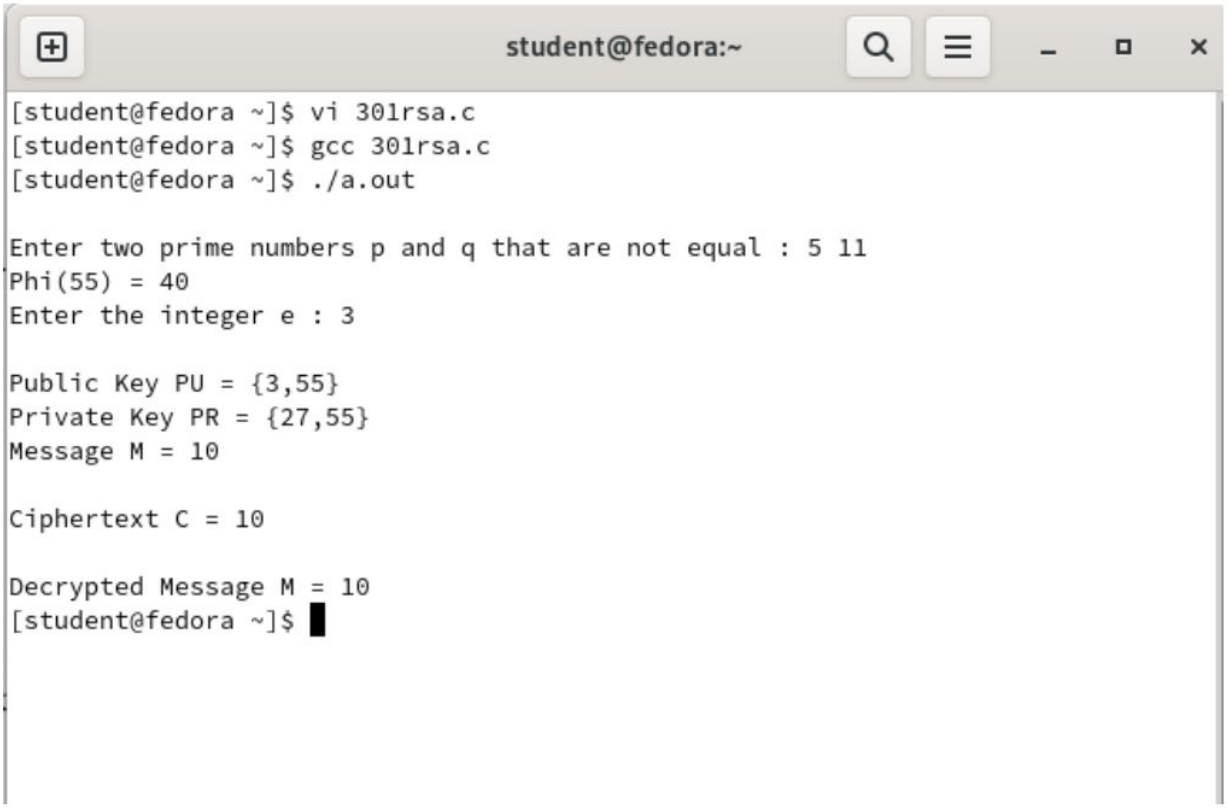
Program Code:

```
#include <stdio.h>
#include <math.h> int
power(int,unsigned int,int);
int gcd(int,int);
int multiplicativeInverse(int,int,int); int
main()
{ int
 p,q,n,e,d,phi,M,C;

 printf("\nEnter two prime numbers p and q that are not equal : ");
 scanf("%d %d",&p,&q); n = p * q; phi = (p - 1)*(q - 1);
 printf("Phi(%d) = %d",n,phi);
 printf("\nEnter the integer e : ");
 scanf("%d",&e); if(e
 >= 1 && e < phi)
 { if(gcd(phi,e)!=1)
        { printf("\nChoose proper value for e !!!\n");
              return 1;
        }
 }

 //Key Generation d =
 multiplicativeInverse(e,phi,n);
 printf("\nPublic Key PU =
 {%d,%d}",e,n); printf("\nPrivate Key PR
 = {%d,%d}",d,n);
```

```
 //Encryption
 printf("\nMessage M =
 "); scanf("%d",&M); C =
 power(M,e,n);
 printf("\nCiphertext C = %d \n",C);

 //Decryption M =
 power(C,d,n);
 printf("\nDecrypted Message M = %d \n",M);

 return 0;
}

int power(int x, unsigned int y, int p)
{ int res = 1;          // Initialize result x = x % p; //
   Update x if it is more than or equal to p

   while (y > 0)
   {
      // If y is odd, multiply x with result if
      (y & 1)
         res = (res*x) % p;

      // y must be even now y
      = y>>1;   // y = y/2 x
      = (x*x) %
   p; } return res;
}

int gcd ( int a, int b )
{ int c; while (
 a != 0 )
 { c = a; a = b %
 a; b = c; }
 return b;
}
int multiplicativeInverse(int a, int b, int n)
{ int sum,x,y;

      for(y=0;y<n;y++)
      { for(x=0;x<n;x++)
            { sum=a*x + b*(-y);
                  if(sum==1) return
                  x;
            }
      }
```

}

Output:



Result: