AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department of Computer Science and Engineering

Program: Bachelor of Science in Computer Science and Engineering

Course Code: CSE 4174
Course Title: Cyber Security Lab
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Assignment Topic: RSA (Rivest-Shamir-Adleman) Algorithm

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Question:

Devise a program using the RSA algorithm demonstrating the key set up and encryption-decryption.

Code:

```
#include<bits/stdc++.h>

using namespace std;
long int p, q, n, t, flag, e[100], d[100], temp[100], j, m[100], en[100], i;
string msg;
int prime(long int);
void ce();
long int cd(long int);
void encrypt();
void decrypt();
void printValues();
void printPossibleValues();

int main()
{
   cout << "\nEnter the value of p: ";
   cin >> p;
   flag = prime(p);
   if (flag == 0)
   {
      cout << "\nWRONG INPUT\n";
      return 0;
   }
   cout << "\nEnter the value of q: ";
   cin >> q;
   flag = prime(q);
   if (flag == 0 || p == q)
   {
      cout << "\nWRONG INPUT\n";
      return 0;
   }
   cout << "\nEnter the message: ";
   fflush(stdin);
   getline(cin,msg);
   //cout <<msg;

   for (i = 0; i<msg.length(); i++)
      m[i] = msg[i];

   n = p * q;
   t = (p - 1) * (q - 1);
```

```
   ce();
   printValues();
   printPossibleValues();
   encrypt();
   decrypt();

   return 0;
}

void printValues()
{
   cout << "\nThe value of n is " << n;
   cout << "\nThe value of phi(n) is " << t;
   cout << "\nThe value of e is " << e[0];
   cout << "\nThe value of d is " << d[0];
   cout << "\nEnter the message: " << msg << endl;
}

void printPossibleValues()
{
   cout << "\nPOSSIBLE VALUES OF e AND d ARE\n";
   for (i = 0; i < j - 1; i++)
      cout << "\n" << e[i] << "\t" << d[i];
}

int prime(long int pr)
{
   int i;
   j = sqrt(pr);
   for (i = 2; i <= j; i++)
   {
      if (pr % i == 0)
         return 0;
   }
   return 1;
}

void ce()
{
   int k;
   k = 0;
   for (i = 2; i < t; i++)
   {
      if (t % i == 0)
         continue;
      flag = prime(i);
```

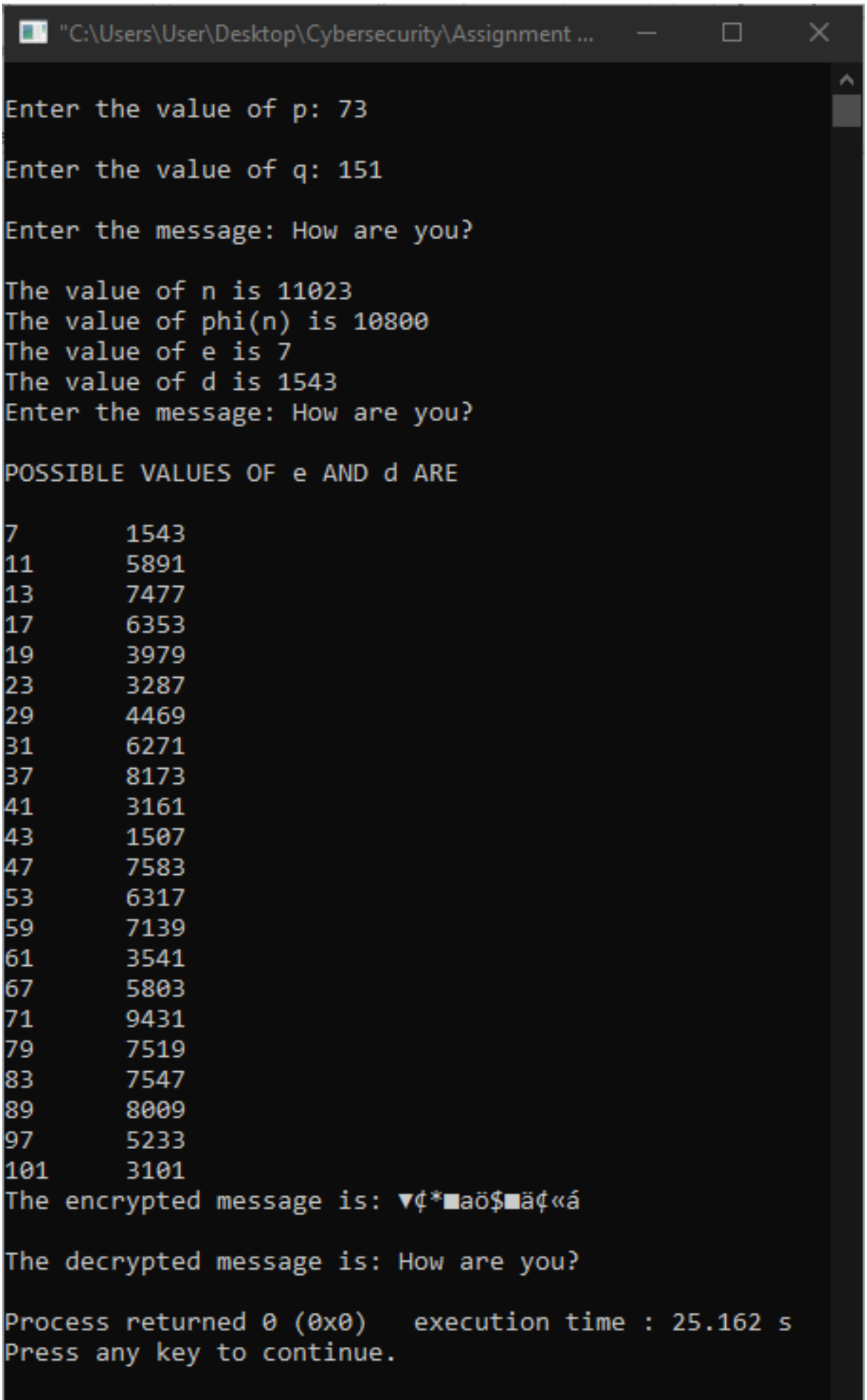
```
      if (flag == 1 && i != p && i != q)
      {
         e[k] = i;
         flag = cd(e[k]);
         if (flag > 0)
         {
            d[k] = flag;
            k++;
         }
         if (k == 99)
            break;
      }
   }
}

long int cd(long int x)
{
   long int k = 1;
   while (1)
   {
      k = k + t;
      if (k % x == 0)
         return (k / x);
   }
}

void encrypt()
{
   long int pt, ct, key = e[0], k, len;
   i = 0;
   len = msg.length();
   while (i != len)
   {
      pt = m[i];
      pt = pt - 96;
      k = 1;
      for (j = 0; j < key; j++)
      {
         k = k * pt;
         k = k % n;
      }
      temp[i] = k;
      ct = k + 96;
      en[i] = ct;
      i++;
   }
```

```
   en[i] = -1;
   cout << "\nThe encrypted message is: ";
   for (i = 0; en[i] != -1; i++)
      cout << (char)en[i];
   cout << endl;
}

void decrypt()
{
   long int pt, ct, key = d[0], k;
   i = 0;
   while (en[i] != -1)
   {
      ct = temp[i];
      k = 1;
      for (j = 0; j < key; j++)
      {
         k = k * ct;
         k = k % n;
      }
      pt = k + 96;
      m[i] = pt;
      i++;
   }
   m[i] = -1;
   cout << "\nThe decrypted message is: ";
   for (i = 0; m[i] != -1; i++)
      cout << (char)m[i];
   cout << endl;
}
```


"C:\Users\User\Desktop\Cybersecurity\Assignment ...
Enter the value of p: 73
Enter the value of q: 151
Enter the message: How are you?
The value of n is 11023
The value of phi(n) is 10800
The value of e is 7
The value of d is 1543
Enter the message: How are you?
POSSIBLE VALUES OF e AND d ARE
7 1543
11 5891
13 7477
17 6353
19 3979
23 3287
29 4469
31 6271
37 8173
41 3161
43 1507
47 7583
53 6317
59 7139
61 3541
67 5803
71 9431
79 7519
83 7547
89 8009
97 5233
101 3101
The encrypted message is: ▼¢*■aö$■ä¢«á
The decrypted message is: How are you?
Process returned 0 (0x0) execution time : 25.162 s
Press any key to continue.