Program and Output

Program :

1. **Encryption :**

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#define SIZE 30

// Function to convert the string to lowercase
void toLowerCase(char plain[], int ps)
{
   int i;
   for (i = 0; i < ps; i++) {
      if (plain[i] > 64 && plain[i] < 91)
         plain[i] += 32;
   }
}

// Function to remove all spaces in a string
int removeSpaces(char* plain, int ps)
{
   int i, count = 0;
   for (i = 0; i < ps; i++)
      if (plain[i] != ' ')
         plain[count++] = plain[i];
   plain[count] = '\0';
   return count;
}

// Function to generate the 5x5 key square
void generateKeyTable(char key[], int ks, char keyT[5][5])
{
   int i, j, k, flag = 0, *dicty;

   // a 26 character hashmap
   // to store count of the alphabet
   dicty = (int*)calloc(26, sizeof(int));
   for (i = 0; i < ks; i++) {
      if (key[i] != 'j')
```

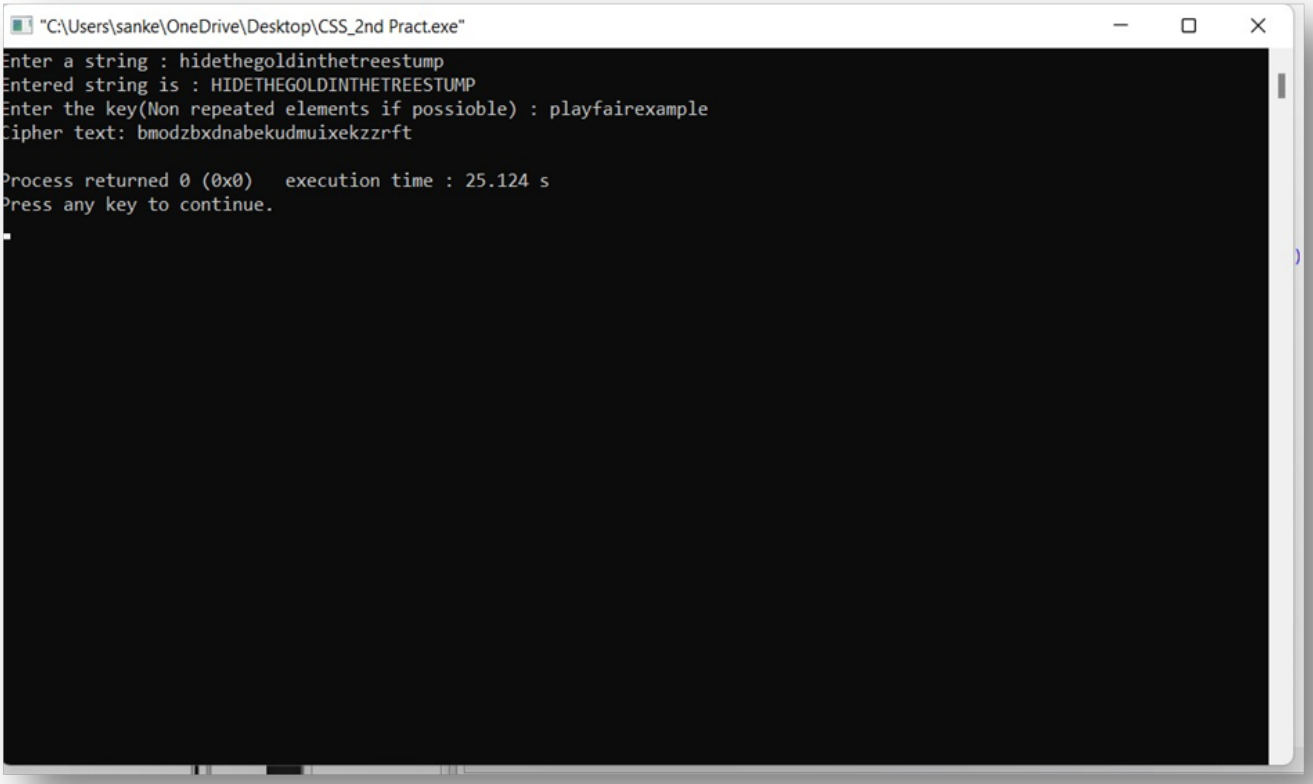
```
        dicty[key[i] - 97] = 2;
    }

    dicty['j' - 97] = 1;

    i = 0;
    j = 0;

    for (k = 0; k < ks; k++) {
        if (dicty[key[k] - 97] == 2) {
            dicty[key[k] - 97] -= 1;
            keyT[i][j] = key[k];
            j++;
            if (j == 5) {
                i++;
                j = 0;
            }
        }
    }

    for (k = 0; k < 26; k++) {
        if (dicty[k] == 0) {
            keyT[i][j] = (char)(k + 97);
            j++;
            if (j == 5) {
                i++;
                j = 0;
            }
        }
    }
}

// Function to search for the characters of a digraph
// in the key square and return their position
void search(char keyT[5][5], char a, char b, int arr[])
{
    int i, j;

    if (a == 'j')
        a = 'i';
    else if (b == 'j')
        b = 'i';

    for (i = 0; i < 5; i++) {

        for (j = 0; j < 5; j++) {
```

```
            if (keyT[i][j] == a) {
                arr[0] = i;
                arr[1] = j;
            }
            else if (keyT[i][j] == b) {
                arr[2] = i;
                arr[3] = j;
            }
        }
    }
}

// Function to find the modulus with 5
int mod5(int a) { return (a % 5); }

// Function to make the plain text length to be even
int prepare(char str[], int ptrs)
{
    if (ptrs % 2 != 0) {
        str[ptrs++] = 'z';
        str[ptrs] = '\0';
    }
    return ptrs;
}

// Function for performing the encryption
void encrypt(char str[], char keyT[5][5], int ps)
{
    int i, a[4];

    for (i = 0; i < ps; i += 2) {

        search(keyT, str[i], str[i + 1], a);

        if (a[0] == a[2]) {
            str[i] = keyT[a[0]][mod5(a[1] + 1)];
            str[i + 1] = keyT[a[0]][mod5(a[3] + 1)];
        }
        else if (a[1] == a[3]) {
            str[i] = keyT[mod5(a[0] + 1)][a[1]];
            str[i + 1] = keyT[mod5(a[2] + 1)][a[1]];
        }
        else {
            str[i] = keyT[a[0]][a[3]];
            str[i + 1] = keyT[a[2]][a[1]];
```

```
        }
    }
}

// Function to encrypt using Playfair Cipher
void encryptByPlayfairCipher(char str[], char key[])
{
    char ps, ks, keyT[5][5];

    // Key
    ks = strlen(key);
    ks = removeSpaces(key, ks);
    toLowerCase(key, ks);

    // Plaintext
    ps = strlen(str);
    toLowerCase(str, ps);
    ps = removeSpaces(str, ps);

    ps = prepare(str, ps);

    generateKeyTable(key, ks, keyT);

    encrypt(str, keyT, ps);
}

// Driver code
int main()
{
    char str[SIZE], key[SIZE];
    int i, j;

    // Plaintext to be encrypted
    printf("Enter a string : ");
    gets(str);
    for(i = 0,j = 0; i<strlen(str); i++){
        if(str[i]!=" "){
            str[j]=toupper(str[i]);
            j++;
        }
    }
    str[j] = '\0';
    printf("Entered string is : %s\n", str);

    // Key to be encrypted
    printf("Enter the key(Non repeated elements if possioble) : ");
```

```
    gets(key);

    for(i = 0,j = 0; i<strlen(str); i++){
        if(str[i]!=" "){
            str[j]=toupper(str[i]);
            j++;
        }
    }
    key[j]='\0';

    // encrypt using Playfair Cipher
    encryptByPlayfairCipher(str, key);

    printf("Cipher text: %s\n", toupper(str));

    return 0;
}
```

Output :



2. Decryption :

```
#include<stdio.h>
#include<string.h>
#include<ctype.h>
int removerepeated(int size,int a[]);
int insertelementat(int position,int a[],int size);
main()
{
 int
i,j,k,numstr[100],numcipher[100],numkey[100],lenkey,templen,tempkey[100
],flag=-1,size,cipherkey[5][5],lennumstr,row1,row2,col1,col2;
 char str[100],key[100];
 printf("Enter a string\n");
 gets(str);
 //converting entered string to Capital letters
 for(i=0,j=0;i<strlen(str);i++)
 {
  if(str[i]!=' ')
  {
   str[j]=toupper(str[i]);
   j++;
  }
 }
 str[j]='\0';
 printf("Entered String is %s\n",str);
 //Storing string in terms of ascii and to restore spaces I used -20
 size=strlen(str);
 for(i=0;i<size;i++)
 {
  if(str[i]!=' ')
  numstr[i]=str[i]-'A';
 }
 lennumstr=i;
 //Key processing
 printf("Enter the key (Non repeated elements if possible)\n");
 gets(key);
 //converting entered key to Capital letters
 for(i=0,j=0;i<strlen(key);i++)
 {
```

```
 if(key[i]!=' ')
 {
  key[j]=toupper(key[i]);
  j++;
 }
}
key[j]='\0';
printf("%s\n",key);
//Storing key in terms of ascii
k=0;
for(i=0;i<strlen(key)+26;i++)
{
 if(i<strlen(key))
 {
  if(key[i]=='J')
  {
   flag=8;
   printf("%d",flag);
  }
      numkey[i]=key[i]-'A';
 }
 else
 {
   if(k!=9 && k!=flag)//Considering I=J and taking I in place of J except when
J is there in key ignoring I
   {
          numkey[i]=k;
     }
     k++;
 }
}
templen=i;
lenkey=removerepeated(templen,numkey);
printf("Entered key converted according to Play Fair Cipher rule\n");
for(i=0;i<lenkey;i++)
{
    printf("%c",numkey[i]+'A');
}
printf("\n");
//Arranging the key in 5x5 grid
k=0;
```

```
 for(i=0;i<5;i++)
 {
  for(j=0;j<5;j++)
  {
   cipherkey[i][j]=numkey[k];
   k++;
  }
 }
 printf("Arranged key\n");
 for(i=0;i<5;i++)
 {
  for(j=0;j<5;j++)
  {
   printf("%c ",cipherkey[i][j]+'A');
  }
  printf("\n");
 }
   //Message Processing
   for(i=0;i<lennumstr;i+=2)
   {
      if(numstr[i]==numstr[i+1])
      {
       insertelementat(i+1,numstr,lennumstr);
       lennumstr++;
      }
   }
   if(lennumstr%2!=0)
   {
    insertelementat(lennumstr,numstr,lennumstr);
    lennumstr++;
   }
   printf("Entered String/Message After Processing according to Play fair
cipher rule\n");
   for(i=0;i<lennumstr;i++)
   {
    printf("%c",numstr[i]+'A');
   }
   for(k=0;k<lennumstr;k+=2)
   {
    for(i=0;i<5;i++)
    {
```

```
 for(j=0;j<5;j++)
 {
  if(numstr[k]==cipherkey[i][j])
  {
     row1=i;
     col1=j;
  }
  if(numstr[k+1]==cipherkey[i][j])
  {
     row2=i;
     col2=j;
  }
 }
}
//Only change between Ecryption to decryption is changing + to -
//If negative add 5 to that row or column
if(row1==row2)
{
 col1=(col1-1)%5;
 col2=(col2-1)%5;
 if(col1<0)
 {
  col1=5+col1;
 }
 if(col2<0)
 {
  col2=5+col2;
 }
 numcipher[k]=cipherkey[row1][col1];
 numcipher[k+1]=cipherkey[row2][col2];
}
if(col1==col2)
{
 row1=(row1-1)%5;
 row2=(row2-1)%5;
  if(row1<0)
 {
  row1=5+row1;
 }
 if(row2<0)
 {
```

```
     row2=5+row2;
    }
    numcipher[k]=cipherkey[row1][col1];
    numcipher[k+1]=cipherkey[row2][col2];
   }
   if(row1!=row2&&col1!=col2)
   {
    numcipher[k]=cipherkey[row1][col2];
    numcipher[k+1]=cipherkey[row2][col1];
   }
  }
  printf("\nCipher Text is\n");
  for(i=0;i<lennumstr;i++)
  {
   if((numcipher[i]+'A')!='X')//Should remove extra 'X' which were created
during Encryption
     printf("%c",numcipher[i]+'A');
  }
  printf("\n");
}
int removerepeated(int size,int a[])
{
 int i,j,k;
 for(i=0;i<size;i++)
  {
 for(j=i+1;j<size;)
 {
   if(a[i]==a[j])
   {
    for(k=j;k<size;k++)
    {
     a[k]=a[k+1];
    }
       size--;
      }
   else
   {
    j++;
    }
 }
 }
```

```
return(size);
}
int insertelementat(int position,int a[],int size)
{
      int i,insitem=23,temp[size+1];
   for(i=0;i<=size;i++)
      {
      if(i<position)
      {
         temp[i]=a[i];
      }
      if(i>position)
      {
       temp[i]=a[i-1];
      }
      if(i==position)
      {
         temp[i]=insitem;
      }
      }
      for(i=0;i<=size;i++)
      {
       a[i]=temp[i];
      }
}
```

Output :

```
"C:\Users\sanke\OneDrive\Desktop\CSS_2nd Pract_decryption.exe"
Enter a string
BMODZBXDNABEKUDMUIXMMOUVIF
Entered String is BMODZBXDNABEKUDMUIXMMOUVIF
Enter the key (Non repeated elements if possible)
playfairexample
PLAYFAIREXAMPLE
Entered key converted according to Play Fair Cipher rule
PLAYFIREXMBCDGHAKNOQSTUVWZ
Arranged key
P L A Y F
I R E X M
B C D G H
A K N O Q
S T U V W
Entered String/Message After Processing according to Play fair cipher rule
BMODZBXDNABEKUDMUIXMMOUVIF
Cipher Text is
HINGAGEGDUDINTHESEEQTUMP

Process returned 0 (0x0)   execution time : 84.526 s
Press any key to continue.
```