EX NO:02	Write a program for demonstration of encrypting and decrypting the messages by Playfair Substitution technique.
DATE:21.02.24	

Aim: To write a c program to perform encryption and decryption of a message using Playfair substitution technique.

Algorithm:

1. Include necessary header files (<stdio.h> and <string.h>).
2. Declare character arrays for the original message (msg), encryption key (key), new key (newKey), encrypted message (encryptedMsg), and decrypted message (decryptedMsg).
3. Declare integer variables msgLen, keyLen, i, and j for storing lengths and loop indices.
4. Initialize msg and key with the original message and encryption key.
5. Calculate msgLen and keyLen using strlen.
6. Use a loop to generate the new key (newKey) based on the original key (key).
7. Initialize i and j to 0.
8. Use a loop to iterate over each character in the original message (msg).
9. Combine it with the corresponding character from the new key (newKey) using modular arithmetic.
10. Add a null terminator at the end of the decrypted message.

Program:

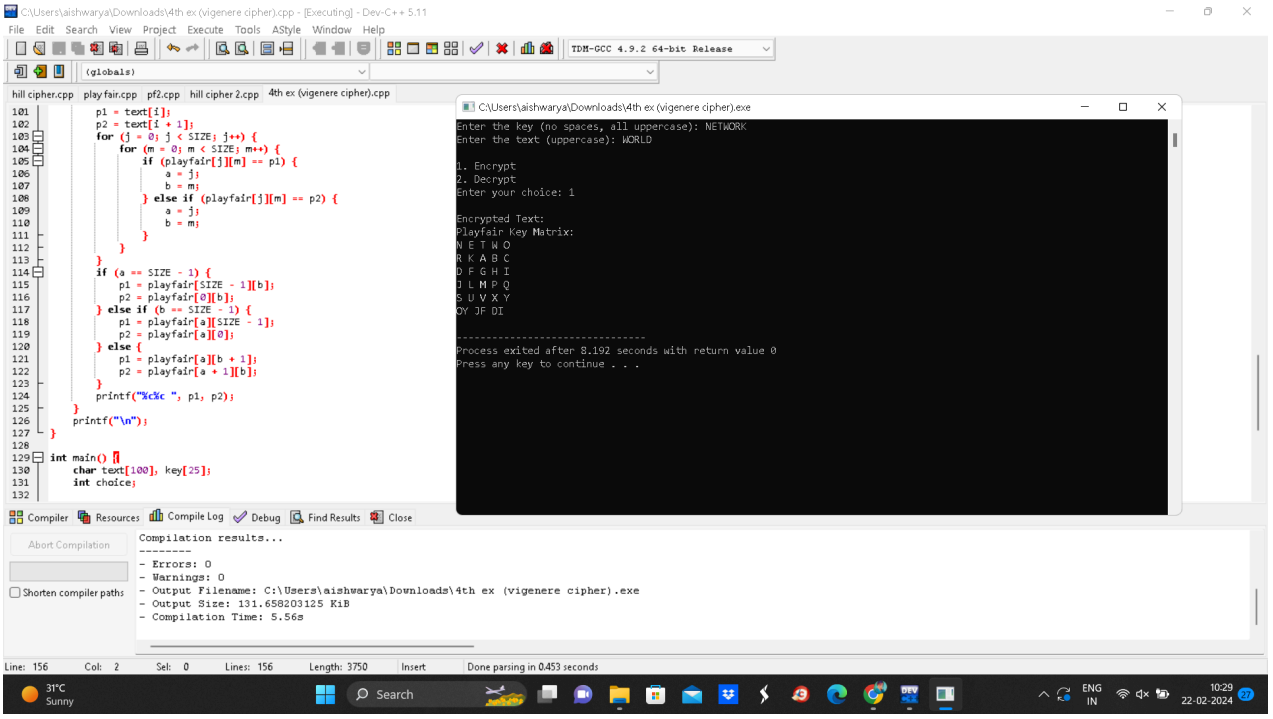
```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#define SIZE 5

char playfair[SIZE][SIZE];

void preparePlayfairKey(char *key) {
   char *ptr, *temp;
   int i, j, k, l, flag = 0;
   char alphabet[26] = {0};

   ptr = key;
   temp = key;

   while (*ptr != '\0') {
      if (*ptr >= 'a' && *ptr <= 'z') {
         *ptr = *ptr - 32;
      }
      ptr++;
   }
```

```
    while (*temp != '\0') {
        if (*temp == 'J') {
            *temp = 'I';
        }
        if (alphabet[*temp - 65] == 0) {
            alphabet[*temp - 65] = 1;
            playfair[flag / SIZE][flag % SIZE] = *temp;
            flag++;
        }
        temp++;
    }

    // Fill the remaining characters
    for (i = 0; i < 26; i++) {
        if (alphabet[i] == 0) {
            playfair[flag / SIZE][flag % SIZE] = (char) (i + 65);
            flag++;
        }
    }
}

void constructPlayfairTable(char *key) {
    int i, j;

    preparePlayfairKey(key);

    printf("\nPlayfair Key Matrix:\n");
    for (i = 0; i < SIZE; i++) {
        for (j = 0; j < SIZE; j++) {
            printf("%c ", playfair[i][j]);
        }
        printf("\n");
    }
}

void encryptPlayfair(char *text, char *key) {
    constructPlayfairTable(key);

    int i, j, a, b, m, n;
    char p1, p2;

    for (i = 0; i < strlen(text); i += 2) {
        p1 = text[i];
        p2 = text[i + 1];
        for (j = 0; j < SIZE; j++) {
            for (m = 0; m < SIZE; m++) {
                if (playfair[j][m] == p1) {
```

```
                a = j;
                b = m;
            } else if (playfair[j][m] == p2) {
                a = j;
                b = m;
            }
        }
    }
    if (a == 0) {
        p1 = playfair[0][b];
        p2 = playfair[SIZE - 1][b];
    } else if (b == 0) {
        p1 = playfair[a][0];
        p2 = playfair[a][SIZE - 1];
    } else {
        p1 = playfair[a][b - 1];
        p2 = playfair[a - 1][b];
    }
    printf("%c%c ", p1, p2);
  }
  printf("\n");
}

void decryptPlayfair(char *text, char *key) {
  constructPlayfairTable(key);

  int i, j, a, b, m, n;
  char p1, p2;

  for (i = 0; i < strlen(text); i += 2) {
    p1 = text[i];
    p2 = text[i + 1];
    for (j = 0; j < SIZE; j++) {
      for (m = 0; m < SIZE; m++) {
        if (playfair[j][m] == p1) {
          a = j;
          b = m;
        } else if (playfair[j][m] == p2) {
          a = j;
          b = m;
        }
      }
    }
    if (a == SIZE - 1) {
      p1 = playfair[SIZE - 1][b];
      p2 = playfair[0][b];
    } else if (b == SIZE - 1) {
      p1 = playfair[a][SIZE - 1];
```

```
            p2 = playfair[a][0];
        } else {
            p1 = playfair[a][b + 1];
            p2 = playfair[a + 1][b];
        }
        printf("%c%c ", p1, p2);
    }
    printf("\n");
}

int main() {
    char text[100], key[25];
    int choice;

    printf("Enter the key (no spaces, all uppercase): ");
    scanf("%s", key);

    printf("Enter the text (uppercase): ");
    scanf("%s", text);

    printf("\n1. Encrypt\n2. Decrypt\nEnter your choice: ");
    scanf("%d", &choice);

    switch (choice) {
        case 1:
            printf("\nEncrypted Text: ");
            encryptPlayfair(text, key);
            break;
        case 2:
            printf("\nDecrypted Text: ");
            decryptPlayfair(text, key);
            break;
        default:
            printf("\nInvalid choice!\n");
    }

    return 0;
}
```

Input and Output:



Result: A c program to perform encryption and decryption of a message using Play fair substitution technique is successfully executed.

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