EX NO:03	Encrypt and decrypt a message with Hill cipher substitution techniques.
DATE:21.02.24	

Aim: To write a c program to encrypt and decrypt a message with Hill cipher substitution techniques.

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.

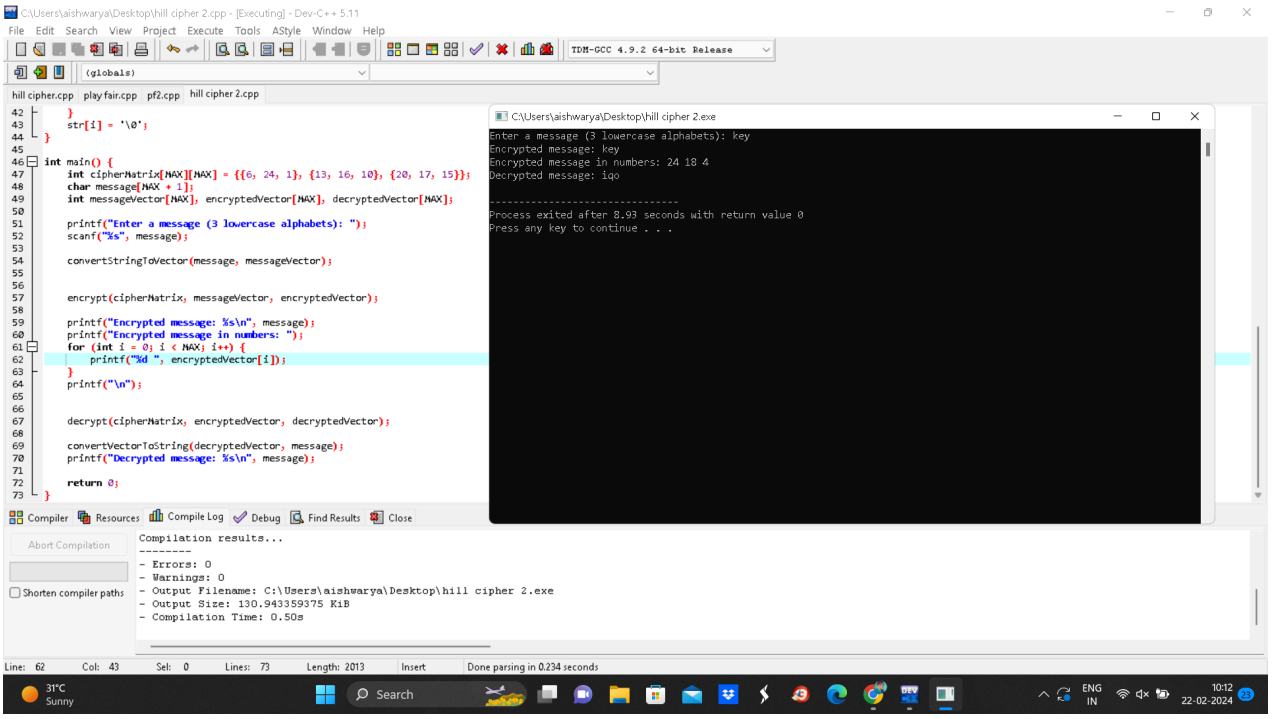
Program:

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

#define MAX 3

void encrypt(int cipherMatrix[MAX][MAX], int messageVector[MAX], int
encryptedVector[MAX]) {
   int i, j;
   for (i = 0; i < MAX; i++) {
      encryptedVector[i] = 0;
      for (j = 0; j < MAX; j++) {
         encryptedVector[i] += cipherMatrix[i][j] * messageVector[j];
      }
      encryptedVector[i] %= 26;
   }
}

void decrypt(int cipherMatrix[MAX][MAX], int encryptedVector[MAX], int
decryptedVector[MAX]) {
   int i, j;
   int inverseMatrix[MAX][MAX] = {{6, 24, 1}, {13, 16, 10}, {20, 17, 15}};
```

```
    for (i = 0; i < MAX; i++) {
        decryptedVector[i] = 0;
        for (j = 0; j < MAX; j++) {
            decryptedVector[i] += inverseMatrix[i][j] * encryptedVector[j];
        }
        decryptedVector[i] = (decryptedVector[i] + 26) % 26;
    }
}

void convertStringToVector(char *str, int *vector) {
    int i;
    for (i = 0; i < MAX; i++) {
        vector[i] = str[i] - 'a';
    }
}

void convertVectorToString(int *vector, char *str) {
    int i;
    for (i = 0; i < MAX; i++) {
        str[i] = vector[i] + 'a';
    }
    str[i] = '\0';
}

int main() {
    int cipherMatrix[MAX][MAX] = {{6, 24, 1}, {13, 16, 10}, {20, 17, 15}};
    char message[MAX + 1];
    int messageVector[MAX], encryptedVector[MAX], decryptedVector[MAX];

    printf("Enter a message (3 lowercase alphabets): ");
    scanf("%s", message);

    convertStringToVector(message, messageVector);


    encrypt(cipherMatrix, messageVector, encryptedVector);

    printf("Encrypted message: %s\n", message);
    printf("Encrypted message in numbers: ");
    for (int i = 0; i < MAX; i++) {
        printf("%d ", encryptedVector[i]);v
    }
    printf("\n");


    decrypt(cipherMatrix, encryptedVector, decryptedVector);

    convertVectorToString(decryptedVector, message);
```

```
    printf("Decrypted message: %s\n", message);

    return 0;
}
```

Input and Output:



Result: A c program to encrypt and decrypt a message with Hill cipher substitution techniques is successfully executed.

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