STUDENT: **PHUC LE**

PROGRAMMING ASSIGNMENT #4

THE CUCKOO HASHING ALGORITHM

ALGORITHM ENGINEERING **335.01**

Cuckoo Hashing Algorithm Pseudocode:

❖ The Hashing Function

```
size_t f(char *s, size_t index) {
    size_t po, len;
    int i, val, temp;
    po = 1;
    val = 0;
    len = strlen(s);

    if (index == 0) {
        val = s[0];
        val = val % tablesize;
        if (val < 0) val += tablesize;
        if (len == 1)
            return val;

        for (i = 1; i < len; i++)
        {
            temp = s[i];
            po *= 37;
            po = po % tablesize;
            if (po < 0) po += tablesize;
            val += temp * po;
            val = val % tablesize;
            if (val < 0) val += tablesize;
        }
        return val;
    }
    else {
        val = s[len-1];
        val = val % tablesize;
        if (val < 0) val += tablesize;

        if (len == 1)
            return val;

        for (i = 1; i < len; i++)
        {
            temp = s[len-i-1];
            po *= 37;

            po = po % tablesize;
            if (po < 0) po += tablesize;

            val += temp * po;
            val = val % tablesize;

            if (val < 0) val += tablesize;
        }
        return val;
    }
}
```

❖ Function: place_in_hash_tables

```
bool place_in_hash_tables(char *s) {
    bool placed;
    size_t pos;
    int index;
    char temp_s[255], temp[255];

    strcpy(temp_s, s);

    int counter = 0;

    index = 0;

    placed = false;

    pos = f(temp_s, index);

    while ((!placed) && (counter < 2 * tablesize)) {

        if (strcmp(t[pos][index], "") == 0) {
            cout << "String <" << temp_s << "> will be placed at";
            cout << " t[" << pos << "][" << index << "]" << endl;
            strcpy(t[pos][index], temp_s);
            placed = true;
            return placed;
        }
        else {
            cout << "String <" << temp_s << "> will be placed at" << " t[" << pos;
            cout << "][" << index << "]" << " replacing <" << t[pos][index] << ">";
            cout << endl;

            strcpy(temp, t[pos][index]);
            strcpy(t[pos][index], temp_s);

            strcpy(temp_s, temp);
            index = 1;

            pos = f(temp_s, index);

            if (strcmp(t[pos][index], "") == 0) {
                cout << "String <" << temp_s << "> will be placed at";
                cout << " t[" << pos << "][" << index << "]" << endl;
                strcpy(t[pos][index], temp_s);
                placed = true;
                counter++;
                return placed;
            }
            else {
                strcpy(temp, t[pos][index]);
                cout << "String <" << temp_s << "> will be placed at" << " t[" << pos;
                cout << "][" << index << "]" << " replacing <" << temp<< ">";
```

```
                cout << endl;
                strcpy(t[pos][index], temp_s);
                return place_in_hash_tables(temp);
            }

        }
    }
    return placed;
};
```

HOW TO RUN THE PROGRAM:

- There is an executable file named "**CuckooHashingAlgo.exe**" inside the folder "**Executable Files**"
- Or the program can be run through opening project using Microsoft Visual Studio

THE OUTPUT SAMPLES:

Example 1:

```
CPSC 335.01 - Programming Assignment #4: Cuckoo Hashing algorithm

Input the file name (no spaces)!

in4.txt

String <Algorithm Engineering> will be placed at t[3][0]

String <California> will be placed at t[14][0]

String <State University> will be placed at t[9][0]

String <Fullerton> will be placed at t[17][0]

String <College of Engineering and Computer Science> will be placed at t[3][0] replacing
<Algorithm Engineering>

String <Algorithm Engineering> will be placed at t[3][1]

String <Department of Computer Science> will be placed at t[17][0] replacing <Fullerton>

String <Fullerton> will be placed at t[17][1]

String <Dynamic Programming> will be placed at t[6][0]

String <Monge Properties> will be placed at t[10][0]

String <String Matching> will be placed at t[12][0]

String <Matrix Searching> will be placed at t[17][0] replacing <Department of Computer Science>

String <Department of Computer Science> will be placed at t[2][1]

String <Optimal Tree Construction> will be placed at t[9][0] replacing <State University>

String <State University> will be placed at t[10][1]

Press any key to continue . . .
```

Example 2:

```
CPSC 335.01 - Programming Assignment #4: Cuckoo Hashing algorithm

Input the file name (no spaces)!

in5.txt

String <Algorithm Engineering> will be placed at t[3][0]

String <California> will be placed at t[14][0]

String <State University> will be placed at t[9][0]

String <Fullerton> will be placed at t[17][0]

String <College of Engineering> will be placed at t[13][0]

String <and Computer Science> will be placed at t[4][0]

String <Dynamic Programming> will be placed at t[6][0]

String <Monge Properties> will be placed at t[10][0]

String <String Matching> will be placed at t[12][0]
```

```
String <Matrix Searching> will be placed at t[17][0] replacing <Fullerton>
String <Fullerton> will be placed at t[17][1]
String <Optimal Tree Construction> will be placed at t[9][0] replacing <State University>
String <State University> will be placed at t[10][1]
String <Online algorithms> will be placed at t[17][0] replacing <Matrix Searching>
String <Matrix Searching> will be placed at t[2][1]
String <emphasis on> will be placed at t[3][0] replacing <Algorithm Engineering>
String <Algorithm Engineering> will be placed at t[3][1]
String <Server Problem> will be placed at t[16][0]
String <Some related problem> will be placed at t[6][0] replacing <Dynamic Programming>
String <Dynamic Programming> will be placed at t[6][1]
String <Self-Stabilization> will be placed at t[2][0]
String <One of the greatest> will be placed at t[10][0] replacing <Monge Properties>
String <Monge Properties> will be placed at t[9][1]
Press any key to continue . . .
```

Example 3:

```
CPSC 335.01 - Programming Assignment #4: Cuckoo Hashing algorithm
Input the file name (no spaces)!
in6.txt
String <Algorithm Engineering> will be placed at t[3][0]
String <California State University> will be placed at t[18][0]
String <Fullerton> will be placed at t[17][0]
String <College of Engineering> will be placed at t[13][0]
String <and Computer Science> will be placed at t[4][0]
String <Department of Computer> will be placed at t[9][0]
String <Science> will be placed at t[5][0]
String <Dynamic Programming> will be placed at t[6][0]
String <Monge Properties> will be placed at t[10][0]
String <String Matching> will be placed at t[12][0]
String <Matrix Searching> will be placed at t[17][0] replacing <Fullerton>
String <Fullerton> will be placed at t[17][1]
String <Optimal Tree Construction> will be placed at t[9][0] replacing <Department of Computer>
```

String <Department of Computer> will be placed at t[10][1]

String <Online algorithms> will be placed at t[17][0] replacing <Matrix Searching>

String <Matrix Searching> will be placed at t[2][1]

String <emphasis on> will be placed at t[3][0] replacing <Algorithm Engineering>

String <Algorithm Engineering> will be placed at t[3][1]

String <Server Problem> will be placed at t[16][0]

String <Some related problem> will be placed at t[6][0] replacing <Dynamic Programming>

String <Dynamic Programming> will be placed at t[6][1]

String <Self-Stabilization> will be placed at t[2][0]

String <One of the greatest> will be placed at t[10][0] replacing <Monge Properties>

String <Monge Properties> will be placed at t[9][1]

String <mysteries in science> will be placed at t[13][0] replacing <College of Engineering>

String <College of Engineering> will be placed at t[6][1] replacing <Dynamic Programming>

String <Dynamic Programming> will be placed at t[6][0] replacing <Some related problem>

String <Some related problem> will be placed at t[13][1]

String <Quantum Nature of Universe> will be placed at t[12][0] replacing <String Matching>

String <String Matching> will be placed at t[12][1]

String <In physics and> will be placed at t[14][0]

String <are known> will be placed at t[18][0] replacing <California State University>

String <California State University> will be placed at t[18][1]

String <Cuckoo hashing is fun> will be placed at t[1][0]

Press any key to continue . . .

	TABLE T1	TABLE T2
[0]		
[1]	Cuckoo hashing is fun	
[2]	Self-Stabilization	Matrix Searching
[3]	emphasis on	Algorithm Engineering
[4]	and Computer Science	
[5]	Science	
[6]	Dynamic Programming	College of Engineering
[7]		
[8]		
[9]	Optimal Tree Construction	Monge Properties
[10]	One of the greatest	Department of Computer
[11]		
[12]	Quantum Nature of Universe	String Matching
[13]	mysteries in science	Some related problem
[14]	In physics and	
[15]		
[16]	Server Problem	
[17]	Online algorithms	Fullerton
[18]	are known	California State University