

# Rajalakshmi Engineering College

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Department: I AI & ML FA

Batch: 2028

Degree: B.E - AI & ML

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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 7\_MCQ\_Updated

Attempt : 1

Total Mark : 20

Marks Obtained : 18

### Section 1 : MCQ

1. In the folding method, what is the primary reason for reversing alternate parts before addition?

**Answer**

To reduce the chance of collisions caused by similar digit patterns

**Status : Correct**

**Marks : 1/1**

2. What is the initial position for a key k in a linear probing hash table?

**Answer**

$k \% \text{table\_size}$

**Status : Correct**

**Marks : 1/1**

3. In linear probing, if a collision occurs at index  $i$ , what is the next index checked?

**Answer**

$(i + 1) \% \text{table\_size}$

**Status : Correct**

**Marks : 1/1**

4. In C, how do you calculate the mid-square hash index for a key  $k$ , assuming we extract two middle digits and the table size is 100?

**Answer**

$((k * k) / 100) \% 100$

**Status : Correct**

**Marks : 1/1**

5. Which folding method divides the key into equal parts, reverses some of them, and then adds all parts?

**Answer**

Folding reversal method

**Status : Correct**

**Marks : 1/1**

6. Which of the following values of ' $m$ ' is recommended for the division method in hashing?

**Answer**

A prime number

**Status : Correct**

**Marks : 1/1**

7. What happens if we do not use modular arithmetic in linear probing?

**Answer**

Index goes out of bounds

**Status :** Correct

**Marks :** 1/1

8. Which of these hashing methods may result in more uniform distribution with small keys?

**Answer**

Mid-Square

**Status :** Correct

**Marks :** 1/1

9. What would be the result of folding 123456 into three parts and summing:  $(12 + 34 + 56)$ ?

**Answer**

102

**Status :** Correct

**Marks :** 1/1

10. Which of the following best describes linear probing in hashing?

**Answer**

Resolving collisions by linearly searching for the next free slot

**Status :** Correct

**Marks :** 1/1

11. Which data structure is primarily used in linear probing?

**Answer**

Array

**Status :** Correct

**Marks :** 1/1

12. Which of the following statements is TRUE regarding the folding method?

**Answer**

It divides the key into parts and adds them.

**Status :** Correct

**Marks :** 1/1

13. Which situation causes clustering in linear probing?

**Answer**

Poor hash function

**Status :** Wrong

**Marks :** 0/1

14. What is the output of the mid-square method for a key  $k = 123$  if the hash table size is 10 and you extract the middle two digits of  $k * k$ ?

**Answer**

1

**Status :** Correct

**Marks :** 1/1

15. What is the worst-case time complexity for inserting an element in a hash table with linear probing?

**Answer**

$O(n)$

**Status :** Correct

**Marks :** 1/1

16. What is the primary disadvantage of linear probing?

**Answer**

Clustering

**Status :** Correct

**Marks :** 1/1

17. What does a deleted slot in linear probing typically contain?

**Answer**

-1

Status : Wrong

Marks : 0/1

18. In division method, if key = 125 and m = 13, what is the hash index?

Answer

8

Status : Correct

Marks : 1/1

19. Which C statement is correct for finding the next index in linear probing?

Answer

index = (index + 1) % size;

Status : Correct

Marks : 1/1

20. In the division method of hashing, the hash function is typically written as:

Answer

$h(k) = k \% m$

Status : Correct

Marks : 1/1

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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 7\_COD\_Question 1

Attempt : 1

Total Mark : 10

Marks Obtained : 10

### Section 1 : Coding

#### 1. Problem Statement

Ravi is building a basic hash table to manage student roll numbers for quick lookup. He decides to use Linear Probing to handle collisions.

Implement a hash table using linear probing where:

The hash function is:  $\text{index} = \text{roll\_number} \% \text{table\_size}$  On collision, check subsequent indexes (i+1, i+2, ...) until an empty slot is found.

You need to:

Insert a list of n student roll numbers into the hash table. Print the final state of the hash table. If a slot is empty, print -1.

#### **Input Format**

The first line of the input contains two integers n and table\_size, where n is the

number of roll numbers to be inserted, and table\_size is the size of the hash table.

The second line contains n space-separated integers — the roll numbers to insert into the hash table.

### **Output Format**

The output should print a single line with table\_size space-separated integers representing the final state of the hash table after all insertions.

If any slot remains unoccupied, it should be represented as -1.

Refer to the sample output for formatting specifications.

### **Sample Test Case**

Input: 4 7

50 700 76 85

Output: 700 50 85 -1 -1 -1 76

### **Answer**

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

```
#define MAX 100
```

```
void initializeTable(int table[], int size) {  
    for (int i = 0; i < size; i++) {  
        table[i] = -1;  
    }  
}
```

```
int linearProbe(int table[], int size, int num) {  
    int index = num % size;  
    while (table[index] != -1) {  
        index = (index + 1) % size;  
    }  
    return index;  
}
```

```
void insertIntoHashTable(int table[], int size, int arr[], int n) {
```

```
    for (int i = 0; i < n; i++) {  
        int index = linearProbe(table, size, arr[i]);  
        table[index] = arr[i];  
    }  
}  
  
void printTable(int table[], int size) {  
    for (int i = 0; i < size; i++) {  
        printf("%d ", table[i]);  
    }  
}  
  
int main() {  
    int n, table_size;  
    scanf("%d %d", &n, &table_size);  
  
    int arr[MAX];  
    int table[MAX];  
  
    for (int i = 0; i < n; i++)  
        scanf("%d", &arr[i]);  
  
    initializeTable(table, table_size);  
    insertIntoHashTable(table, table_size, arr, n);  
    printTable(table, table_size);  
  
    return 0;  
}
```

**Status :** Correct

**Marks :** 10/10



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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 7\_COD\_Question 2

Attempt : 1

Total Mark : 10

Marks Obtained : 10

### Section 1 : Coding

#### 1. Problem Statement

Priya is developing a simple student management system. She wants to store roll numbers in a hash table using Linear Probing, and later search for specific roll numbers to check if they exist.

Implement a hash table using linear probing with the following operations:

Insert all roll numbers into the hash table. For a list of query roll numbers, print "Value x: Found" or "Value x: Not Found" depending on whether it exists in the table.

#### ***Input Format***

The first line contains two integers,  $n$  and  $table\_size$  — the number of roll numbers to insert and the size of the hash table.

The second line contains n space-separated integers — the roll numbers to insert.

The third line contains an integer q — the number of queries.

The fourth line contains q space-separated integers — the roll numbers to search for.

### ***Output Format***

The output print q lines — for each query value x, print: "Value x: Found" or "Value x: Not Found"

Refer to the sample output for formatting specifications.

### ***Sample Test Case***

Input: 5 10  
21 31 41 51 61  
3  
31 60 51

Output: Value 31: Found  
Value 60: Not Found  
Value 51: Found

### ***Answer***

```
#include <stdio.h>

#define MAX 100

void initializeTable(int table[], int size) {
    for (int i = 0; i < size; i++) {
        table[i] = -1;
    }
}

int linearProbe(int table[], int size, int num) {
    int index = num % size;
    while (table[index] != -1) {
        index = (index + 1) % size;
    }
}
```

```

        return index;
    }
}

void insertIntoHashTable(int table[], int size, int arr[], int n) {
    for (int i = 0; i < n; i++) {
        int index = linearProbe(table, size, arr[i]);
        table[index] = arr[i];
    }
}

```

```

int searchInHashTable(int table[], int size, int num) {
    int index = num % size;
    int start = index;
    while (table[index] != -1) {
        if (table[index] == num)
            return 1;
        index = (index + 1) % size;
        if (index == start)
            break;
    }
    return 0;
}

```

```

int main() {
    int n, table_size;
    scanf("%d %d", &n, &table_size);

    int arr[MAX], table[MAX];
    for (int i = 0; i < n; i++)
        scanf("%d", &arr[i]);

    initializeTable(table, table_size);
    insertIntoHashTable(table, table_size, arr, n);

    int q, x;
    scanf("%d", &q);
    for (int i = 0; i < q; i++) {
        scanf("%d", &x);
        if (searchInHashTable(table, table_size, x))
            printf("Value %d: Found\n", x);
        else
            printf("Value %d: Not Found\n", x);
    }
}

```

```
} return 0;
```

**Status :** Correct

**Marks :** 10/10

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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 7\_COD\_Question 3

Attempt : 1

Total Mark : 10

Marks Obtained : 10

### Section 1 : Coding

#### 1. Problem Statement

In a messaging application, users maintain a contact list with names and corresponding phone numbers. Develop a program to manage this contact list using a dictionary implemented with hashing.

The program allows users to add contacts, delete contacts, and check if a specific contact exists. Additionally, it provides an option to print the contact list in the order of insertion.

#### ***Input Format***

The first line consists of an integer  $n$ , representing the number of contact pairs to be inserted.

Each of the next  $n$  lines consists of two strings separated by a space: the name of the contact (key) and the corresponding phone number (value).

The last line contains a string  $k$ , representing the contact to be checked or removed.

### **Output Format**

If the given contact exists in the dictionary:

1. The first line prints "The given key is removed!" after removing it.
2. The next  $n - 1$  lines print the updated contact list in the format: "Key: X; Value: Y" where X represents the contact's name and Y represents the phone number.

If the given contact does not exist in the dictionary:

1. The first line prints "The given key is not found!".
2. The next  $n$  lines print the original contact list in the format: "Key: X; Value: Y" where X represents the contact's name and Y represents the phone number.

Refer to the sample outputs for the formatting specifications.

### **Sample Test Case**

Input: 3

Alice 1234567890

Bob 9876543210

Charlie 4567890123

Bob

Output: The given key is removed!

Key: Alice; Value: 1234567890

Key: Charlie; Value: 4567890123

### **Answer**

```
// You are using GCC
```

```
#include <iostream>
```

```
#include <string>
```

```
#include <list>
```

```
#include <vector>
```

```
using namespace std;
```

```
const int TABLE_SIZE = 101;
```

```
struct HashEntry {  
    string key;  
    string value;  
    HashEntry(string k, string v) : key(k), value(v) {}  
};
```

```
class HashTable {
```

```
private:
```

```
    vector<list<HashEntry>> table;
```

```
    int hashFunction(const string& key) const {  
        int hash = 0;  
        for (char ch : key) {  
            hash = (hash * 31 + ch) % TABLE_SIZE;  
        }  
        return hash;  
    }
```

```
public:
```

```
    HashTable() : table(TABLE_SIZE) {}
```

```
    void insert(const string& key, const string& value) {
```

```
        int index = hashFunction(key);  
        for (auto& entry : table[index]) {  
            if (entry.key == key) {  
                entry.value = value;  
                return;  
            }  
        }
```

```
        table[index].emplace_back(key, value);  
    }
```

```
    bool remove(const string& key) {
```

```
        int index = hashFunction(key);  
        for (auto it = table[index].begin(); it != table[index].end(); ++it) {  
            if (it->key == key) {  
                table[index].erase(it);  
                return true;  
            }  
        }  
    }
```

```

        return false;
    }

    string search(const string& key) const {
        int index = hashFunction(key);
        for (const auto& entry : table[index]) {
            if (entry.key == key) {
                return entry.value;
            }
        }
        return "";
    }

    void printAll() const {
        for (const auto& bucket : table) {
            for (const auto& entry : bucket) {
                cout << "Key: " << entry.key << "; Value: " << entry.value << endl;
            }
        }
    }
};

```

```

int main() {
    int n;
    cin >> n;

    HashTable contacts;
    vector<pair<string, string>> inputContacts;

    for (int i = 0; i < n; ++i) {
        string name, phone;
        cin >> name >> phone;
        contacts.insert(name, phone);
        inputContacts.emplace_back(name, phone);
    }

    string keyToRemove;
    cin >> keyToRemove;

    if (contacts.remove(keyToRemove)) {
        cout << "The given key is removed!" << endl;
    } else {

```



```
        cout << "The given key is not found!" << endl;
    }

    for (const auto& contact : inputContacts) {
        if (contact.first != keyToRemove) {
            cout << "Key: " << contact.first << "; Value: " << contact.second << endl;
        }
    }

    return 0;
}
```

**Status :** Correct

**Marks :** 10/10

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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 7\_COD\_Question 4

Attempt : 1

Total Mark : 10

Marks Obtained : 10

### Section 1 : Coding

#### 1. Problem Statement

Develop a program using hashing to manage a fruit contest where each fruit is assigned a unique name and a corresponding score. The program should allow the organizer to input the number of fruits and their names with scores.

Then, it should enable them to check if a specific fruit, identified by its name, is part of the contest. If the fruit is registered, the program should display its score; otherwise, it should indicate that it is not included in the contest.

#### ***Input Format***

The first line consists of an integer N, representing the number of fruits in the contest.

The following N lines contain a string K and an integer V, separated by a space, representing the name and score of each fruit in the contest.

The last line consists of a string T, representing the name of the fruit to search for.

### **Output Format**

If T exists in the dictionary, print "Key "T" exists in the dictionary.".

If T does not exist in the dictionary, print "Key "T" does not exist in the dictionary.".

Refer to the sample outputs for the formatting specifications.

### **Sample Test Case**

Input: 2  
banana 2  
apple 1  
Banana

Output: Key "Banana" does not exist in the dictionary.

### **Answer**

```
// You are using GCC
#include <iostream>
#include <unordered_map>
#include <string>
```

```
int main() {
    int N;
    std::cin >> N;

    std::unordered_map<std::string, int> fruitScores;
    std::string fruit;
    int score;

    for (int i = 0; i < N; ++i) {
        std::cin >> fruit >> score;
        fruitScores[fruit] = score;
    }
}
```

```
}  
std::cin >> fruit;  
  
if (fruitScores.find(fruit) != fruitScores.end()) {  
    std::cout << "Key \"<\" exists in the dictionary." << std::endl;  
} else {  
    std::cout << "Key \"<\" does not exist in the dictionary." <<  
std::endl;  
}  
  
return 0;  
}
```

**Status :** Correct

**Marks :** 10/10

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## NeoColab\_REC\_CS23231\_DATA STRUCTURES

### REC\_DS using C\_Week 7\_COD\_Question 5

Attempt : 1

Total Mark : 10

Marks Obtained : 10

### Section 1 : Coding

#### 1. Problem Statement

You are provided with a collection of numbers, each represented by an array of integers. However, there's a unique scenario: within this array, one element occurs an odd number of times, while all other elements occur an even number of times. Your objective is to identify and return the element that occurs an odd number of times in this arrangement.

Utilize mid-square hashing by squaring elements and extracting middle digits for hash codes. Implement a hash table for efficient integer occurrence tracking.

Note: Hash function: squared = key \* key.

Example

Input:

7

2 2 3 3 4 4 5

Output:

5

Explanation

The hash function and the calculated hash indices for each element are as follows:

2 ->  $\text{hash}(2*2) \% 100 = 4$

3 ->  $\text{hash}(3*3) \% 100 = 9$

4 ->  $\text{hash}(4*4) \% 100 = 16$

5 ->  $\text{hash}(5*5) \% 100 = 25$

The hash table records the occurrence of each element's hash index:

Index 4: 2 occurrences

Index 9: 2 occurrences

Index 16: 2 occurrences

Index 25: 1 occurrence

Among the elements, the integer 5 occurs an odd number of times (1 occurrence) and satisfies the condition of the problem. Therefore, the program outputs 5.

### ***Input Format***

The first line of input consists of an integer N, representing the size of the array.

The second line consists of N space-separated integers, representing the elements of the array.

### ***Output Format***

The output prints a single integer representing the element that occurs an odd

number of times.

If no such element exists, print -1.

Refer to the sample output for the formatting specifications.

### **Sample Test Case**

Input: 7

2 2 3 3 4 4 5

Output: 5

### **Answer**

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

#define MAX_SIZE 100

unsigned int hash(int key, int tableSize) {
    int squared = key * key;
    return squared % tableSize;
}

int getOddOccurrence(int arr[], int size) {
    int tableSize = 101;
    int hashTable[101][2] = {0};

    for (int i = 0; i < size; i++) {
        int h = hash(arr[i], tableSize);
        if (hashTable[h][0] == arr[i]) {
            hashTable[h][1]++;
        } else if (hashTable[h][0] == 0) {
            hashTable[h][0] = arr[i];
            hashTable[h][1] = 1;
        } else {
            int found = 0;
            for (int j = 0; j < tableSize; j++) {
                int newHash = (h + j) % tableSize;
```

```

        if (hashTable[newHash][0] == arr[i]) {
            hashTable[newHash][1]++;
            found = 1;
            break;
        } else if (hashTable[newHash][0] == 0) {
            hashTable[newHash][0] = arr[i];
            hashTable[newHash][1] = 1;
            found = 1;
            break;
        }
    }
    if (!found) return -1;
}
}

for (int i = 0; i < tableSize; i++) {
    if (hashTable[i][0] != 0 && hashTable[i][1] % 2 == 1) {
        return hashTable[i][0];
    }
}

return -1;
}

int main() {
    int n;
    scanf("%d", &n);

    int arr[MAX_SIZE];
    for (int i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    }

    printf("%d\n", getOddOccurrence(arr, n));

    return 0;
}

```

**Status :** Correct

**Marks :** 10/10