

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 : 14

Section 1 : MCQ

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

Answer

index = (index + key) % size;

Status : Wrong

Marks : 0/1

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

Answer

Mid-Square

Status : Correct

Marks : 1/1

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

Answer

$$h(k) = k \% m$$

Status : Correct

Marks : 1/1

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

Answer

8

Status : Correct

Marks : 1/1

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

Answer

Linked List

Status : Wrong

Marks : 0/1

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

Answer

It uses square of key values.

Status : Wrong

Marks : 0/1

7. 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

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

Answer

$(i + \text{key}) \% \text{table_size}$

Status : Wrong

Marks : 0/1

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

Answer

Folding boundary method

Status : Wrong

Marks : 0/1

10. Which situation causes clustering in linear probing?

Answer

Poor hash function

Status : Wrong

Marks : 0/1

11. 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

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

Answer

Index goes out of bounds

Status : Correct

Marks : 1/1

13. 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

14. 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

15. 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

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

Answer

A prime number

Status : Correct

Marks : 1/1

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

Answer

102

Status : Correct

Marks : 1/1

18. 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

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

Answer

A special "deleted" marker

Status : Correct

Marks : 1/1

20. What is the primary disadvantage of linear probing?

Answer

Clustering

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
```

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

```
void initializeTable(int table[], int size) {
```

```
    for (int i = 0; i < size; i++) {
```

```
        table[i] = -1; // Initialize all slots to -1 (empty)
```

```
    } // Type your code here
```

```
}
```

```
int linearProbe(int table[], int size, int num) {
```

```
    int index = num % size; // Hash function
```

```
    int originalIndex = index; // Store original index for loop control
```

```
    // Linear probing to find an empty slot
```

```
    while (table[index] != -1) {
```

```
        index = (index + 1) % size; // Move to the next index
```

```
        if (index == originalIndex) {
```

```
            // If we have looped back to the original index, the table is full
```

```

        return -1; // Indicate that the table is full
    }
}
return index; // Type your code here
}

void insertIntoHashTable(int table[], int size, int arr[], int n) {
    for (int i = 0; i < n; i++) {
        int index = linearProbe(table, size, arr[i]);
        if (index != -1) {
            table[index] = arr[i]; // Insert the roll number into the table
        }
    }
    // Type your code here
}

void printTable(int table[], int size) {
    for (int i = 0; i < size; i++) {
        printf("%d ", table[i]);
    }
    printf("\n"); // Type your code here
}

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

// You are using GCC
void initializeTable(int table[], int size) {
    for (int i = 0; i < size; i++) {
        table[i] = -1; // Use -1 to indicate an empty slot
    } //Type your code here
}

int linearProbe(int table[], int size, int num) {
    int index = num % size; // Initial hash index
    while (table[index] != -1) { // While the slot is occupied
        index = (index + 1) % size; // Move to the next slot
    }
}
```

```

    }
    return index;//Type your code here
}

void insertIntoHashTable(int table[], int size, int arr[], int n) {
    for (int i = 0; i < n; i++) {
        int index = linearProbe(table, size, arr[i]); // Get the index using linear probing
        table[index] = arr[i]; // Insert the roll number into the table
    }//Type your code here
}

int searchInHashTable(int table[], int size, int num) {
    int index = num % size; // Initial hash index
    while (table[index] != -1) { // While the slot is occupied
        if (table[index] == num) {
            return 1; // Found
        }
        index = (index + 1) % size; // Move to the next slot
    }
    return 0;//Type your code here
}

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 <stdio.h>
```

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

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

```
#define MAX_CONTACTS 50
```

```
#define MAX_NAME_LENGTH 11
```

```

#define MAX_PHONE_LENGTH 11
typedef struct {
    char name[MAX_NAME_LENGTH];
    char phone[MAX_PHONE_LENGTH];
} Contact;
typedef struct {
    Contact contacts[MAX_CONTACTS];
    int size;
} ContactList;
void add_contact(ContactList *list, const char *name, const char *phone) {
    if (list->size < MAX_CONTACTS) {
        strcpy(list->contacts[list->size].name, name);
        strcpy(list->contacts[list->size].phone, phone);
        list->size++;
    }
}
int remove_contact(ContactList *list, const char *name) {
    for (int i = 0; i < list->size; i++) {
        if (strcmp(list->contacts[i].name, name) == 0) {
            // Shift contacts to remove the contact
            for (int j = i; j < list->size - 1; j++) {
                list->contacts[j] = list->contacts[j + 1];
            }
            list->size--;
            return 1; // Contact found and removed
        }
    }
    return 0; // Contact not found
}
void print_contacts(const ContactList *list) {
    for (int i = 0; i < list->size; i++) {
        printf("Key: %s; Value: %s\n", list->contacts[i].name, list->contacts[i].phone);
    }
}
int main() {
    ContactList contactList;
    contactList.size = 0;
    int n;
    scanf("%d", &n);
    for (int i = 0; i < n; i++) {
        char name[MAX_NAME_LENGTH], phone[MAX_PHONE_LENGTH];
        scanf("%s %s", name, phone);
    }
}

```

```
        add_contact(&contactList, name, phone);
    }
    char key[MAX_NAME_LENGTH];
    scanf("%s", key);
    if (remove_contact(&contactList, key)) {
        printf("The given key is removed!\n");
        print_contacts(&contactList);
    } else {
        printf("The given key is not found!\n");
        print_contacts(&contactList);
    }
    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 <stdio.h>
#include <stdlib.h>
#include <string.h>
#define MAX_FRUITS 15
#define MAX_NAME_LENGTH 20
typedef struct {
    char name[MAX_NAME_LENGTH];
    int score;
} Fruit;
typedef struct {
    Fruit fruits[MAX_FRUITS];
    int size;
} FruitContest;
void add_fruit(FruitContest *contest, const char *name, int score) {
    if (contest->size < MAX_FRUITS) {
```

```

        strcpy(contest->fruits[contest->size].name, name);
        contest->fruits[contest->size].score = score;
        contest->size++;
    }
}

int find_fruit(const FruitContest *contest, const char *name) {
    for (int i = 0; i < contest->size; i++) {
        if (strcmp(contest->fruits[i].name, name) == 0) {
            return contest->fruits[i].score; // Return the score if found
        }
    }
    return -1; // Return -1 if not found
}

int main() {
    FruitContest contest;
    contest.size = 0;
    int N;
    scanf("%d", &N);
    for (int i = 0; i < N; i++) {
        char name[MAX_NAME_LENGTH];
        int score;
        scanf("%s %d", name, &score);
        add_fruit(&contest, name, score);
    }
    char search_name[MAX_NAME_LENGTH];
    scanf("%s", search_name);
    int score = find_fruit(&contest, search_name);
    if (score != -1) {
        printf("Key \"%s\" exists in the dictionary.\n", search_name);
    } else {
        printf("Key \"%s\" does not exist in the dictionary.\n", search_name);
    }
    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

// You are using GCC
unsigned int hash(int key, int tableSize) {
    int squared = key * key;
    unsigned int midDigits = (squared / 10) % 100;
    return midDigits % tableSize; // Type your code here
}

int getOddOccurrence(int arr[], int size) {
    const int TABLE_SIZE = 100;
    int countTable[TABLE_SIZE];
    int elementTable[TABLE_SIZE];
    for (int i = 0; i < TABLE_SIZE; i++) {
        countTable[i] = 0;
        elementTable[i] = -1; // initialize empty slot
    }
    for (int i = 0; i < size; i++) {
        int key = arr[i];
        unsigned int idx = hash(key, TABLE_SIZE);

        // Handle collisions - linear probing
```

```

while (elementTable[idx] != -1 && elementTable[idx] != key) {
    idx = (idx + 1) % TABLE_SIZE;
}
elementTable[idx] = key;
countTable[idx]++;
}
// Find the element that has odd count
for (int i = 0; i < TABLE_SIZE; i++) {
    if (elementTable[i] != -1 && (countTable[i] % 2) != 0) {
        return elementTable[i];
    }
}
return -1; //Type your code here
}

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