Rajalakshmi Engineering College

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NeoColab_REC_CS23231_DATA STRUCTURES

REC_DS using C_Week 7_MCQ_Updated

Attempt : 1
Total Mark : 20
Marks Obtained : 19

Section 1 : MCQ

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

Answer

A prime number

Status : Correct   *Marks : 1/1*

2. 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*

3. 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*

4. What is the primary disadvantage of linear probing?

Answer

Clustering

Status : Correct   *Marks : 1/1*

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

Answer

102

Status : Correct   *Marks : 1/1*

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

Answer

k % table_size

Status : Correct   *Marks : 1/1*

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

2

Status : Wrong   *Marks : 0/1*

8.   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**

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

Answer

8

Status : Correct   **Marks : 1/1**

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

Answer

Index goes out of bounds

Status : Correct   **Marks : 1/1**

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

Answer

(i + 1) % table_size

Status : Correct   **Marks : 1/1**

13. Which situation causes clustering in linear probing?

Answer

All the mentioned options

Status : Correct   *Marks : 1/1*

14. 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*

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

Answer

h(k) = k % m

Status : Correct   *Marks : 1/1*

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

Answer

A special "deleted" marker

Status : Correct   *Marks : 1/1*

17. 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*

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

Answer

Array

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

Answer

Mid-Square

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: index = roll_number % table_sizeOn 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

```c
#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 h = num % size;
    int c = h;
    while (table[c] != -1) {
        c = (c + 1) % size;
    }
    return c;
}
```

```c
void insertIntoHashTable(int table[], int size, int arr[], int n_elements) {
    for (int i = 0; i < n_elements; i++) {
        int v = arr[i];
        int idx = linearProbe(table, size, v);
        table[idx] = v;
    }
}

void printTable(int table[], int size) {
    for (int i = 0; i < size; i++) {
        printf("%d", table[i]);
        if (i < size - 1) {
            printf(" ");
        }
    }
    printf("\n");
}
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 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 <string.h>

#define MAX_CONTACTS 50
#define MAX_STR_LEN 11
```

```c
#define HASH_TABLE_SIZE 100

typedef struct {
    char k[MAX_STR_LEN];
    char v[MAX_STR_LEN];
    int o;
} E;

E ol[MAX_CONTACTS];
E ht[HASH_TABLE_SIZE];
int c = 0;

int hf(char* ks) {
    unsigned long hv = 0;
    for (int i = 0; ks[i] != '\0'; i++) {
        hv = (hv * 31 + ks[i]);
    }
    return hv % HASH_TABLE_SIZE;
}

int main() {
    for (int i = 0; i < HASH_TABLE_SIZE; i++) {
        ht[i].o = 0;
    }

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

    for (int i = 0; i < n; i++) {
        scanf("%s %s", ol[c].k, ol[c].v);

        char* cur_k = ol[c].k;
        char* cur_v = ol[c].v;

        int h_idx = hf(cur_k);
        while (ht[h_idx].o == 1) {
            h_idx = (h_idx + 1) % HASH_TABLE_SIZE;
        }
        strcpy(ht[h_idx].k, cur_k);
        strcpy(ht[h_idx].v, cur_v);
        ht[h_idx].o = 1;
```

```c
        c++;
    }

    char qk_str[MAX_STR_LEN];
    scanf("%s", qk_str);

    int f = 0;
    int s_idx = hf(qk_str);
    int tr = 0;

    while (ht[s_idx].o != 0 && tr < HASH_TABLE_SIZE) {
        if (ht[s_idx].o == 1 && strcmp(ht[s_idx].k, qk_str) == 0) {
            f = 1;
            break;
        }
        s_idx = (s_idx + 1) % HASH_TABLE_SIZE;
        tr++;
    }

    if (f) {
        printf("The given key is removed!\n");
        for (int i = 0; i < c; i++) {
            if (strcmp(ol[i].k, qk_str) == 0) {
                continue;
            }
            printf("Key: %s; Value: %s\n", ol[i].k, ol[i].v);
        }
    } else {
        printf("The given key is not found!\n");
        for (int i = 0; i < c; i++) {
            printf("Key: %s; Value: %s\n", ol[i].k, ol[i].v);
        }
    }

    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 <string.h>

#define M_S_L 50
#define H_T_S 31

typedef struct {
    char k[M_S_L];
    int v;
    int o;
} E;

E ht[H_T_S];

int hf(char* s_param) {
```

```c
    unsigned long hv_val = 0;
    int i_loop;
    for (i_loop = 0; s_param[i_loop] != '\0'; i_loop++) {
        hv_val = (hv_val * 31 + s_param[i_loop]);
    }
    return hv_val % H_T_S;
}

int main() {
    int i;
    for (i = 0; i < H_T_S; i++) {
        ht[i].o = 0;
    }

    int n_val;
    scanf("%d", &n_val);

    char k_str[M_S_L];
    int v_val;

    for (i = 0; i < n_val; i++) {
        scanf("%s %d", k_str, &v_val);
        int idx = hf(k_str);
        while (ht[idx].o == 1) {
            idx = (idx + 1) % H_T_S;
        }
        strcpy(ht[idx].k, k_str);
        ht[idx].v = v_val;
        ht[idx].o = 1;
    }

    char t_str[M_S_L];
    scanf("%s", t_str);

    int s_idx = hf(t_str);
    int f_flag = 0;
    int tr_cnt = 0;

    while (ht[s_idx].o != 0 && tr_cnt < H_T_S) {
        if (ht[s_idx].o == 1 && strcmp(ht[s_idx].k, t_str) == 0) {
            f_flag = 1;
            break;
```

```c
        }
        s_idx = (s_idx + 1) % H_T_S;
        tr_cnt++;
    }

    if (f_flag) {
        printf("Key \"%s\" exists in the dictionary.\n", t_str);
    } else {
        printf("Key \"%s\" does not exist in the dictionary.\n", t_str);
    }

    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 : 0

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 -> hash(2*2) % 100 = 4

3 -> hash(3*3) % 100 = 9

4 -> hash(4*4) % 100 = 16

5 -> 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

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

#define MAX_SIZE 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 h = num % size;
    int c = h;
    while (table[c] != -1) {
        c = (c + 1) % size;
    }
    return c;
}

void insertIntoHashTable(int table[], int size, int arr[], int n_elements) {
    for (int i = 0; i < n_elements; i++) {
        int v = arr[i];
        int idx = linearProbe(table, size, v);
```

```
        table[idx] = v;
    }
}

void printTable(int table[], int size) {
    for (int i = 0; i < size; i++) {
        printf("%d", table[i]);
        if (i < size - 1) {
            printf(" ");
        }
    }
    printf("\n");
}
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 : Wrong   ***Marks : 0/10***

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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

```c
#include <stdio.h>

#define MAX 100

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

int linearProbe(int t[], int s, int v) {
    int h = v % s;
    int c = h;
    while (t[c] != -1) {
        c = (c + 1) % s;
```

```c
    }
    return c;
}

void insertIntoHashTable(int t[], int s, int a[], int n_val) {
    for (int i = 0; i < n_val; i++) {
        int v = a[i];
        int idx = linearProbe(t, s, v);
        t[idx] = v;
    }
}

int searchInHashTable(int t[], int s, int v) {
    int h = v % s;
    int c = h;
    int tries = 0;
    while (t[c] != -1 && tries < s) {
        if (t[c] == v) {
            return 1;
        }
        c = (c + 1) % s;
        tries++;
    }
    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);
```

```c
        else
            printf("Value %d: Not Found\n", x);
    }

    return 0;
}
```

Status : Correct   *Marks : 10/10*

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2024_28_III_OOPS Using Java Lab

2028_REC_OOPS using Java_Week 7_Q4

Attempt : 1
Total Mark : 10
Marks Obtained : 10

Section 1 : Coding

1. Problem Statement

Maria, a software developer, is working on an inventory management system project using Java that utilizes an inventory interface to manage a store's products.

The interface should define two methods: addProduct, which adds a product by accepting its name, price, and quantity, and calculateTotalValue, which computes the total value of all products in the inventory. Implement the interface in a class called SimpleInventory, which internally manages a list of Product objects.

Each Product object should encapsulate the product's name, price, and quantity and include a method to calculate its value as price × quantity. The system should allow users to dynamically add products to the inventory and calculate the total value of all products stored.

Help Maria achieve the task.

Input Format

The first line of input consists of an integer to choose one of the following options:

1 - to add a product to the inventory.

2 - to calculate and view the total inventory value.

3 - to exit the program.

For Choice 1 (Add Product):

The next input line is the string representing the product name as a string (single or multi-word, without quotes).

The next line is a double value representing the price as a decimal value

The next line is an integer value representing the quantity as an integer

For Choices 2 and 3, no additional input is required

Output Format

The output displays the results of the commands as follows:

- For the addProduct command, the program should display "Product added to inventory."
- For choice 2, the program should display "Total inventory value [totalvalue]. "The total value should be displayed with one decimal place. If there is no product in the inventory, print the total as 0.0.
- For choice 3, the program should exit

If the choice is not 1, 2, or 3, then print "Invalid choice. Please select a valid option (1/2/3).".

Refer to the sample output for the formatting specifications.

Input: 1
Laptop
800.0
3
2
5
3

Output: Product added to inventory.
Total inventory value: $2400.0
Invalid choice. Please select a valid option (1/2/3).

Answer

```java
import java.util.Scanner;
import java.util.List;
import java.util.ArrayList;

interface Inventory {
    void addProduct(String name, double price, int quantity);
    double calculateTotalValue();
}

class Product {
    private String name;
    private double price;
    private int quantity;

    public Product(String name, double price, int quantity) {
        this.name = name;
        this.price = price;
        this.quantity = quantity;
    }

    public double getValue() {
        return price * quantity;
    }
}

class SimpleInventory implements Inventory {
    private List<Product> products = new ArrayList<>();
```

```java
    public SimpleInventory() {}

    public SimpleInventory(int unused) {
        // This constructor is required due to the platform calling new
SimpleInventory(10)
    }

    public void addProduct(String name, double price, int quantity) {
        products.add(new Product(name, price, quantity));
        System.out.println("Product added to inventory.");
    }

    public double calculateTotalValue() {
        double total = 0.0;
        for (Product p : products) {
            total += p.getValue();
        }
        return total;
    }
}

public class Main {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        Inventory inventory = new SimpleInventory(10);
        while (true) {
            int choice = scanner.nextInt();
            if (choice == 1) {
                scanner.nextLine();
                String productName = scanner.nextLine();
                double price = scanner.nextDouble();
                int quantity = scanner.nextInt();
                inventory.addProduct(productName, price, quantity);
            } else if (choice == 2) {
                double totalValue = inventory.calculateTotalValue();
                System.out.println("Total inventory value: $" + totalValue);
            } else if (choice == 3) {
                break;
            } else {
                System.out.println("Invalid choice. Please select a valid option
(1/2/3).");
            }
        }
```

```
        scanner.close();
    }
}
```

Status : Correct   *Marks : 10/10*