Practical 9

Implement a hash table data structure using different hash function and collision resolution techniques such as chaining and open addressing.

```
#include <stdio.h>

#include <stdlib.h>


#define SIZE 10


// Node for chaining

struct Node {

   int data;

   struct Node* next;

};


struct Node* chainTable[SIZE]; // Hash table for chaining

int openAddressingTable[SIZE];  // Hash table for open addressing


// Hash function

int hashFunction(int value) {

   return value % SIZE;

}


// Chaining

void insertChaining(int value) {

   int index = hashFunction(value);

   struct Node* newNode = (struct Node*)malloc(sizeof(struct Node));

   newNode->data = value;

   newNode->next = chainTable[index];
```

```
    chainTable[index] = newNode;
}

void displayChaining() {
    for (int i = 0; i < SIZE; i++) {
        struct Node* temp = chainTable[i];
        printf("Index %d: ", i);
        while (temp) {
            printf("%d -> ", temp->data);
            temp = temp->next;
        }
        printf("NULL\n");
    }
}

// Linear Probing
void insertLinearProbing(int value) {
    int index = hashFunction(value);
    while (openAddressingTable[index] != 0) {
        index = (index + 1) % SIZE;
    }
    openAddressingTable[index] = value;
}

void displayLinearProbing() {
    for (int i = 0; i < SIZE; i++) {
        printf("Index %d: %d\n", i, openAddressingTable[i]);
    }
}
```

```
// Quadratic Probing
void insertQuadraticProbing(int value) {
    int index = hashFunction(value);
    for (int i = 0; i < SIZE; i++) {
        int newIndex = (index + i * i) % SIZE;
        if (openAddressingTable[newIndex] == 0) {
            openAddressingTable[newIndex] = value;
            return;
        }
    }
}

// Double Hashing
int secondHashFunction(int value) {
    return 7 - (value % 7); // Secondary hash function
}

void insertDoubleHashing(int value) {
    int index = hashFunction(value);
    int stepSize = secondHashFunction(value);
    while (openAddressingTable[index] != 0) {
        index = (index + stepSize) % SIZE;
    }
    openAddressingTable[index] = value;
}

// Main function
int main() {
```

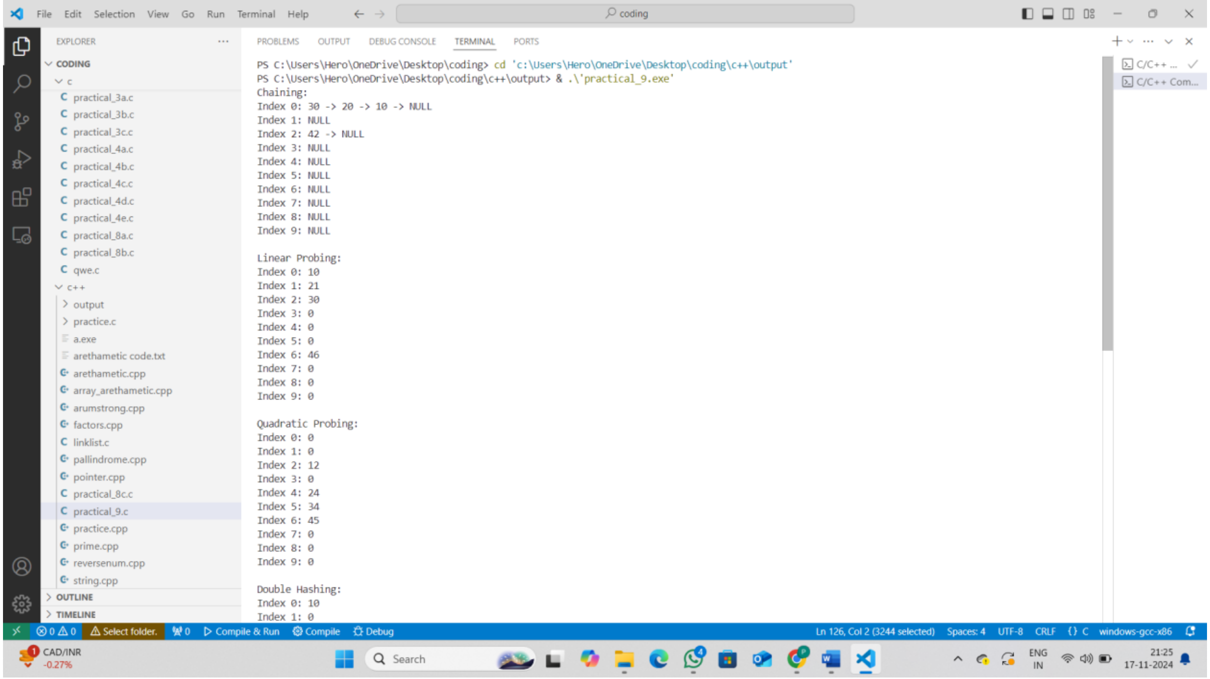
```
// Chaining
printf("Chaining:\n");
insertChaining(10);
insertChaining(20);
insertChaining(30);
insertChaining(42);
displayChaining();

// Open Addressing
printf("\nLinear Probing:\n");
for (int i = 0; i < SIZE; i++) {
  openAddressingTable[i] = 0; // Initialize the table
}
insertLinearProbing(10);
insertLinearProbing(21);
insertLinearProbing(30);
insertLinearProbing(46);
displayLinearProbing();

// Quadratic Probing
printf("\nQuadratic Probing:\n");
for (int i = 0; i < SIZE; i++) {
  openAddressingTable[i] = 0; // Initialize the table
}
insertQuadraticProbing(12);
insertQuadraticProbing(24);
insertQuadraticProbing(34);
insertQuadraticProbing(45);
displayLinearProbing(); // Reusing display function
```

```
    // Double Hashing
    printf("\nDouble Hashing:\n");
    for (int i = 0; i < SIZE; i++) {
        openAddressingTable[i] = 0; // Initialize the table
    }
    insertDoubleHashing(10);
    insertDoubleHashing(22);
    insertDoubleHashing(32);
    insertDoubleHashing(45);
    displayLinearProbing(); // Reusing display function

    return 0;
}
```



```
PS C:\Users\Hero\OneDrive\Desktop\coding> cd 'c:\Users\Hero\OneDrive\Desktop\coding\c++\output'
PS C:\Users\Hero\OneDrive\Desktop\coding\c++\output> & .\'practical_9.exe'
Chaining:
Index 0: 30 -> 20 -> 10 -> NULL
Index 1: NULL
Index 2: 42 -> NULL
Index 3: NULL
Index 4: NULL
Index 5: NULL
Index 6: NULL
Index 7: NULL
Index 8: NULL
Index 9: NULL

Linear Probing:
Index 0: 10
Index 1: 21
Index 2: 30
Index 3: 0
Index 4: 0
Index 5: 0
Index 6: 46
Index 7: 0
Index 8: 0
Index 9: 0

Quadratic Probing:
Index 0: 0
Index 1: 0
Index 2: 12
Index 3: 0
Index 4: 24
Index 5: 34
Index 6: 45
Index 7: 0
Index 8: 0
Index 9: 0

Double Hashing:
Index 0: 10
Index 1: 0
```