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Roll Number: SYCOC303 Division: C

PRN Number: 122B2B303 Batch: C4

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Problem Statement:

- ⇨ Consider an employee database of N employees. Make use of a hash table implementation toquickly look up the employee‟s id number.
- ⇨ Implemented the collision technique of LINEAR PROBING.

==========

INPUT:

```
/*
 *    ====================================
 *          Program Name: Hashing.cpp
 *    Created on: November 25, 2022
 *      Author: Vinayak Shete
 *  ====================================
 */
#include<iostream>
#include<stdlib.h>
#include<stdio.h>
#include<string.h>
using namespace std;
struct employee
{
      int emp_id;
      string emp_name;
      string emp_address;
      double emp_salary;
};
class EmpTable
```

```
{
	int id;
	int current_size=0;
	string name;
	string addr;
	double salary;
	public:
		//calculating the hashkey
		int calcHashKey(int X,int table_size)
		{
			int hashkey=X%table_size;
			return hashkey;
		}
		//function for insertion operation
		void insert(int table_size,struct employee emp[])
		{
			if(current_size>=table_size)
			{
				cout<<"\nEntries exceeded than the size you
entered!Insertion Operation failed!";
			}
			else
			{
				cout<<"\n=======================\nYou are doing
Insertion Operation\n=======================";
				cout<<"\nEnter the id of an employee:";
				cin>>id;
				cout<<"\nEnter the name of an employee:";
				cin>>name;
				cout<<"\nEnter the address of an employee:";
				cin>>addr;
				cout<<"\nEnter the salary of an employee:";
				cin>>salary;
				int i=calcHashKey(id,table_size);
				//if key index is empty
```

```
                        if(emp[i].emp_id==-1)
                        {
                              emp[i].emp_id=id;
                              emp[i].emp_name=name;
                              emp[i].emp_address=addr;
                              emp[i].emp_salary=salary;
                              cout<<"\nThe record is entered successfully at
"<<i<<"th location\n";
                              current_size++;
                              cout<<"Current Size:"<<current_size;
                        }
                        //if key index is not empty do linear probing
                        else
                        {
                              cout<<"\nCollision occurred!!The key index
"<<i<<" for this record is already filled so doing linear probing...";
                              for(int j=i+1;j!=i;j++)
                              {
                                    if(j==table_size)
                                    {
                                          j=j%table_size;
                                    }
                                    if(emp[j].emp_id==-1)
                                    {
                                          emp[j].emp_id=id;
                                          emp[j].emp_name=name;
                                          emp[j].emp_address=addr;
                                          emp[j].emp_salary=salary;
                                          cout<<"\nThe record is entered
successfully at "<<j<<"th location\n";
                                          current_size++;
                                          cout<<"Current
Size:"<<current_size;
                                          break;
                                    }
                              }
```

```
                        }
                  }
            }
            //delete function
            void deletefun(int tb_size, struct employee emp[])
            {
                  if(current_size==0)
                  {
                        cout<<"\nNo records are present!Deletion Operation
failed!";
                  }
                  else
                  {
                        cout<<"\n=======================\nYou are doing
Deletion Operation\n=======================";
                        cout<<"\nEnter the id of an employee to be deleted:";
                        cin>>id;
                        int delkey=calcHashKey(id,tb_size);
                        if(id==emp[delkey].emp_id)
                        {
                              emp[delkey].emp_id=-1;
                              emp[delkey].emp_name="NULL";
                              emp[delkey].emp_address="NULL";
                              emp[delkey].emp_salary=-1;
                              cout<<"\nThe record is deleted successfully
from "<<delkey<<"th location\n";
                              current_size--;
                              cout<<"Current Size:"<<current_size;
                        }
                        else
                        {
                              cout<<"\nThe record is not present at its key
index..May be linear probing done.. Deleting..";
                              for(int j=delkey+1;j!=delkey;j++)
                              {
                                    if(j==tb_size)
```

```
                                    {
                                          j=j%tb_size;
                                    }
                                    if(emp[j].emp_id==id)
                                    {
                                                emp[j].emp_id=-1;
                                                emp[j].emp_name="NULL";
                                                emp[j].emp_address="NULL";
                                                emp[j].emp_salary=-1;
                                                cout<<"\nThe record is
deleted successfully from "<<j<<"th location\n";
                                                current_size--;
                                                cout<<"Current
Size:"<<current_size;
                                                break;
                                    }
                              }
                        }
                  }
            }
            //search function
            void search(int tb_size, struct employee emp[])
            {
                  if(current_size==0)
                  {
                        cout<<"\nNo records are present!Search Operation
failed!";
                  }
                  else
                  {
                        cout<<"\n=======================\nYou are doing
Searching Operation\n=======================";
                        cout<<"\nEnter the id of an employee to be
searched:";
                        cin>>id;
                        int searchkey=calcHashKey(id,tb_size);
```

```
                        if(id==emp[searchkey].emp_id)
                        {
                              cout<<"\nThe record is found successfully at
"<<searchkey<<"th location\n";
      cout<<"\n=============================================================
==========================================";
      cout<<"\nIndex\t\t\tEmpID\t\t\tEmpName\t\t\tEmpAddr\t\t\tEmpSalary";

      cout<<"\n"<<searchkey<<"\t\t\t"<<emp[searchkey].emp_id<<"\t\t\t"<<emp[s
earchkey].emp_name<<"\t\t\t"<<emp[searchkey].emp_address<<"\t\t\t"<<emp[searc
hkey].emp_salary;
      cout<<"\n=============================================================
==========================================";
                        }
                        else
                        {
                              cout<<"\nThe record is not present at its key
index..May be linear probing done.. Searching..";
                              for(int j=searchkey+1;j!=searchkey;j++)
                              {
                                    if(j==tb_size)
                                    {
                                          j=j%tb_size;
                                    }
                                    if(emp[j].emp_id==id)
                                    {
                                                cout<<"\nThe record is found
successfully at "<<j<<"th location\n";
      cout<<"\n=============================================================
==========================================";
      cout<<"\nIndex\t\t\tEmpID\t\t\tEmpName\t\t\tEmpAddr\t\t\tEmpSalary";

      cout<<"\n"<<j<<"\t\t\t"<<emp[j].emp_id<<"\t\t\t"<<emp[j].emp_name<<"\t\
t\t"<<emp[j].emp_address<<"\t\t\t"<<emp[j].emp_salary;
      cout<<"\n=============================================================
==========================================";
                                                break;
                                    }
                              }
                        }
                  }
            }
            //display function
```

```
            void display(struct employee emp[],int tb_size)
            {
                  cout<<"\n=========================HASH TABLE STORING
"<<tb_size<<" EMPLOYEE INFORMATION==============================";
      cout<<"\n=================================================================
=============================================";
      cout<<"\nIndex\t\t\tEmpID\t\t\tEmpName\t\t\tEmpAddr\t\t\tEmpSalary";
                  for(int l=0;l<tb_size;l++)
                  {
      cout<<"\n"<<l<<"\t\t\t"<<emp[l].emp_id<<"\t\t\t"<<emp[l].emp_name<<"\t\
t\t"<<emp[l].emp_address<<"\t\t\t"<<emp[l].emp_salary;
                  }
      cout<<"\n=================================================================
=============================================";
            }
};
int main()
{
      int size,ch,doch;
      EmpTable obj;
      cout<<"================================Welcome=========================
======================\n";
      cout<<"Enter the number of employees to be stored in a hash table:";
      cin>>size;
      struct employee empArr[size];
      for(int k=0;k<size;k++)
      {
            empArr[k].emp_id=-1;
            empArr[k].emp_name="NULL";
            empArr[k].emp_address="NULL";
            empArr[k].emp_salary=-1;
      }
      do
      {
      cout<<"\n=================================================================
====================";
```

```
            cout<<"\n1.Enter the record in the hash table\n2.Delete the
record in the hash table\n3.Search for the record in the hash
table\n4.Display the hash table\n5.EXIT\n==>>Enter your choice:";
            cin>>ch;
            switch(ch)
            {
                  case 1:
                              obj.insert(size,empArr);
                              break;
                  case 2:
                              obj.deletefun(size,empArr);
                              break;
                  case 3:
                              obj.search(size,empArr);
                              break;
                  case 4:
                              obj.display(empArr,size);
                              break;
                  case 5:
                              goto exit;
                              break;
                  default:
                              cout<<"\n======================\nYou have
entered wrong choice!\n======================";
            }
            cout<<"\n============================\nDo you want to
continue?Press 1 for YES and Press 0 for NO-->";
            cin>>doch;
      }while(doch==1);
      exit:
      cout<<"============================ Thank You!!
============================";
}
```

==========

OUTPUT:

```
==================================Welcome=============================================
Enter the number of employees to be stored in a hash table:10

=======================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:
```

Initial Values in the HASH TABLE:

```
=======================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:4

========================HASH TABLE STORING 10 EMPLOYEE INFORMATION=============================
=================================================================================================================
Index                   EmpID                   EmpName                 EmpAddr                 EmpSalary
0                       -1                      NULL                    NULL                    -1
1                       -1                      NULL                    NULL                    -1
2                       -1                      NULL                    NULL                    -1
3                       -1                      NULL                    NULL                    -1
4                       -1                      NULL                    NULL                    -1
5                       -1                      NULL                    NULL                    -1
6                       -1                      NULL                    NULL                    -1
7                       -1                      NULL                    NULL                    -1
8                       -1                      NULL                    NULL                    -1
9                       -1                      NULL                    NULL                    -1
=================================================================================================================
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

Search and Delete options will not work as there is no record present in the HASH TABLE

```
=======================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:2

No records are present!Deletion Operation failed!
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->1

=======================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:3

No records are present!Search Operation failed!
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

Inserting record in the HASH TABLE:

```
================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:1

========================
You are doing Insertion Operation
========================
Enter the id of an employee:101

Enter the name of an employee:ABC

Enter the address of an employee:PUNE

Enter the salary of an employee:100000

The record is entered successfully at 1th location
Current Size:1
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

```
The record is entered successfully at 1th location
Current Size:1
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->1

================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:4

========================HASH TABLE STORING 10 EMPLOYEE INFORMATION=============================
=============================================================================================================
Index                   EmpID                   EmpName                 EmpAddr                 EmpSalary
0                       -1                      NULL                    NULL                    -1
1                       101                     ABC                     PUNE                    100000
2                       -1                      NULL                    NULL                    -1
3                       -1                      NULL                    NULL                    -1
4                       -1                      NULL                    NULL                    -1
5                       -1                      NULL                    NULL                    -1
6                       -1                      NULL                    NULL                    -1
7                       -1                      NULL                    NULL                    -1
8                       -1                      NULL                    NULL                    -1
9                       -1                      NULL                    NULL                    -1
=============================================================================================================
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

Keeping on adding the records into the HASH TABLE:

```
========================
You are doing Insertion Operation
========================
Enter the id of an employee:100

Enter the name of an employee:JKL

Enter the address of an employee:Sangli

Enter the salary of an employee:600000

The record is entered successfully at 0th location
Current Size:4
============================
```

Collision resolved using LINEAR PROBING Technique:

```
================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:1

=======================
You are doing Insertion Operation
=======================
Enter the id of an employee:111

Enter the name of an employee:MNO

Enter the address of an employee:Satara

Enter the salary of an employee:450000

Collision occurred!!The key index 1 for this record is already filled so doing linear probing...
The record is entered successfully at 3th location
Current Size:5
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

```
=======================
You are doing Insertion Operation
=======================
Enter the id of an employee:116

Enter the name of an employee:PQR

Enter the address of an employee:Mumbai

Enter the salary of an employee:624555

Collision occurred!!The key index 6 for this record is already filled so doing linear probing...
The record is entered successfully at 7th location
Current Size:6
============================
```

When the max size of the table is reached it will not accept the further records:

```
========================
You are doing Insertion Operation
========================
Enter the id of an employee:109

Enter the name of an employee:XYZ

Enter the address of an employee:Hyderabad

Enter the salary of an employee:75000

The record is entered successfully at 9th location
Current Size:10
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->1

================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:1

Entries exceeded than the size you entered!Insertion Operation failed!
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

Displaying the HASH TABLE:

```
================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:4

=========================HASH TABLE STORING 10 EMPLOYEE INFORMATION=============================
=======================================================================================================
Index                   EmpID                   EmpName                 EmpAddr                 EmpSalary
0                       100                     JKL                     Sangli                  600000
1                       101                     ABC                     PUNE                    100000
2                       102                     DEF                     Amravati                        56000
3                       111                     MNO                     Satara                  450000
4                       114                     VWX                     Lonavala                        654444
5                       121                     LMN                     Bangalore                       920000
6                       106                     GHI                     Kolhapur                        450000
7                       116                     PQR                     Mumbai                  624555
8                       108                     STU                     Karjat                  65422
9                       109                     XYZ                     Hyderabad                       75000
=======================================================================================================
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

Searching for a particular ID in the HASH TABLE:

```
=======================
You are doing Searching Operation
=======================
Enter the id of an employee to be searched:101

The record is found successfully at 1th location

=======================================================================================================
Index                   EmpID                   EmpName                 EmpAddr                 EmpSalary
1                       101                     ABC                     PUNE                    100000
=======================================================================================================
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->1

================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:3

=======================
You are doing Searching Operation
=======================
Enter the id of an employee to be searched:111

The record is not present at its key index..May be linear probing done.. Searching..
The record is found successfully at 3th location

=======================================================================================================
Index                   EmpID                   EmpName                 EmpAddr                 EmpSalary
3                       111                     MNO                     Satara                  450000
=======================================================================================================
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

Deleting a record from the HASH Table:

```
========================
You are doing Deletion Operation
========================
Enter the id of an employee to be deleted:106

The record is deleted successfully from 6th location
Current Size:9
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->1

================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:2

========================
You are doing Deletion Operation
========================
Enter the id of an employee to be deleted:116

The record is not present at its key index..May be linear probing done.. Deleting..
The record is deleted successfully from 7th location
Current Size:8
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

```
================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:4

========================HASH TABLE STORING 10 EMPLOYEE INFORMATION=============================
=======================================================================================================
Index                   EmpID                   EmpName                 EmpAddr                 EmpSalary
0                       100                     JKL                     Sangli                  600000
1                       2                       111                     hgd                     454555
2                       102                     DEF                     Amravati                        56000
3                       111                     MNO                     Satara                  450000
4                       114                     VWX                     Lonavala                        654444
5                       121                     LMN                     Bangalore                       920000
6                       -1                      NULL                    NULL                    -1
7                       -1                      NULL                    NULL                    -1
8                       108                     STU                     Karjat                  65422
9                       109                     XYZ                     Hyderabad                       75000
=======================================================================================================
============================
Do you want to continue?Press 1 for YES and Press 0 for NO-->
```

```
================================================================================
1.Enter the record in the hash table
2.Delete the record in the hash table
3.Search for the record in the hash table
4.Display the hash table
5.EXIT
==>>Enter your choice:5
----------------------------Thank You!!----------------------------
```