Experiment A1

```
# Program to implement Hashing with Linear Probing
from Record import Record
class hashTable:
    # initialize hash Table
    def _init_(self):
        self.size = int(input("Enter the Size of the hash table : "))
        # initialize table with all elements 0
        self.table = list(None for i in range(self.size))
        self.elementCount = 0
        self.comparisons = 0
    # method that checks if the hash table is full or not
    def isFull(self):
        if self.elementCount == self.size:
            return True
        else:
            return False
    # method that returns position for a given element
    def hashFunction(self, element):
        return element % self.size
    # method that inserts element into the hash table
    def insert(self, record):
        # checking if the table is full
        if self.isFull():
            print("Hash Table Full")
            return False
        isStored = False
        position = self.hashFunction(record.get_number())
        # checking if the position is empty
        if self.table[position] == None:
            self.table[position] = record
            print("Phone number of " + record.get_name() + " is at position " + str(position))
            isStored = True
            self.elementCount += 1
        # collision occured hence we do linear probing
        else:
            print("Collision has occured for " + record.get_name() + "'s phone number at position
" + str(
                position) + " finding new Position.")
            while self.table[position] != None:
                position += 1
                if position >= self.size:
                    position = 0
            self.table[position] = record
            print("Phone number of " + record.get_name() + " is at position " + str(position))
            isStored = True
            self.elementCount += 1
        return isStored
    # method that searches for an element in the table
    # returns position of element if found
    # else returns False
    def search(self, record):
        found = False
        position = self.hashFunction(record.get_number())
        self.comparisons += 1
        if (self.table[position] != None):
            if (self.table[position].get_name() == record.get_name() and self.table[
                position].get_number() == record.get_number()):
                isFound = True
                print("Phone number found at position {} ".format(position) + " and total comparisons are " + str(1))
                return position
            # if element is not found at position returned hash function
            else:
                position += 1
                if position >= self.size - 1:
                    position = 0
                while self.table[position] != None or self.comparisons <= self.size:
                    if (self.table[position].get_name() == record.get_name() and self.table[
                        position].get_number() == record.get_number()):
                        isFound = True
                        # i=0
                        i = self.comparisons + 1
                        print(
                            "Phone number found at position {} ".format(position) + " and total comparisons are " + str(
                                i))
                        return position
                    position += 1
                    # print(position)
                    if position >= self.size - 1:
                        position = 0
                    # print(position)
                    self.comparisons += 1
                    # print(self.comparisons)
                if isFound == False:
                    print("Record not found")
                    return false

    # method to display the hash table
    def display(self):
        print("\n")
        for i in range(self.size):
            print("Hash Value: " + str(i) + "\t\t" + str(self.table[i]))
        print("The number of phonebook records in the Table are : " + str(self.elementCount))
```

2. DoubleHashing.py

```
from Record import Record
class doubleHashTable:
    # initialize hash Table
    def _init_(self):
        self.size = int(input("Enter the Size of the hash table : "))
        # initialize table with all elements 0
        self.table = list(None for i in range(self.size))
        self.elementCount = 0
        self.comparisons = 0
    # method that checks if the hash table is full or not
    def isFull(self):
        if self.elementCount == self.size:
            return True
        else:
            return False
    # First hash function
    def h1(self, element):
        return element % self.size
    # Second hash function
    def h2(self, element):
        return 5 - (element % 5)

    # method to resolve collision by double hashing method
    def doubleHashing(self, record):
        posFound = False
        # limit variable is used to restrict the function from going into infinite loop
        # limit is useful when the table is 80% full
        limit = self.size
        i = 1
        # start a loop to find the position
        while i <= limit:
            # calculate new position by quadratic probing
            newPosition = (self.h1(record.get_number()) + i * self.h2(record.get_number())) % self.size
            # if newPosition is empty then break out of loop and return new Position
            if self.table[newPosition] == None:
                posFound = True
                break
            else:
                # as the position is not empty increase i
                i += 1
        return posFound, newPosition
    # method that inserts element inside the hash table
    def insert(self, record):
        # checking if the table is full
        if self.isFull():
            print("Hash Table Full")
            return False
        posFound = False
        position = self.h1(record.get_number())
        # checking if the position is empty
        if self.table[position] == None:
            # empty position found , store the element and print the message
            self.table[position] = record
            print("Phone number of " + record.get_name() + " is at position " + str(position))
            isStored = True
            self.elementCount += 1
        # If collision occured
        else:
            print("Collision has occured for " + record.get_name() + "'s phone number at position
" + str(
                position) + " finding new Position.")
            while not posFound:
                posFound, position = self.doubleHashing(record)
                if posFound:
                    self.table[position] = record
                    # print(self.table[position])
                    self.elementCount += 1
                    # print(position)
                    # print(posFound)
                    print("Phone number of " + record.get_name() + " is at position " + str(position))
        return posFound
    # searches for an element in the table and returns position of element if found else returns
False
    def search(self, record):
        found = False
        position = self.h1(record.get_number())
        self.comparisons += 1
        if (self.table[position] != None):
            if (self.table[position].get_name() == record.get_name()):
                print("Phone number found at position {}".format(position) + " and total
comparisons are " + str(1))
                return position


            # if element is not found at position returned hash function
            # then we search element using double hashing
            else:
                limit = self.size
                i = 1
                newPosition = position
                # start a loop to find the position
                while i <= limit:
                    # calculate new position by double Hashing
                    position = (self.h1(record.get_number()) + i * self.h2(record.get_number())) %
self.size
                    self.comparisons += 1
                    # if element at newPosition is equal to the required element

                    if (self.table[position] != None):
                        if self.table[position].get_name() == record.get_name():
                            found = True
                            break
                        elif self.table[position].get_name() == None:
                            found = False
                            break
                        else:
                            # as the position is not empty increase i
                            i += 1
            if found:
                print("Phone number found at position {}".format(position) + " and total
comparisons are " + str(i + 1))
            # return position
            else:
                print("Record not Found")
                return found


                # method to display the hash table
```

```
    def display(self):
        print("\n")
        for i in range(self.size):
            print("Hash Value: " + str(i) + "\t\t" + str(self.table[i]))
        print("The number of phonebook records in the Table are : " + str(self.elementCount))
```

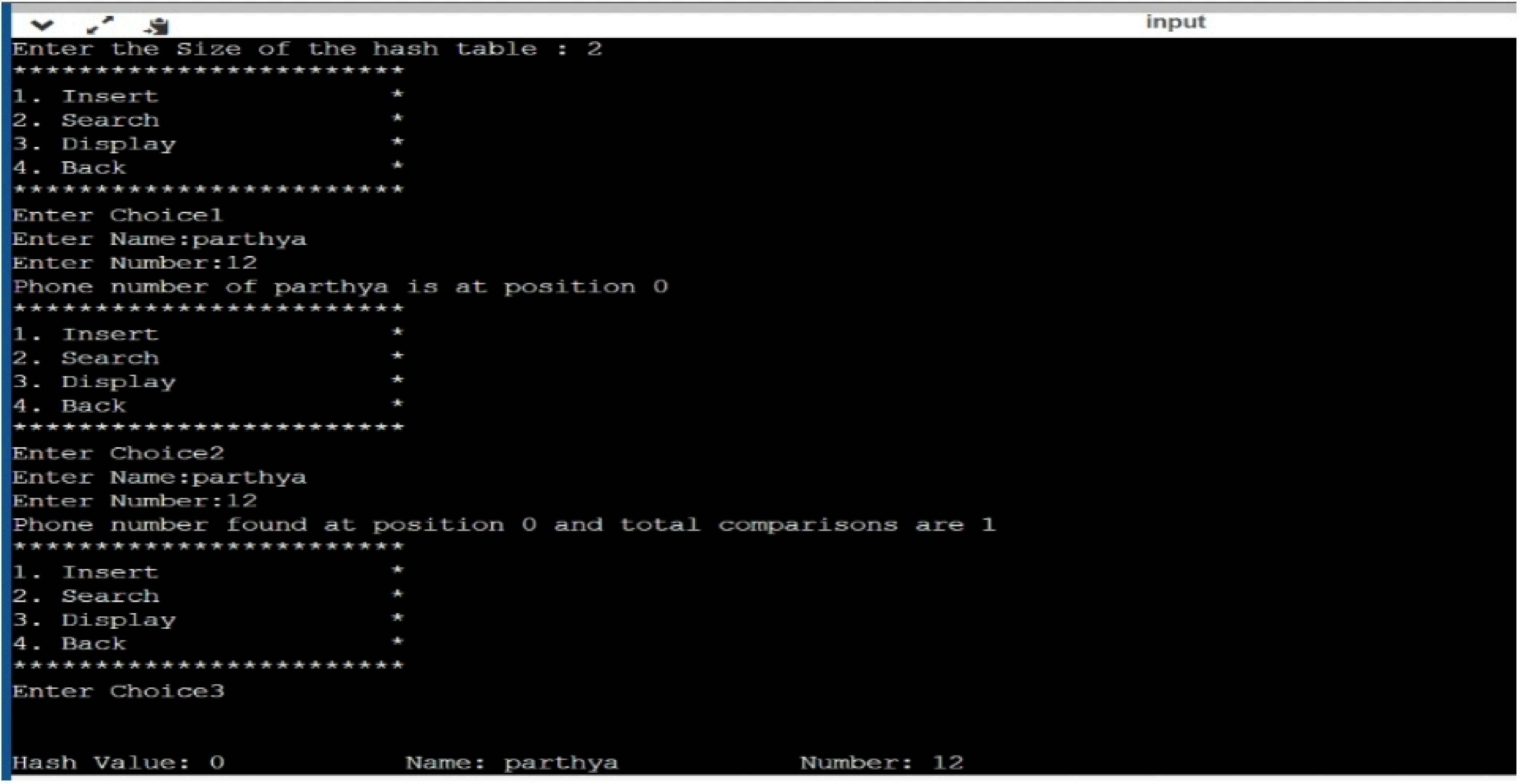
3.Record.py

```
class Record:
    def _init_(self):
        self._name = None
        self._number = None
    def get_name(self):
        return self._name
    def get_number(self):
        return self._number
    def set_name(self,name):
        self._name = name
    def set_number(self,number):
        self._number = number
    def _str_(self):
        record = "Name: "+str(self.get_name())+"\t"+"\tNumber: "+str(self.get_number())
        return record
```

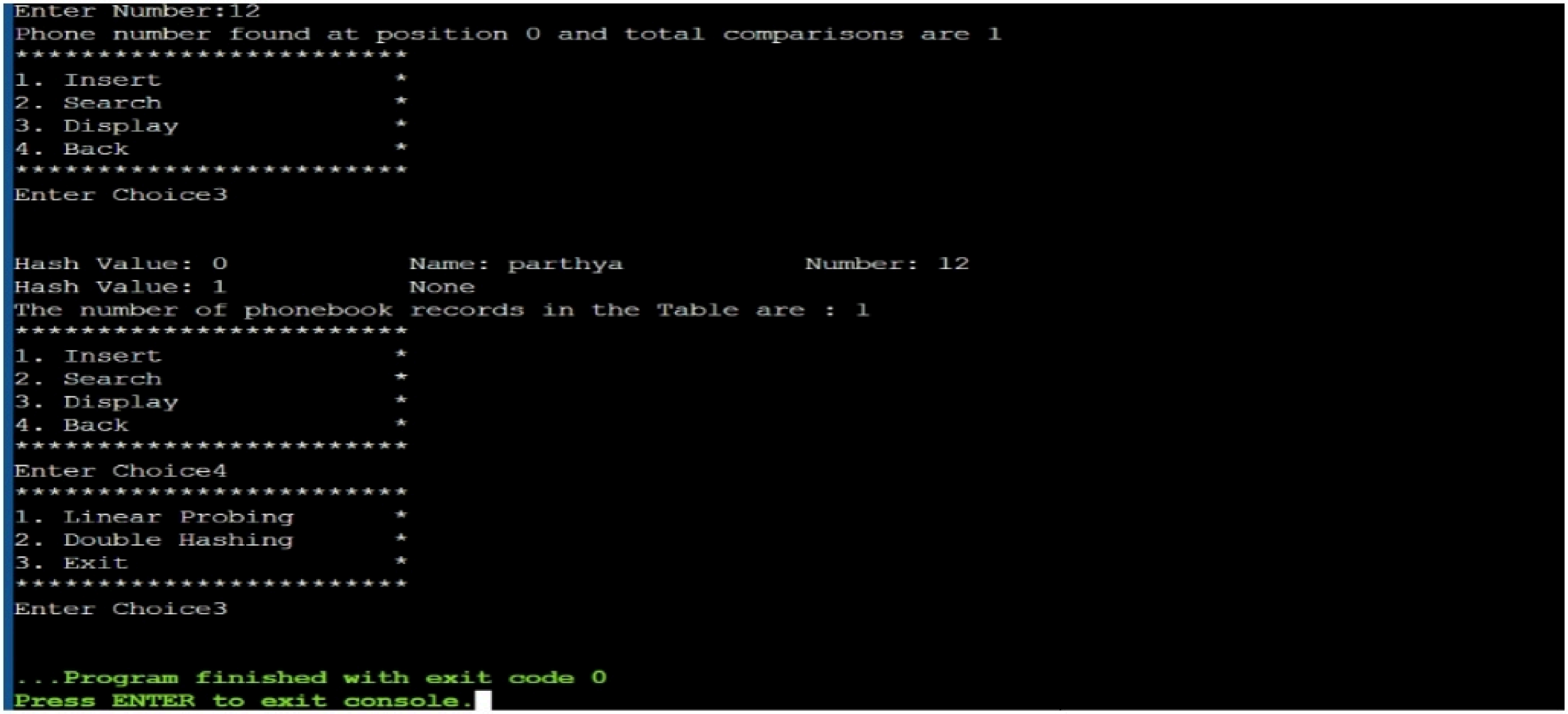
4. main.py

```
from LinearProbing import hashTable
from Record import Record
from DoubleHashing import doubleHashTable
def input_record():
    record = Record()
    name = input("Enter Name:")
    number = int(input("Enter Number:"))
    record.set_name(name)
    record.set_number(number)
    return record
choice1 = 0
while (choice1 != 3):
    print("********")
    print("1. Linear Probing      *")
    print("2. Double Hashing      *")
    print("3. Exit                *")
    print("********")
    choice1 = int(input("Enter Choice"))
    if choice1 > 3:
        print("Please Enter Valid Choice")
    if choice1 == 1:
        h1 = hashTable()
        choice2 = 0
        while (choice2 != 4):
            print("********")
            print("1. Insert              *")
            print("2. Search              *")
            print("3. Display             *")
            print("4. Back                *")
            print("********")
            choice2 = int(input("Enter Choice"))
            if choice2 > 4:
                print("Please Enter Valid Choice")
            if (choice2 == 1):
                record = input_record()
                h1.insert(record)

            elif (choice2 == 2):
```

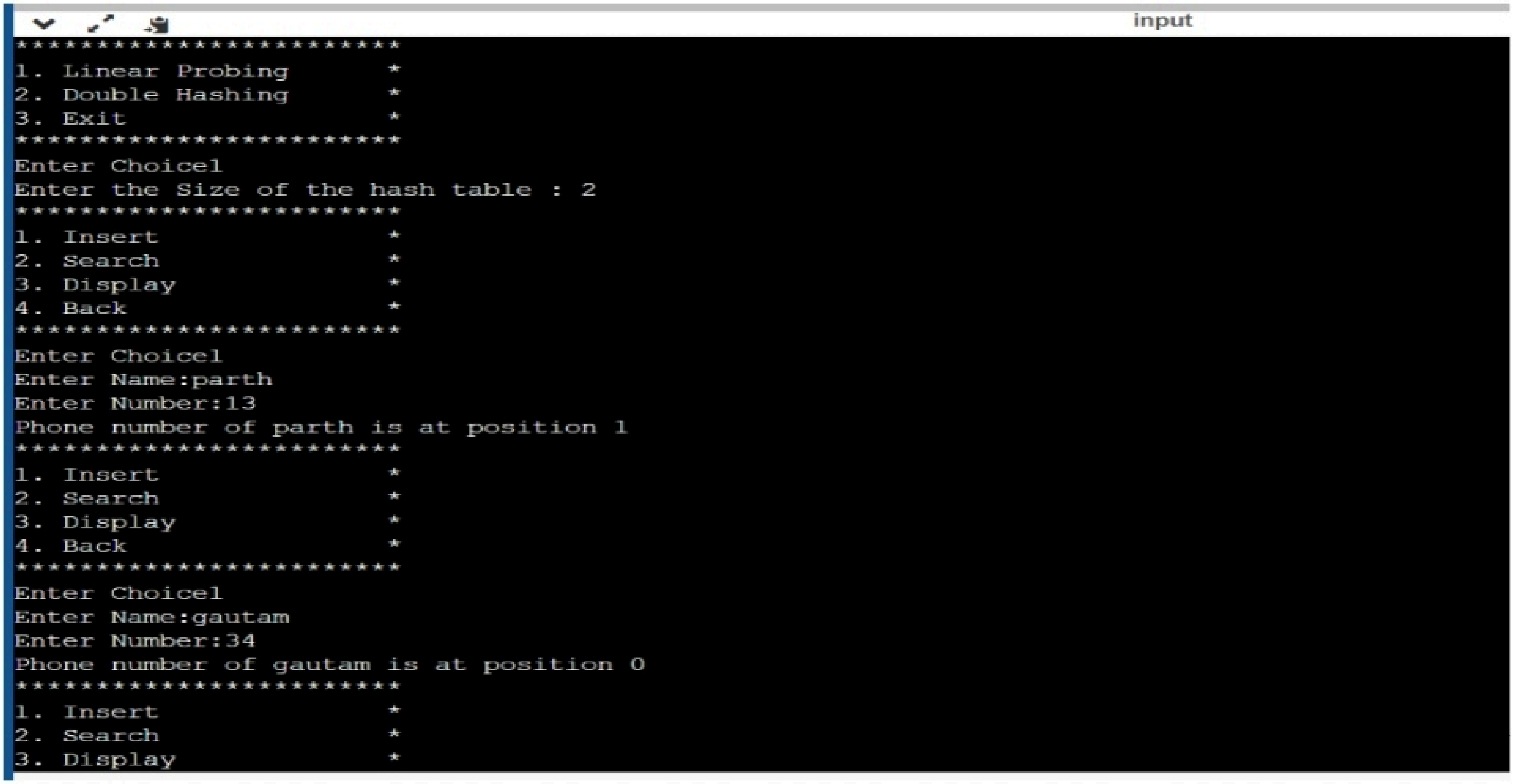
```
            record = input_record()
            position = h1.search(record)
        elif (choice2 == 3):
            h1.display()
elif choice1 == 2:
    h2 = doubleHashTable()
    choice2 = 0
    while (choice2 != 4):
        print("********")
        print("1. Insert            *")
        print("2. Search            *")
        print("3. Display           *")
        print("4. Back              *")
        print("********")
        choice2 = int(input("Enter Choice"))
        if choice2 > 4:
            print("Please Enter Valid Choice")
        if (choice2 == 1):
            record = input_record()
            h2.insert(record)
        elif (choice2 == 2):
            record = input_record()
            position = h2.search(record)
        elif (choice2 == 3):
            h2.display()
```



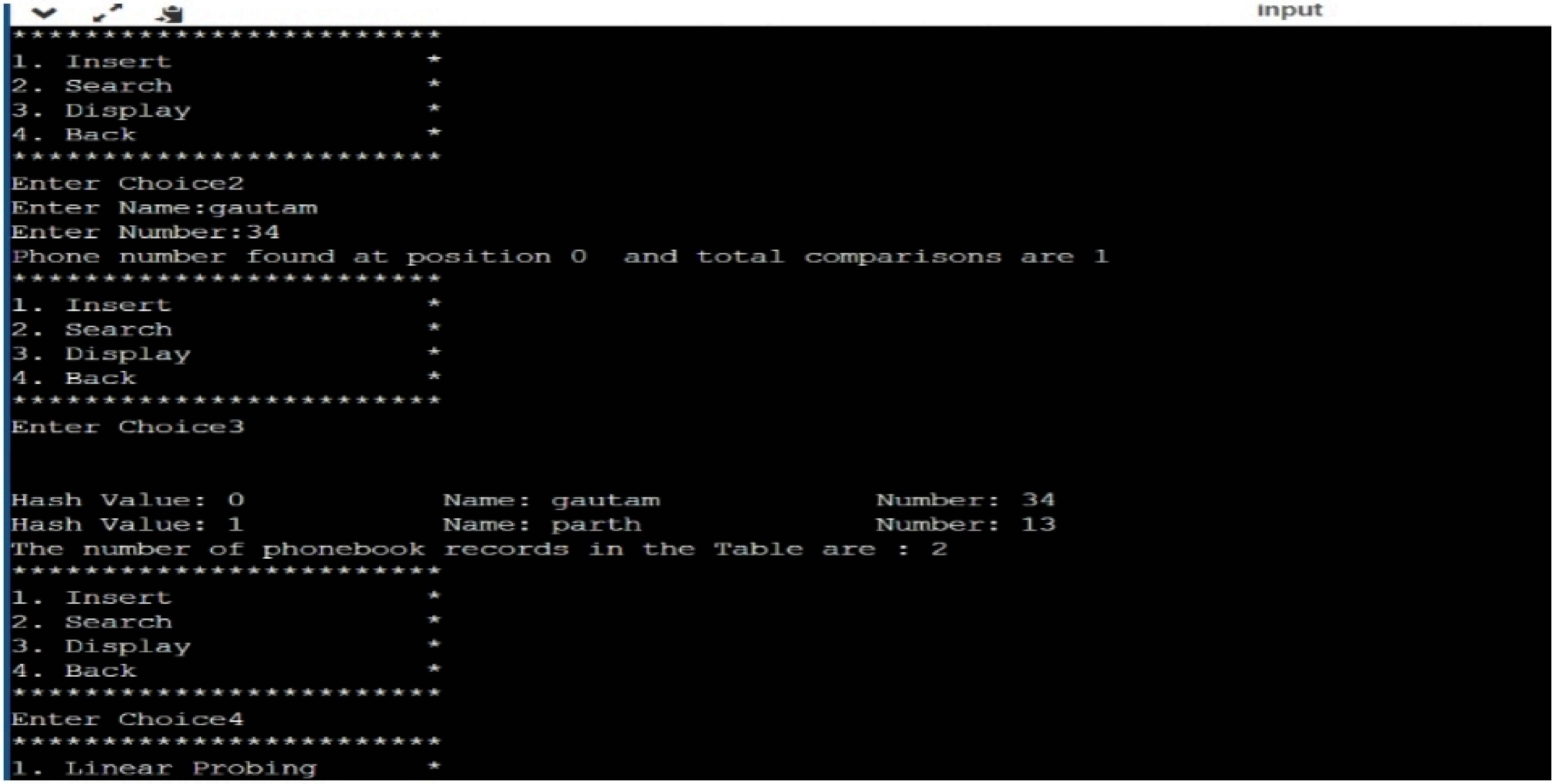
```
Enter the Size of the hash table : 2
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice1
Enter Name:parthya
Enter Number:12
Phone number of parthya is at position 0
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice2
Enter Name:parthya
Enter Number:12
Phone number found at position 0 and total comparisons are 1
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice3


Hash Value: 0           Name: parthya           Number: 12
```



```
Enter Number:12
Phone number found at position 0 and total comparisons are 1
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice3


Hash Value: 0           Name: parthya           Number: 12
Hash Value: 1           None
The number of phonebook records in the Table are : 1
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice4
************************
1. Linear Probing      *
2. Double Hashing      *
3. Exit                *
************************
Enter Choice3


...Program finished with exit code 0
Press ENTER to exit console.
```



```
************************
1. Linear Probing      *
2. Double Hashing      *
3. Exit                *
************************
Enter Choice1
Enter the Size of the hash table : 2
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice1
Enter Name:parth
Enter Number:13
Phone number of parth is at position 1
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice1
Enter Name:gautam
Enter Number:34
Phone number of gautam is at position 0
************************
1. Insert              *
2. Search              *
3. Display             *
```



```
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice2
Enter Name:gautam
Enter Number:34
Phone number found at position 0  and total comparisons are 1
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice3


Hash Value: 0           Name: gautam            Number: 34
Hash Value: 1           Name: parth             Number: 13
The number of phonebook records in the Table are : 2
************************
1. Insert              *
2. Search              *
3. Display             *
4. Back                *
************************
Enter Choice4
************************
1. Linear Probing      *
```