



***NAMAL UNIVERSITY MIANWALI
DEPARTMENT OF ELECTRICAL ENGINEERING***

***DATA STRUCTURE AND ALGORITHM
LAB # 14 Open Ended Lab
REPORT
Title : Hash Table***

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<i>Date</i>	<i>13-July-2023</i>
<i>Marks</i>	

1. Lab Objectives

Students will perform an open ended lab on the topic of Hash Table.

2. Lab Outcomes

- ★ CLO 1: Recognize the usage of fundamental Data structure using Python Programming Language.
- ★ CLO 3: Demonstrate solution to real life problems using appropriate data structures.

3. Equipment

- Software ○ IDLE (Python 3.11)

4. Instructions

1. This is an individual lab. You will perform the tasks individually and submit a report.
2. Some of these tasks (marked as 'Example') are for practice purposes only while others (marked as 'Task') have to be answered in the report.
3. When asked to display an output in the task, either save it as jpeg or take a screenshot, in order to insert it in the report.
4. The report should be submitted on the given template, including:
 - a. Code (copy and pasted, NOT a screenshot)
 - b. Output figure (as instructed in 3)
 - c. Explanation where required
5. The report should be properly formatted, with easy to read code and easy to see figures.
6. Plagiarism or any hint thereof will be dealt with strictly.
7. Late submission of report is allowed within 03 days after lab with 20% deduction of marks every day.
8. You have to submit report in pdf format (Reg.X_DSA_LabReportX.pdf).

5. Hash Table

Hash table is one of the most important data structures that uses a special function known as a hash function that maps a given value with a key to access the elements faster.

A Hash table is a data structure that stores some information, and the information has basically two main components, i.e., key and value. The hash table can be implemented with the help of an associative array. The efficiency of mapping depends upon the efficiency of the hash function used for mapping.

For example, suppose the key value is John and the value is the phone number, so when we pass the key value in the hash function shown as below:

Hash(key)= index;

Task 1: Write the python code to implement a hash table. Perform insert, delete, and search operation on the table. The table must contain 25 values.

Code :

```
class HashTable:
    def __init__(self):
        self.size = 25
        self.table = [None] * self.size

    def _hash(self, key):
        return hash(key) % self.size
```

```

def insert(self, key, value):
    index = self._hash(key)
    if self.table[index] is None:
        self.table[index] = [(key, value)]
    else:
        for item in self.table[index]:
            if item[0] == key:
                item = (key, value)
                return
        self.table[index].append((key, value))

def delete(self, key):
    index = self._hash(key)
    if self.table[index] is None:
        return
    for i, item in enumerate(self.table[index]):
        if item[0] == key:
            del self.table[index][i]
            return

def search(self, key):
    index = self._hash(key)
    if self.table[index] is None:
        return None
    for item in self.table[index]:
        if item[0] == key:
            return item[1]
    return None

hash_table = HashTable()

hash_table.insert("key1", "value1")
hash_table.insert("key2", "value2")
hash_table.insert("key3", "value3")

hash_table.delete("key2")

value = hash_table.search("key1")
print(value)

```

Output:

PS E:\Semester 4\Data Structure and Algorithm\Lab\Lab 14 Open Ended Lab> python -u "e:\Semester 4\Data Structure and Algorithm\Lab\Lab 14 Open Ended Lab\Task_01.py"

value1

PS E:\Semester 4\Data Structure and Algorithm\Lab\Lab 14 Open Ended Lab>



Task 2: Compare the performance of your hash table implementation with other data structures, such as arrays or linked lists.

The hash table outperforms arrays and linked lists in terms of insertion, deletion, and search operations, with an average time complexity of $O(1)$ compared to $O(n)$ for arrays and linked lists. Hash tables provide efficient access to elements based on their keys and are suitable for applications that require fast lookup based on key-value pairs. However, they consume more memory and require well-designed hash functions to minimize collisions.

Lab Evaluation Rubrics

Domain	CLOs/ Rubric	Performance Indicator	Unsatisfactory 0- 2	Marginal 3- 5	Satisfactory 6- 8	Exemplary 9- 10	Allocate d Marks
Psychomotor	CLO:1 R2	Implementation with Results (P)	Does not try to solve problems. Many mistakes in code and difficult to comprehend for the instructor. There is not result of the problem.	Does not suggests or refine solutions but is willing to try out solutions suggested by others. Few mistakes in code, but done along with comments, and easy to comprehend for the instructor. Few mistake in result.	Refines solutions suggested by others. Complete and error-free code is done. No comments in the code, but easy to comprehend for the instructor. Results are correctly produced.	Actively looks for and suggests solution to problems. Complete and error free code is done, easy to comprehend for the instructor. Results are correctly produced. Student incorporated comments in the code.	
Affective	CLO:3 R3	Lab Report (A)	Code of the problem is not given. Outputs are not provided. Explanation of the solution is not stated.	Code of the problem is given. Output is not complete. Explanation of the solution is not satisfactory.	Code of the problem is given. Output is completely given. Explanation of the solution is not satisfactory.	Code of the problem is given. Output is completely given. Explanation of the solution is satisfactory.	
	CLO:1 R5	Discipline and Behavior (A)	Got and wandered around. More than two incidents of talking non-lab related stuff in lab and/or any talk with other groups, voice level exceeding the appropriate level, use of cell phones and involvement in any non-lab activity.	Got out of seat and wander around for some time. No more than two incidents of talking non-lab related stuff in lab. Voice level exceeding the appropriate level, use of cell phones and involvement in any non-lab related activity.	Stayed in seat and got up for a specific lab related reason, but took more time than required to do the job. No more than one incidents of talking non-lab related stuff in lab. Voice level exceeding the appropriate level, use of cell phones and involvement in any non-lab related activity.	Stayed in seat and got up for a specific lab related reason. Took care of lab related business and sat down right away. Voice level kept appropriate. Not used cell phones or involved in any non- lab related activity.	