Basic Data Structures- Python

# 1. Arrays - Lists

Arrays store data in continuous memory address. Python uses lists as array.

* List is dynamic array
* hetrogeneous
* allows nesting to create multidimensional array
* Supports Indexing
* Supports Slicing
* Supports Iteration [in cases like ‘for’ loop]
* Mutable

#### Complexity

* Lookup time by index: O(1)
* Lookup time by value: O(n)
* Traversal: O(n)
* Insertion by index: O(n) # can use arr.insert()
* Deletion by index: O(n)

#### Important Methods

* Insert(), append()
* sort(), reverse()
* remove(), pop()
* len()
* index(element), count(element)
* copy()
* "*separator* ".join(list)

#### List Comprehension

L = [2\*i+1 for i in range(10)] creates list [1,3,5,7,9,11,13,15,17,18]

# 2. Linked List

A linked list consists of a series of nodes, each containing two main components: the data or value that the node holds and a reference (or pointer) to the next node in the sequence.The first node of the linked list is called the "head."

* Insertion is easier
* Dynamic memory allocation is very efficient



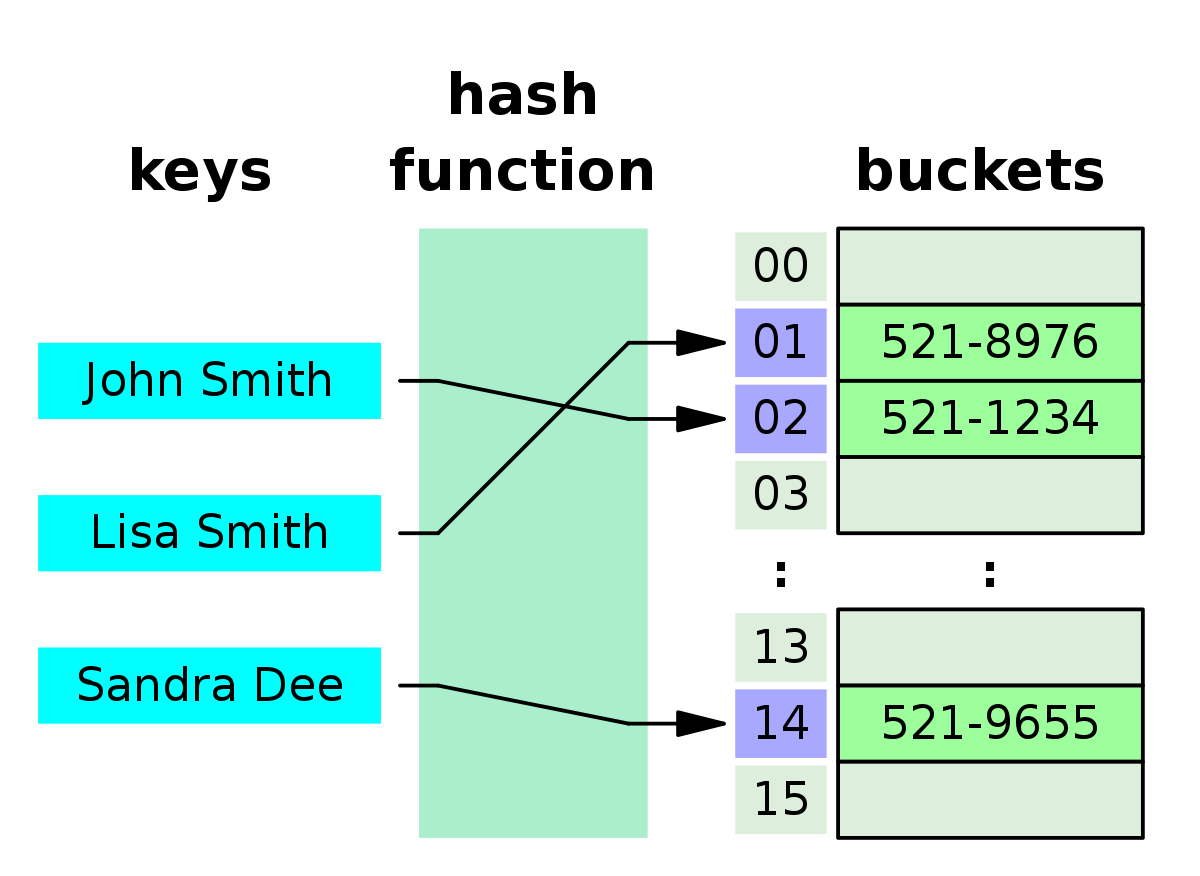
#### Complexity

* Insertion/ Deletion at head: O(1)
* Insertion/ Deletion: O(n)
* Traversal: O(n)
* Access element by value/index [search]: O(n)

Doubly linked list: Links to next and previous elements

# 3. Hash Maps

Hash maps/ Hash tables are used to store key-value pair. First we create an empty array. Then we define a hash function that converts the key to an index value. This index is used to store the corresponding value.

Python dictionary implements hash maps.

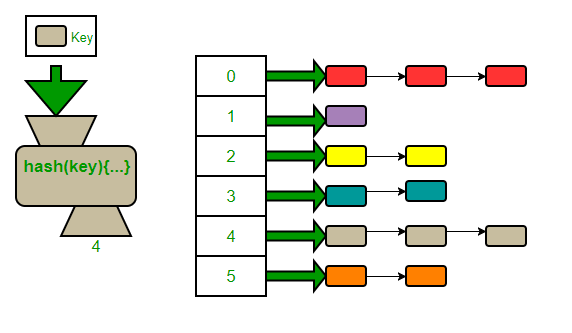
#### Complexity

* Insertion/ Deletion: O(1)
* Lookup by key[search]: O(1) # This is average case. Collisions can reduce this

#### Collisions

When multiple keys point to the same index, the situation is called collision. Some common ways to handle collision are:

1. **Chaining**: Creating an linked list at the collision part and chaining the (key,value) there.



1. **Linear Probing**: Stores the value in the next available slot in the array. We are ‘linearly probing’ the array for an empty slot.