What is Hashing?

- Hashing is a technique used for storing, retrieving and removing information as quick as possible.
- It's a process of converting a arbitrary size key into fixed sized value. The conversion is done via special function called as Hash function.
- The operations supported by hashing such as storing, retrieving and removing information have average runtime complexity of O(1).

What are Hash Functions?

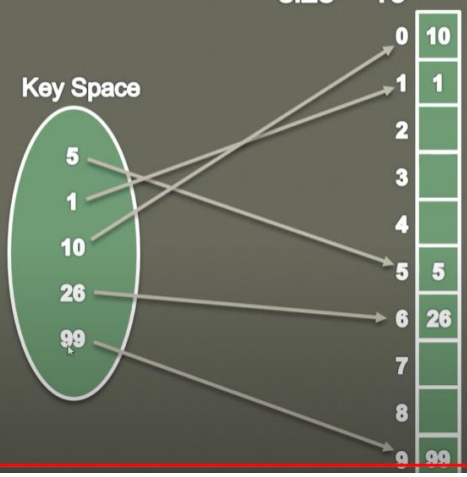
- A Hash function simply takes an arbitrary size key and provides fixed size value also called as index.

Modular Hash Function

- A Modular Hash function simply takes a key and size, returns remainder by dividing key by size.
- The remainder is used as an index to store the key in an array of provided size.

Modular Hash Function

index = h(key) = key % size
size = 10



5 % 10 = 5

1 % 10 = 1

10 % 10 = 0

26 % 10 = 6

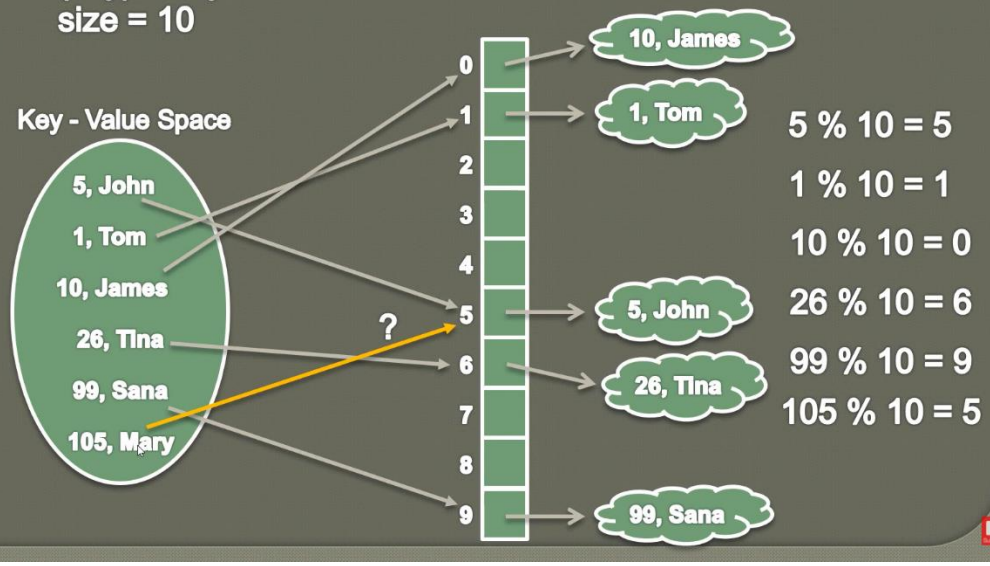
99 % 10 = 9

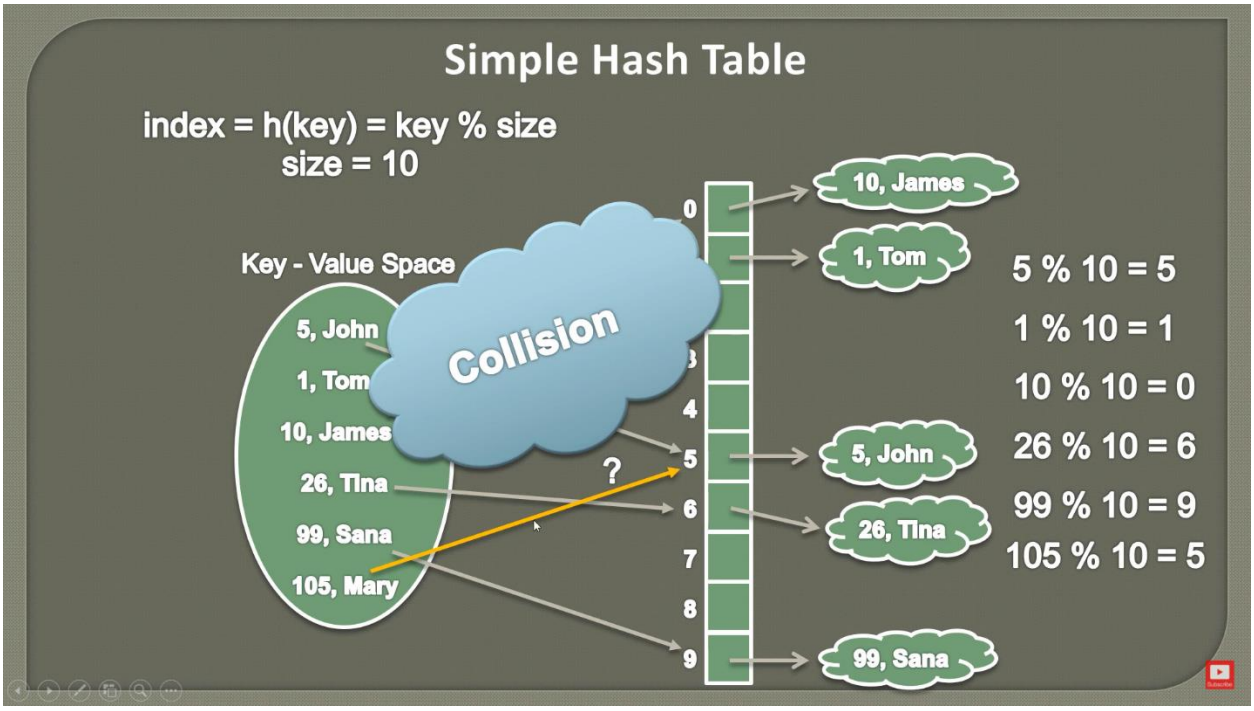
What is a Hash Table?

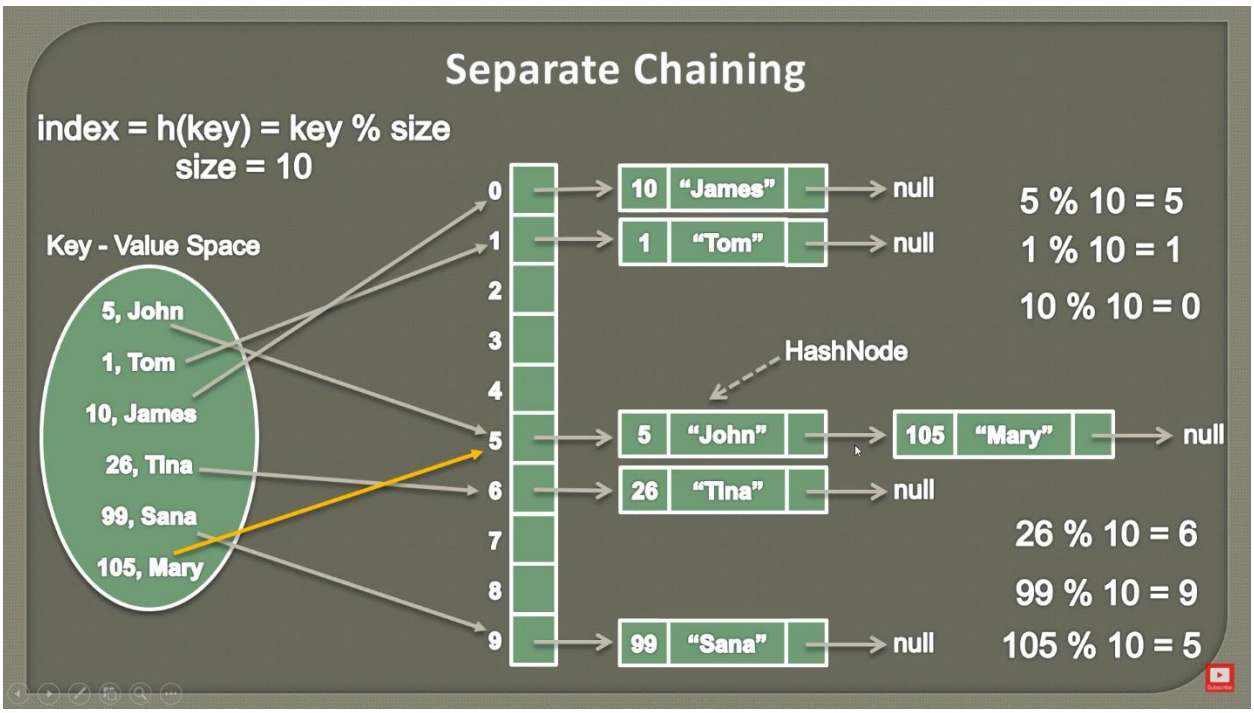
- It is a generalized form of an array.
- It stores the data in form of key-value pair.
- It converts key to an index using hash function.
- Taking the index we store key-value in array.
- The primary operations supported by HashTable are –
  - put(key, value) – Adds key-value pair against unique key.
  - get(key) – Get value for the provided key.
  - remove(key) – Removes the key-value pair from HashTable.
- Average running time is of O(1).
- Java Collections Framework has HashMap class - if we want to deal with key-value pair and HashSet class if we want to deal with only keys.

Simple Hash Table

index = h(key) = key % size
size = 10




Simple Hash Table
index = h(key) = key % size
size = 10
Key - Value Space
5, John
1, Tom
10, James
26, Tina
99, Sana
105, Mary
Collision
?
0
1
4
5
6
7
8
9
10, James
1, Tom
5, John
26, Tina
99, Sana
5 % 10 = 5
1 % 10 = 1
10 % 10 = 0
26 % 10 = 6
99 % 10 = 9
105 % 10 = 5


Separate Chaining
index = h(key) = key % size
size = 10
Key - Value Space
5, John
1, Tom
10, James
26, Tina
99, Sana
105, Mary
0
1
2
3
4
5
6
7
8
9
10 "James"
1 "Tom"
5 "John"
105 "Mary"
26 "Tina"
99 "Sana"
null
HashNode
5 % 10 = 5
1 % 10 = 1
10 % 10 = 0
26 % 10 = 6
99 % 10 = 9
105 % 10 = 5

Representation of a HashNode in HashTable

A HashNode class in HashTable consists of three data members.

1. K key – It is a unique value which helps in storing data. Here, K signifies generic type.
2. V value – It is the data that is stored based on location computed by key. Here, V signifies generic type.
3. HashNode next – It refers to next HashNode in chain of hash nodes.

HashTable Terminology