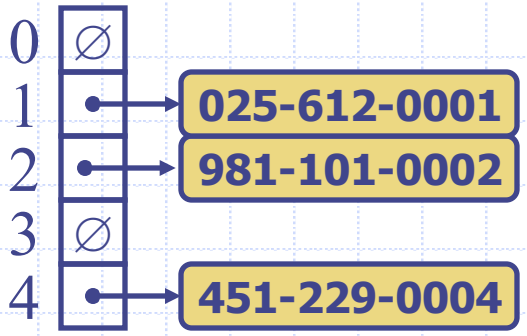
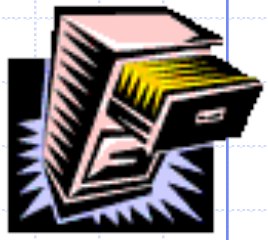
Hash Tables



The Motivation

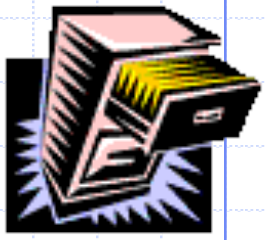


- Assume we need a data structure to associate person's SSN with their Name.
- If you use an array,

123045678	John
123056789	Tom
123056790	Tony
123056767	Smith
….	

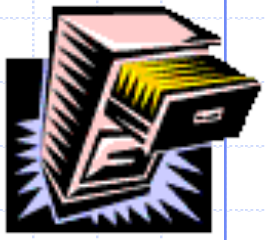
- How to retrieve person's name after given its SSN? E.g. getName(123045678)

The Motivation



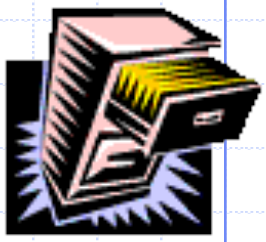
- How to retrieve person's name after given its SSN? E.g. getName(123045678)
  - With the array implementation, you have to first search the array to locate the SSN=123045678, then return the name associated with that SSN.
  - This search is time consuming in an array size of n.
    - For an unsorted array, it takes O(n).
    - For an sorted array, it takes O(log n), if use binary search.

The Motivation



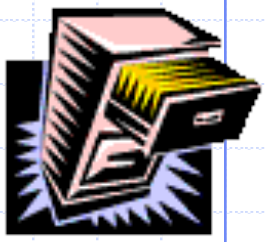
- How to retrieve person's name after given its SSN? E.g. getName(123045678)
- In this quarter, we learn a new data structure called HashTable,
  - HashTable stores a set of records,
  - Each record consists of a key and a value associated with the key.
    - E.g. SSN can be the key, person's name is the value attached to the key.
    - Given an unique key, it has **only one** value associated with it. But a same value can be associated with different keys. Thinking people could have the same name but their SSN is distinct.
  - Given the key, retrieving the value for the key takes O(1) on average. VERY FAST!

Java Built-in HashTable



- Let us look at a demo regarding how to use HashTable in an application.
- The demo code has been posted on canvas, under Files -> Demo →D17_HashTableDemo.zip

Operations of HashTable H



- get(k): if the H has an entry with key k, return its associated value; else, return null
- put(k, v): insert entry (k, v) into the H; if key k is not already in H, then return null; else, return old value associated with k
- remove(k): if the H has an entry with key k, remove it from H and return its associated value; else, return null
- size(), isEmpty()
- entrySet(): return an iterable collection of the entries in H
- keySet(): return an iterable collection of the keys in H
- values(): return an iterator of the values in H