**Section 7: Hashtables**

**Hashtables**

* ADT
* Provide access to data using keys
* Key doesn’t have to be an integer
* Consists of key/value pairs – data types don’t have to match
* Optimized for retrieval (when you know the key)
* Associative array is one type of hash table
* Other names are dictionaries, map

**Hashing**

* Maps keys of any data type to an integer
* Hash function maps keys to int
* In Java, hash function is **Object.hashCode()**
* Collision occurs when more than one value has the same hashed value

**Load Factor**

* Tells us how full a hashtable is
* Load factor = # of items / capacity = size / capacity
* Load factor is used to decide when to resize the array backing the hash table
* Don’t want to load factor too low (lots of empty space)
* Don’t want load factor too high (will increase the likelihood of collisions)
* Can play a role in determining the time complexity for retrieval

**Add to a Hashtable backed by an array**

1. Provide a key/pair
2. Use a hash function to hash the key to an int value
3. Store the value at hashed key value – this is the index into the array

**Retrieve a value from a Hashtable**

1. Provide the key
2. Use the same hash function to hash the key to an int value
3. Retrieve the values stored at the hashed key value

**Map Interface**

[**https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/Map.html**](https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/Map.html)

**HashMap Class**

[**https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/HashMap.html**](https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/HashMap.html)

**LinkedHashMap Class**

[**https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/LinkedHashMap.html**](https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/LinkedHashMap.html)

**Hashtable Class**

[**https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/Hashtable.html**](https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/Hashtable.html)

**ConcurrentHashMap**

[**https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/concurrent/ConcurrentHashMap.html**](https://docs.oracle.com/en/java/javase/11/docs/api/java.base/java/util/concurrent/ConcurrentHashMap.html)