

Definition

- In computer science, an **associative array**, **map**, or **dictionary** is an abstract data type composed of (key, value) pairs, such that each key appears at most once
- Modern programming languages natively supports them
E.g. Perl, Python, Ruby, Go
- Implemented through hash tables or tree data structure

```
V1[42] = "h2g2"  
V2["h2g2"] = 42
```





Map interface

Map<K,V>

- K: the type of keys maintained by this map
- V: the type of mapped values

Add/remove elements

- value **put**(key, value)
- value **remove**(key)

Search

- boolean **containsKey**(key)
- boolean **containsValue**(value)



Map interface (cont.)

□ Nested Class

- `Map.Entry<K,V>`

- A map entry (key-value pair).

□ `Set<Map.Entry<K,V>> entrySet()`

- Returns a **Set view** of the mappings contained in this map

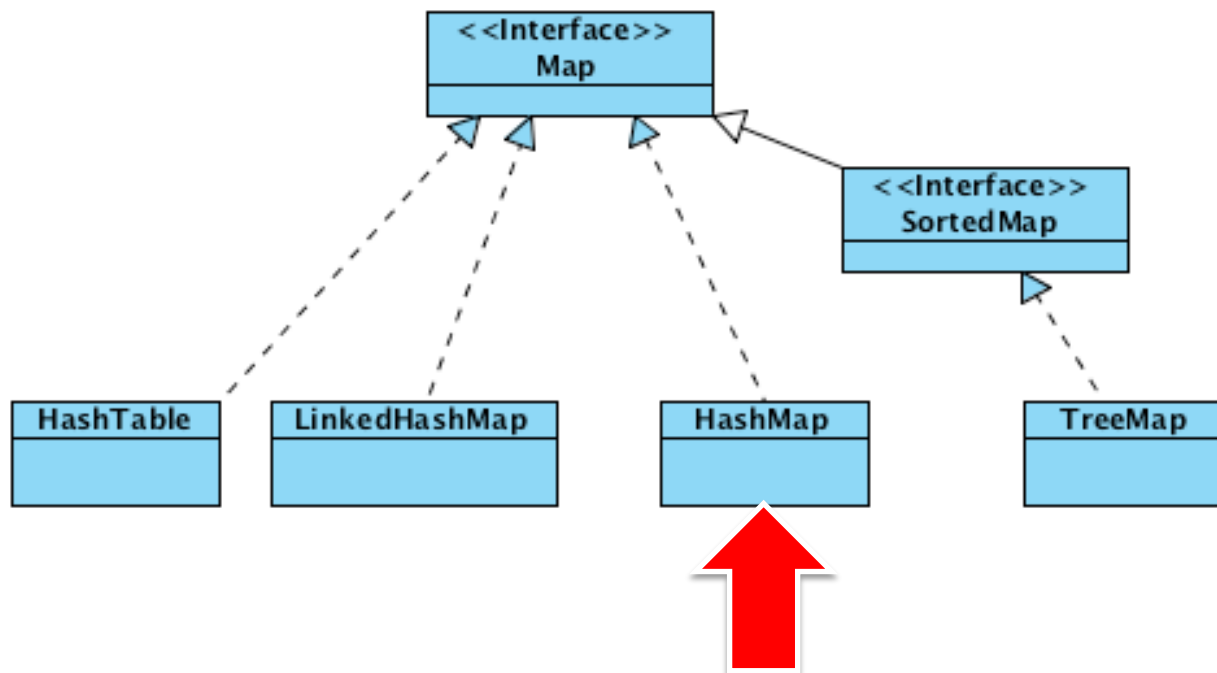
□ `Set<K> keySet()`

- Returns a **Set view** of the keys contained in this map

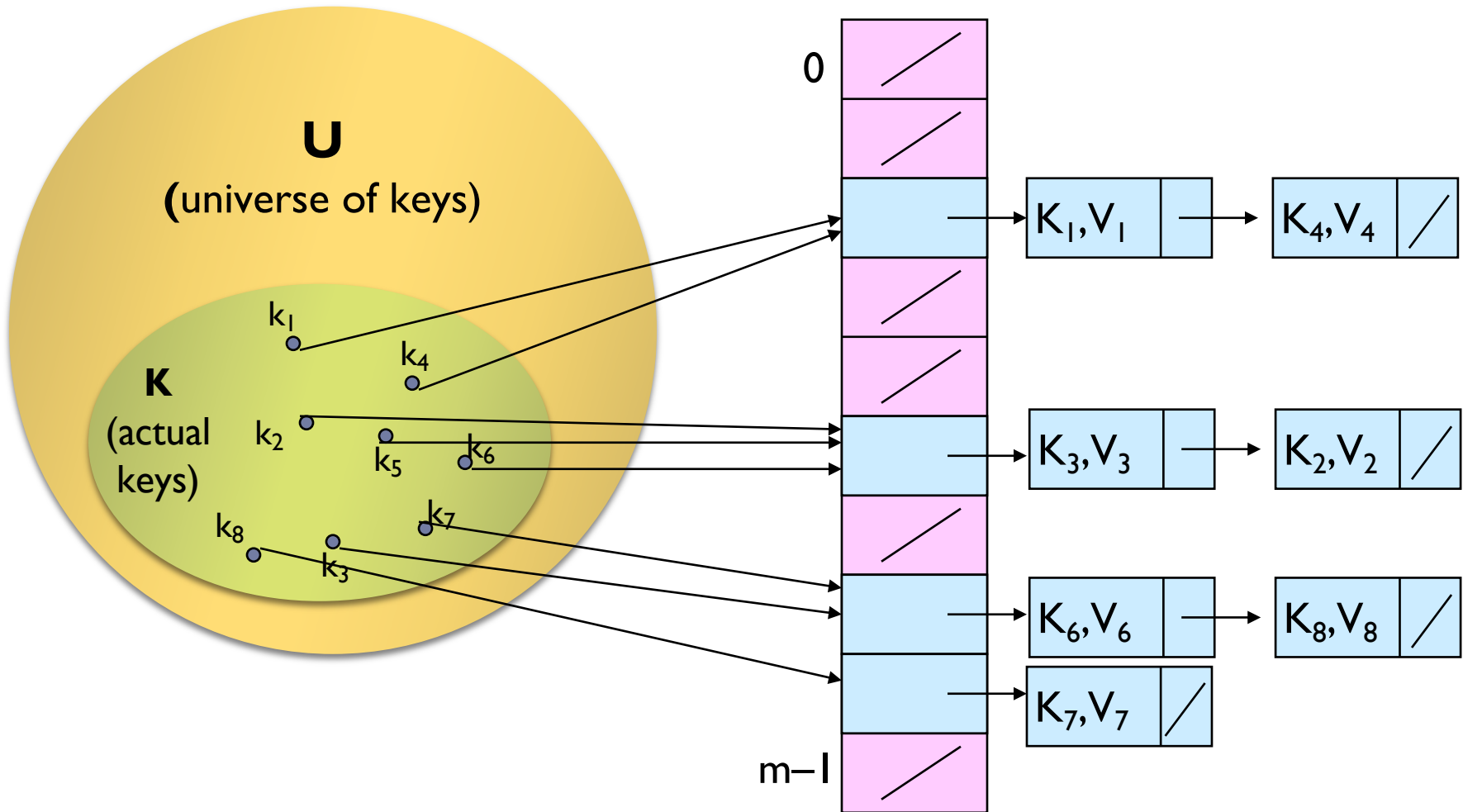
□ `Collection<V> values()`

- Returns a **Collection** view of the values contained in this map

HashMap



HashMap and Chaining



HashMap and Chaining

- Non duplicated keys (values could be duplicated)
 - Chaining is not used to store multiple keys with the same value. Each key should be unique
 - Chaining is used to solve the collision problem.





HashMap

- Non duplicated keys (values could be duplicated)
- Not ordered (neither sorted)

- Implementation is based on a hash table
 - Operations *put(k, v)*, *get(k)*, *remove(k)*, *containsKey(k)* are immediate

- Requires to override *hashCode()* & *equals()*
- Key object must be immutable



HashMap vs HashSet

- ❑ HashMap allows to insert key-value pairs. Each key is associated to a value

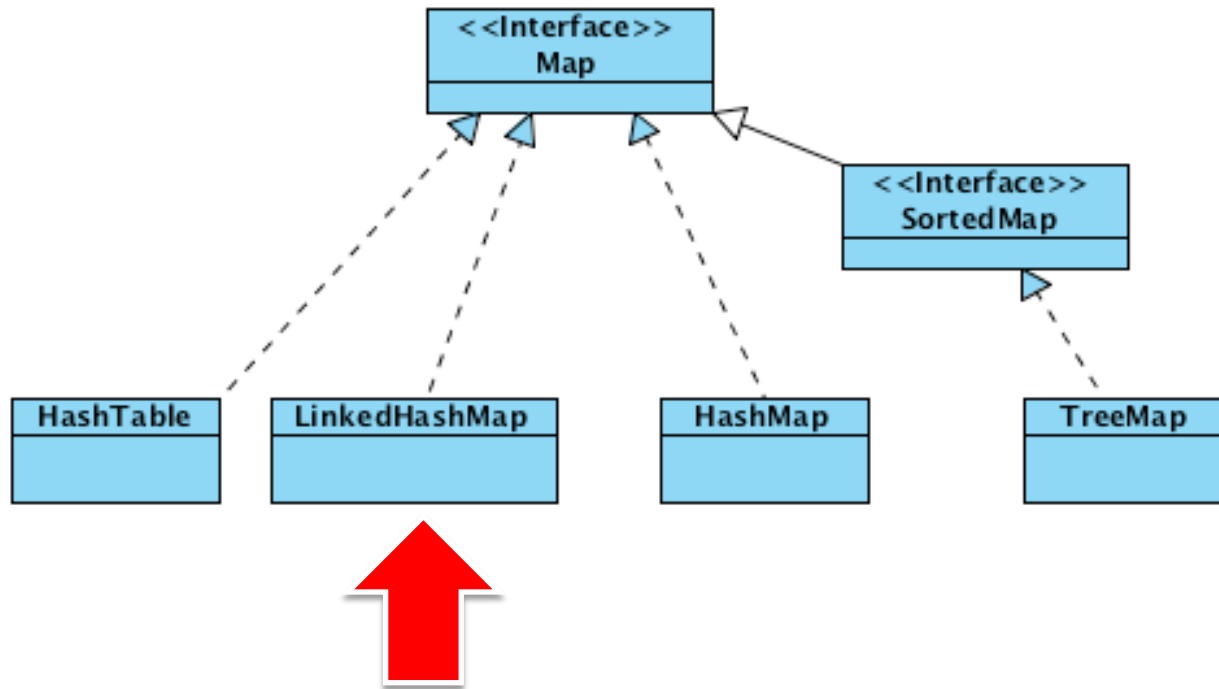
- ❑ HashSet allows to insert an object in a collection of objects. The object itself (or part of it) is the key

- ❑ Similarities:
 - ❑ Do not accept duplicated key
 - ❑ Not ordered (neither sorted)
 - ❑ Implementation is based on a hash table
 - ❑ Requires to override hashCode() & equals() for the Key object
 - ❑ Key object must be immutable (at least for the field used in hashCode() and equals())

HashMap operations

	HashMap
put(key, object)	IMMEDIATE
get(key)	IMMEDIATE
remove(key)	IMMEDIATE
containsKey(key)	IMMEDIATE
containsValue(object)	SLUGGISH

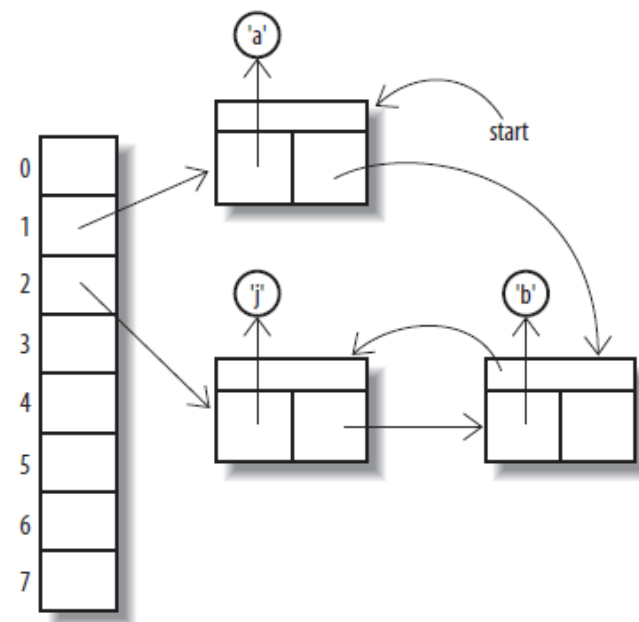
LinkedHashMap










LinkedHashMap

- Implementation is based on a hash table and a double-linked list running through all of its entries:
 - Operations $put(k, v)$, $get(k)$, $remove(k)$, $containsKey(k)$ are immediate
- Non duplicated keys
 - Values could be duplicated
- Ordered (usually insertion-order)
 - Insertion order is not affected a key is re-inserted
- Not sorted



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