



#ASLI ENGINEERING

Implementing Hash Sets



BY

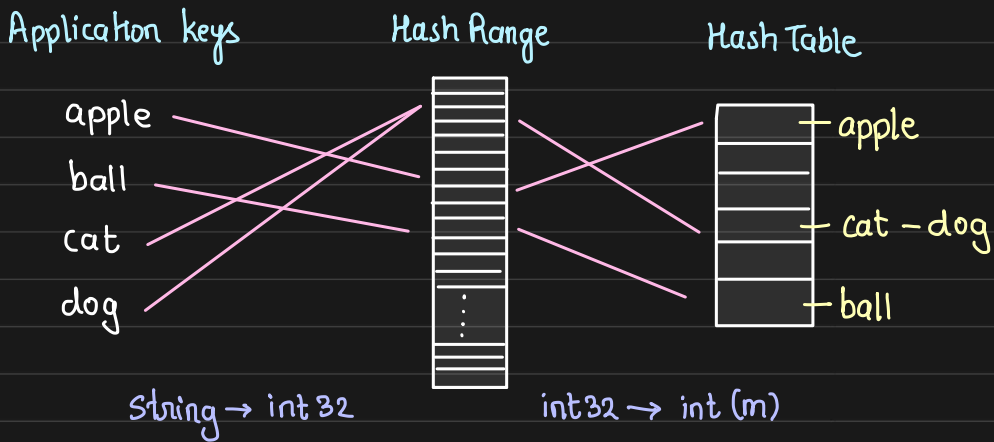
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Implementing Hash Sets

Hash Set is a data structure that implements set over a hash table

{ apple, ball, cat, dog }

The idea is to allow only unique values in the data structure, but how do we implement it with Hash Tables



Different application keys map to same Hash Key

↓

eg: cat and dog

From same hash key, they would be placed in two different slots of the hash table [collision handling]

Hence, while looking up we have to compare actual application key, and cannot just rely on hash key

Hence, we need to store

- the application keys in the Hash Table
- the hash keys along with the key
 - ↳ avoid computing $fn(k) = h$

Hash Table

	apple
	cat - dog
	ball

```
struct Key {
```

```
    void *key:    ← hold key of any type
```

```
    int hash_key; ← hash stored to avoid re-computation
```

```
}
```

Implementation detail: if we support generic key (`void *`) how would we compare two such keys?

hence, we would need a **custom comparator** for the type

Implementation detail: when we delete a key from the hash table it may be our responsibility to clean them up

[manual memory management]

Hence, as part of robust implementation we would need **comparator function** and **destructor function**

Implementing Hash Set with Hash Table with Chaining

Hash Set overall
will have

1. array
2. # size
3. # keys
4. comparator function
5. destructor function



struct node {

int32 hash_key;

void * key;

struct node * next;

}

application key

hash of the key

to avoid re-computation

Implementation Detail

1. To have fast insert, prepend keys at head of the list
2. To have just unique keys, we have to
check and insert
a little slow on time but good on space

Implementing Hash Set with Hash Table with Open Addressing



└── struct slot {

marks if slot is

Hash Set overall

bool is-empty; — empty

will have

bool is-deleted; — marks if key is

soft deleted

1. array

2. # keys

3. # used slots

4. comparator function

5. destructor function

int32 hash-key;

void * key;

}

application key

hash of the key

to avoid re-computation

Implementation Detail

During insert, lookup and delete when we find the matching hash key we need to explicitly compare the keys to check its existence.

Implementation Detail

Destructor should be invoked only when we are hard deleting the key