

2. dict (HashMap)

A dictionary (dict) is a data structure that stores data in key → value pairs.

Each key is unique and is used to quickly access its value.

$mp = \{ \}$

} #creation of dictionary

$mp = \text{dict}()$

} in two ways

Example:

$mp = \{ "a": 10, "b": 20 \}$

- Insert / update

$mp["a"] = 10$

if key does not exists → it inserts

if key exists → updates

- Access value

$value = mp["a"]$

if key does not

exist → KeyError

∴ Safe Access

$value = mp.get("a", 0)$

If key exists → return value

If not → return default (here 0)

- Delete key

$\text{del. } mp["a"]$

removes key-value pair

• Looping through Dictionary

Method 1: Loop through keys

```
for key in mp:  
    print(key, mp[key])
```

Method 2: Loop through key-value pairs

```
for k, v in mp.items():  
    print(k, v)
```

• Time Complexity (Average Case)

Operation	Complexity
Insert	$O(1)$
Search	$O(1)$
Delete	$O(1)$

Where dict is used in DSA

• Frequency Counting

```
arr = [1, 1, 2, 3, 2, 1]  
freq = {1: 2, 2: 2, 3: 1}
```

```
for num in arr:
```

```
    freq[num] = freq.get(num, 0) + 1
```

- Two Sum Problems

Store number → index mapping

- Prefix Sum + Hashing

Used in :

- subarray sum problems
- longest subarray problems

- Counting problems

- count occurrences
- find duplicates
- frequency map

Imp: Keys must be immutable

Allowed keys:

int

float

string

tuple

Not allowed:

list

set

dict

- dict is a hash-based key-value data structure that provides $O(1)$ average time for insert, search and delete.