



What is hashing?

Hash Tables

Hashing

Hash

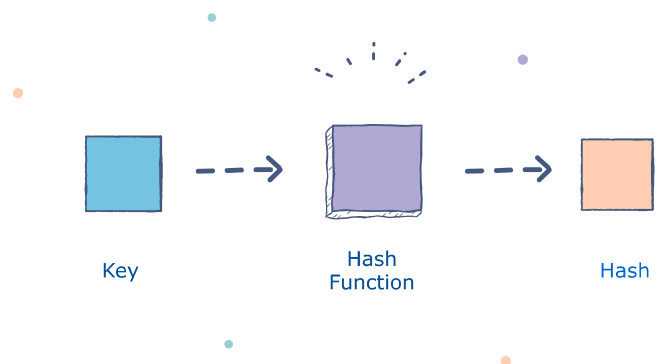
Data Structures

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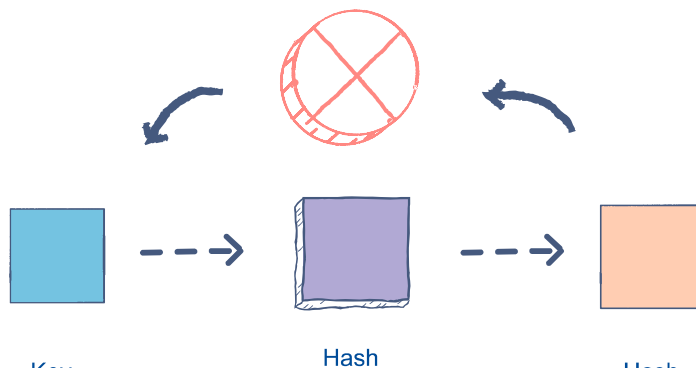
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Hashing is the process of converting a given key into another value. A **hash function** is used to generate the new value according to a mathematical algorithm. The result of a hash function is known as a **hash value** or simply, a **hash**.



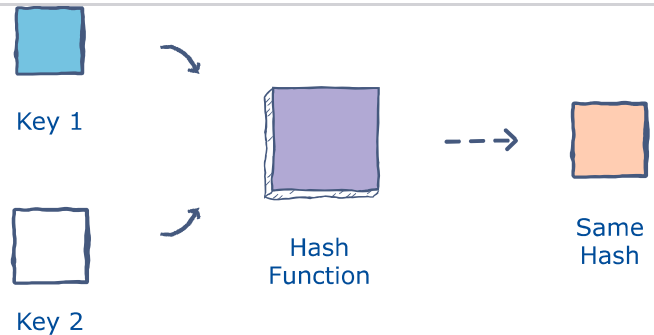
A good hash function uses a **one-way** hashing algorithm, or in other words, the hash cannot be converted back into the original key.





Collisions

Keep in mind that two keys can generate the same hash. This phenomenon is known as a **collision**. There are several ways to handle collisions, but that's a topic for another time.



Applications

Hashing is most commonly used to implement *hash tables*. A hash table stores key/value pairs in the form of a list where any element can be accessed using its index.

Since there is no limit to the number of key/value pairs, we can use a hash function to map the keys to the size of the table; the hash value becomes the index for a given element.

A simple hashing approach would be to take the modular of the key (assuming it's numerical) against the table's size:

$$index = key \text{ MOD } tableSize$$

This will ensure that the hash is always within the limits of the table size. Here is the code for such a hash function:

```
def hashModular(key, size):
    return key % size

list_ = [None] * 10  # List of size 10
key = 35
index = hashModular(key, len(list_))  # Fit the key into the list size
print("The index for key " + str(key) + " is " + str(index))
```





Hashing is also used in data encryption. Passwords can be stored in the form of their hashes so that even if a database is breached, plaintext passwords are not accessible. MD5, SHA-1 and SHA-2 are popular cryptographic hashes.

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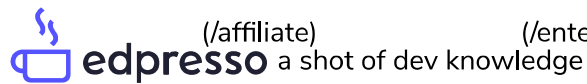
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