

What is Hashing?

Hashing is a technique used to map data into a fixed-size index. It involves using a hash function to convert a variable-length input into a fixed-length output. This process is crucial in data structures as it enables fast retrieval of data based on its key.

Hash Function

A hash function is a mathematical operation that takes a key as input and produces a hash code or hash value as output.

Properties:

Deterministic: It should always produce the same hash value for the same key.

Unique: Every input should have a unique hash code.

Collision-friendly: It should minimize collisions, which occur when two different keys produce the same hash value.

Fast: The calculation should be quick.

Hash Table

A hash table is a data structure that stores data in an array format. It uses a hash function to map keys to values in the array. This allows for fast search, insertion, and deletion operations.

Types of Hash Functions

Division Method:

$$\text{Key \% Hash Table Size}$$

Multiplication Method:

$$(\text{Key} * \text{Constant}) \% \text{Hash Table Size}$$

Universal Hashing:

A family of hash functions designed to minimize collisions