



Map

KEY	VALUE
1	A
2	B
456	PQO
789	A



*Map data structure (also known as a **dictionary**, **associative array**, or **hash map**) is defined as a data structure that stores a collection of key-value pairs, where each key is associated with a single value which means there can nor be duplicate key.*

Types of Maps in Data Structures:

There are several different types of maps or dictionary data structures used in computer science and data structures:

1. Hash Map

A hash map is a data structure that uses a hash function to map keys to indices in an array. The hash function takes the key as input and produces an index into the array, where the corresponding value is stored. Hash maps have an average time complexity of $O(1)$ for operations such as insertion and retrieval, making them one of

the **most efficient map data structures**. However, hash collisions can occur when two keys map to the same index, leading to slower performance in the worst case.

2. Tree Map

A tree map is a type of map that is implemented as a binary search tree. In a tree map, the keys are stored in a sorted order, allowing for efficient searching, insertion, and deletion operations. Tree maps have an average time complexity of $O(\log n)$ for operations such as insertion and retrieval, where n is the number of elements in the map.

3. Linked Hash Map

A linked hash map is a type of map that maintains a doubly-linked list of the entries in the map, in the order in which they were inserted. This allows for fast iteration over the elements in the map, as well as efficient insertion, retrieval, and deletion operations.

4. Trie Map

A trie map, also known as a prefix tree, is a type of map that is used to store a set of strings, where each node in the tree represents a prefix of one or more strings. Tries are particularly useful for searching for strings that start with a given prefix, as the search can be terminated early once the prefix is not found in the trie.

5. Bloom Filter Map

A bloom filter map is a type of map that uses a bloom filter, a probabilistic data structure, to determine whether a key is present in the map or not. Bloom filter maps are used when it is important to have a fast response time for key existence checks, but where the occasional false positive result is acceptable.



SUMMARY: In arrays and vectors data is stored serially so the index range from 0 to n. But, in a map, **we define the index** so we can access the index in O(1). And the map provides us with a function that can tell us whether a particular exists or not!

Features:	Array	Set	Map
Duplicate values	Duplicate Values	Unique Values	keys are unique, but the values can be duplicated
Order	Ordered Collection	Unordered Collection	Unordered Collection
Size	Static	Dynamic	Dynamic
Retrieval	Elements in an array can be accessed using their index	Iterate over the set to retrieve the value.	Elements can be retrieved using their key
Operations	Adding, removing, and accessing elements	Set operations like union, intersection, and difference.	Maps are used for operations like adding, removing, and accessing key-value pairs.
Memory	Stored as contiguous blocks of memory	Implemented using linked lists or trees	Implemented using linked lists or trees

Applications of Map Data Structure:

→ **Indexing and retrieval:** Maps are used to index elements in an array and retrieve elements based on their keys.

→ **Grouping and categorization:** Maps can be used to group elements and categorize them into different buckets.

For example, you can group employees based on their departments, cities, or salary ranges.

→ **Network routing:** Maps are used in computer networks to store information about routes between nodes.

The information stored in the map can be used to find the shortest path between two nodes.

- **Graph algorithms:** Maps can be used to represent graphs and perform graph algorithms, such as depth-first search and breadth-first search.
- **Game Development:** Maps are commonly used in gaming to store information about game objects and their properties. For example, a game might use a map to store the health points of each character, with the character's ID serving as the key and the health points serving as the value.

Advantages

- **Fast access to data:** Maps allow you to retrieve specific values quickly and efficiently, even if the dataset is very large.
- **Flexibility:** Maps can store any type of data, including strings, numbers, and objects. This makes them very flexible and useful for a wide range of applications.
- **Relationship representation:** Maps can be used to represent relationships between pieces of data. For example, you can use a map to store a list of people and their ages, or to store the scores of a video game leaderboard.

Disadvantages

- **Memory usage:** Maps can be memory-intensive, especially if the dataset is very large. This can be a problem on systems with limited memory.
- **Hash collisions:** If the hash function used by the map generates many collisions, it can slow down map operations and reduce the efficiency of the data structure.
- **Complexity:** Maps can be complex to implement and maintain, especially if they are used in complex applications.



References

GeeksforGeeks | A computer science portal for geeks

A Computer Science portal for geeks. It contains well written, well thought and well explained computer science and programming articles, quizzes and practice/competitive

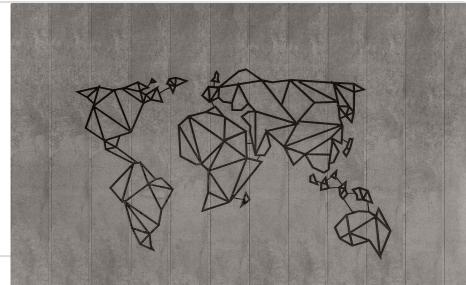
🔗 <https://www.geeksforgeeks.org/>



Why Map is my favorite data structure!

The data structure, which is just a simple combination of key-value pairs, can be your key to solving majority coding questions!

⌚ <https://hrishi84.medium.com/why-map-is-my-favorite-data-structure-bc1189da728d>



Introduction to the Map Data Structure

In this article we will learn about Map data structure and also where it is getting used, how it is implemented along with advantages , disadvantages.

⌚ <https://cloudnativejourney.wordpress.com/2023/05/04/introduction-to-the-map-data-structure/>



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SerhatKumas - Overview

Computer engineering student who loves coding in different fields instead of focusing on a one specific area. - SerhatKumas

⌚ <https://github.com/SerhatKumas>

