# **Overall Leetcode Tag Type Appear in the Question Count**

| Tag | Count |
| --- | --- |
| Array | 1606 |
| String | 680 |
| Hash Table | 572 |
| Math | 487 |
| Dynamic Programming | 485 |
| Sorting | 388 |
| Greedy | 358 |
| Depth-First Search | 287 |
| Database | 260 |
| Binary Search | 254 |
| Tree | 228 |
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| Bit Manipulation | 194 |
| Two Pointers | 193 |
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| Heap (Priority Queue) | 165 |
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| Stack | 151 |
| Simulation | 145 |
| Graph | 139 |
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| Design | 121 |
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| Enumeration | 75 |
| Linked List | 75 |
| Ordered Set | 58 |
| Monotonic Stack | 57 |
| Trie | 53 |
| Number Theory | 50 |
| Divide and Conquer | 46 |
| Recursion | 45 |
| Bitmask | 43 |
| Queue | 43 |
| Binary Search Tree | 40 |
| Segment Tree | 40 |
| Memoization | 37 |
| Geometry | 36 |
| Hash Function | 35 |
| Binary Indexed Tree | 35 |
| Topological Sort | 31 |
| String Matching | 30 |
| Combinatorics | 28 |
| Rolling Hash | 28 |
| Shortest Path | 26 |
| Game Theory | 25 |
| Interactive | 22 |
| Data Stream | 20 |
| Brainteaser | 16 |
| Monotonic Queue | 15 |
| Randomized | 12 |
| Merge Sort | 11 |
| Iterator | 9 |
| Concurrency | 9 |
| Doubly-Linked List | 8 |
| Probability and Statistics | 7 |
| Quickselect | 7 |
| Bucket Sort | 6 |
| Suffix Array | 6 |
| Minimum Spanning Tree | 5 |
| Counting Sort | 5 |
| Shell | 4 |
| Line Sweep | 4 |
| Reservoir Sampling | 4 |
| Strongly Connected Component | 3 |
| Eulerian Circuit | 3 |
| Radix Sort | 3 |
| Rejection Sampling | 2 |
| Biconnected Component | 1 |

# **Array**

In the context of **LeetCode**, an **array** refers to different data structures in various programming languages, such as a **List** in Python, **Array** or **Vector** in C++, **Array** or **ArrayList** in Java, and **Array** in Javascript. Arrays are linear data structures used to store collections of elements, each identified by an index or key. [They are set up in a way that all elements are stored in a contiguous chunk of memory, allowing efficient access using a base address plus an offset1](https://leetcodethehardway.com/tutorials/basic-topics/arrays)[2](https://leetcode.fandom.com/wiki/Array).

Here are **five free reference links** where you can learn more about arrays and practice LeetCode problems:

1. [**Arrays | LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/basic-topics/arrays): This resource provides tutorials and practical examples to enhance your array-related skills.
2. [**Mastering LeetCode: 10 Common Array Questions and How to Solve Them**](https://medium.com/@johnadjanohoun/mastering-leetcode-10-common-array-questions-and-how-to-solve-them-ad61b47cfc38): Explore common array-based LeetCode questions and learn effective problem-solving techniques.
3. [**Microsoft Coding Interview Questions**](https://www.tutorialcup.com/interview-questions/microsoft.htm): This page covers various interview questions, including array-related topics.
4. [**Non-decreasing Array - LeetCode**](https://leetcode.com/problems/non-decreasing-array/): Dive into LeetCode’s non-decreasing array problem and practice solving it.
5. [**LeetCode Array Tag**](https://leetcode.com/tag/array/): Explore a collection of array-related problems on LeetCode and improve your coding skills.

Happy learning! 🚀

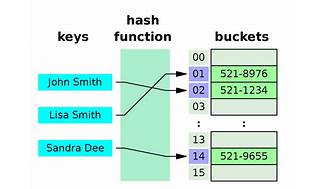
# **String**

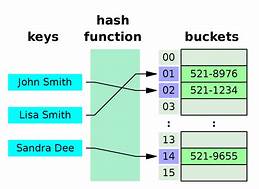
In **LeetCode**, a **string** refers to a sequence of characters. It’s a fundamental data type used for solving various algorithmic problems. Here are **five free reference links** where you can learn more about string-related challenges and solutions:

1. [**LeetCode String Problems**](https://leetcode.com/tag/string/): Explore a wide range of string-related problems, from simple to complex[1](https://leetcode.com/tag/string/).
2. [**Decode String LeetCode Solution**](https://tutorialcup.com/leetcode-solutions/decode-string-leetcode-solution.htm): Understand how to convert an encoded string into a decoded one using the given encoding rule[2](https://tutorialcup.com/leetcode-solutions/decode-string-leetcode-solution.htm).
3. [**Decode String Problem**](https://leetcode.com/problems/decode-string/): Dive into the details of solving the “Decode String” problem, which involves decoding an encoded string[3](https://leetcode.com/problems/decode-string/).
4. [**String Compression Problem**](https://leetcode.com/problems/string-compression/): Learn about compressing an array of characters using a specific algorithm[4](https://leetcode.com/problems/string-compression/).
5. [**LeetCode Problems by Difficulty**: Explore more string problems and other algorithmic challenges categorized by difficulty level1](https://leetcode.com/tag/string/).

Feel free to explore these resources to enhance your understanding of string manipulation and algorithms! 🚀

# **Hash Table**





Explore

Certainly! A **hash table** (also known as a hash map) is a data structure that allows efficient **key-value** pair storage and retrieval. [It uses a **hash function** to map keys to specific indices in an array, enabling fast access to values based on their associated keys](https://leetcode.com/tag/hash-table/) [1](https://leetcode.com/tag/hash-table/). Here are five free reference links where you can learn more about hash tables:

1. **LeetCode Hash Table Tag**: Explore a collection of problems related to hash tables on LeetCode. [Solve these problems to enhance your understanding and coding skills](https://leetcode.com/tag/hash-table/) [1](https://leetcode.com/tag/hash-table/).
2. [**Design HashMap**](https://leetcode.com/problems/design-hashmap/): This LeetCode problem challenges you to implement your own hash map without using built-in libraries.
3. [**Design HashSet**](https://leetcode.ca/2017-11-04-705-Design-HashSet/): Another LeetCode problem where you create a hash set from scratch.
4. [**LeetCode Explore - Hash Table**](https://leetcode.com/explore/learn/card/hash-table/): A comprehensive learning resource with topics related to hash tables.
5. **LeetCode Explore**: Whether you’re a beginner or an expert, LeetCode Explore offers various topics, including hash tables, waiting for you to explore and practice.

Happy learning! 📚🔍

# **Math**

**Math** in **LeetCode** refers to a category of problems that involve mathematical concepts and algorithms. These problems often require creative thinking and efficient solutions. Here are some free resources to enhance your math skills on LeetCode:

1. [**LeetCode Math Problems**](https://leetcode.com/tag/math/): Explore a wide range of math-related problems, including topics like addition, multiplication, permutations, and more[1](https://leetcode.com/tag/math/).
2. [**The Zen of Grinding LeetCode Problems: Easy Math**](https://blog.devgenius.io/the-zen-of-grinding-leetcode-problems-day-20-easy-math-f400d7261079): Dive into easy math problems and learn practical problem-solving techniques[2](https://blog.devgenius.io/the-zen-of-grinding-leetcode-problems-day-20-easy-math-f400d7261079).
3. [**Pow(x, n) Problem**](https://leetcode.com/problems/powx-n/): Practice implementing the pow function, which calculates x raised to the power n[3](https://leetcode.com/problems/powx-n/).
4. [**Solve the Equation Problem**](https://leetcode.com/problems/solve-the-equation/): Solve equations involving variables and coefficients using only addition and subtraction operations[4](https://leetcode.com/problems/solve-the-equation/).
5. [**LeetCode Explore**](https://leetcode.com/explore/learn/): Whether you’re a beginner or an experienced coder, LeetCode Explore offers a variety of topics, including math, to help you level up your coding skills[5](https://leetcode.com/explore/learn/).

Happy coding! 🚀🔢

# **Dynamic Programming**

**Dynamic Programming (DP)** is a programming paradigm that systematically and efficiently explores all possible solutions to a problem by breaking it down into simpler sub-problems in a recursive manner. It is particularly useful for problems with overlapping subproblems and optimal substructure characteristics.

Here are **five free reference links** where you can learn more about Dynamic Programming:

1. [**LeetCode Explore**: LeetCode’s dynamic programming section provides a comprehensive learning experience with practice problems and explanations1](https://leetcode.com/explore/learn/card/dynamic-programming/).
2. [**LeetCode Ultimate DP Study Plan**: This GitHub repository contains solutions to dynamic programming problems, along with explanations and study materials](https://leetcode.com/explore/learn/card/dynamic-programming/)[2](https://github.com/ShubhanshuJha/LeetCode-Ultimate-DP-Study-Plan).
3. [**Dynamic Programming by Tushar Roy (Coding Made Simple) on YouTube**: If you prefer video tutorials, Tushar Roy’s channel covers dynamic programming concepts and examples](https://leetcode.com/explore/learn/card/dynamic-programming/)[3](https://www.redgreencode.com/leetcode-tip-40-learn-dynamic-programming/).
4. [**Dynamic Programming Patterns by Atalyk Akash on LeetCode**: For sample code and common DP patterns, explore this resource on LeetCode](https://leetcode.com/explore/learn/card/dynamic-programming/)[3](https://www.redgreencode.com/leetcode-tip-40-learn-dynamic-programming/).
5. [**LeetCode Problem Set for Dynamic Programming**: LeetCode offers a range of essential DP problems for practice, including questions asked by top-tier companies](https://leetcode.com/explore/learn/card/dynamic-programming/)[4](https://leetcode.com/problemset/?search=dynamic%20programming).

Feel free to explore these resources to enhance your understanding of dynamic programming! 🚀

# **Sorting**

Certainly! **Sorting algorithms** play a crucial role in solving problems on **LeetCode**. Some common sorting algorithms include:

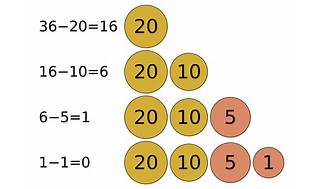
1. **Selection Sort**: Loops through the array, maintaining the index of separation between sorted and unsorted subarrays. It then identifies the minimum element and moves it to the end of the sorted subarray.
2. **Bubble Sort**: Repeatedly compares adjacent elements and swaps them if they are in the wrong order.
3. **Insertion Sort**: Builds the sorted array one element at a time by repeatedly inserting the next unsorted element into its correct position within the sorted part.
4. **QuickSort**: Divides the array into smaller subarrays, recursively sorts them, and combines them to achieve the final sorted result.
5. **Merge Sort**: Divides the array into halves, sorts each half, and then merges them back together.

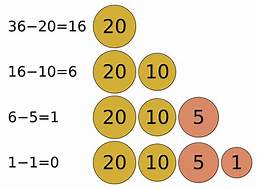
To learn more about these algorithms and practice sorting problems, here are some free resources:

1. [**LeetCode’s “Sort an Array” Problem**](https://leetcode.com/problems/sort-an-array/): Solve this problem to practice sorting in ascending order.
2. [**LeetCode’s “Sort List” Problem**](https://leetcode.com/problems/sort-list/): Sort a linked list in ascending order using a divide-and-conquer approach.
3. [**Selection Sort Tutorial on LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/basic-topics/sorting/selection-sort): Detailed explanation of selection sort.
4. [**Insertion Sort Tutorial on LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/basic-topics/sorting/insertion-sort): Learn about insertion sort step by step.
5. [**LeetCode’s Sorting Tag**](https://leetcode.com/tag/sorting/): Explore various sorting-related problems and solutions.

Happy learning! 📚🔍

# **Greedy**





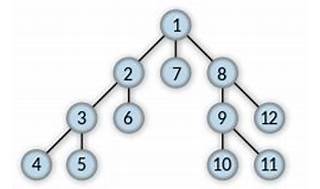
Explore

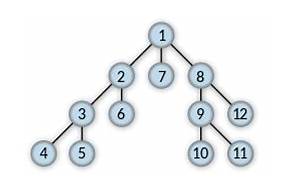
**Greedy algorithms** are a class of algorithms that make locally optimal choices at each step with the hope of finding a global optimum. They are often simpler to describe and implement than other algorithms, but their efficiency can vary depending on the problem. Here are **five free reference links** where you can learn more about greedy algorithms and practice solving related problems:

1. **LeetCode’s Greedy Tag**: Explore a curated list of problems tagged as “Greedy” on LeetCode. [This is an excellent place to practice and deepen your understanding1](https://leetcode.com/tag/greedy/).
2. **GeeksforGeeks - Greedy Algorithm for Minimum Number of Coins**: Learn how to find the minimum number of coins needed to make a given amount using a greedy approach. [The article provides a step-by-step explanation and sample code](https://leetcode.com/tag/greedy/)[2](https://www.geeksforgeeks.org/greedy-algorithm-to-find-minimum-number-of-coins/).
3. **Huffman Coding**: Dive into Huffman coding, a classic example of a greedy algorithm used for data compression. [Understand how it constructs an optimal prefix-free binary tree for encoding characters](https://leetcode.com/tag/greedy/)[3](https://www.geeksforgeeks.org/huffman-coding-greedy-algo-3/).
4. [**Medium Article on Greedy Algorithms Explained with LeetCode Problems**: This article discusses the pros and cons of greedy algorithms and provides insights into solving LeetCode problems using this approach](https://leetcode.com/tag/greedy/)[4](https://medium.com/algorithms-and-leetcode/greedy-algorithm-explained-using-leetcode-problems-80d6fee071c4).
5. **LeetCode Discuss: Greedy for Beginners**: Join discussions on LeetCode’s forum specifically tailored for beginners learning about greedy algorithms. [Engage with the community, share solutions, and gain practical insights](https://leetcode.com/tag/greedy/)[5](https://leetcode.com/discuss/general-discussion/669996/greedy-for-beginners-problems-sample-solutions).

Happy learning! 🌟

# **Depth-First Search**





Explore

**Depth-First Search (DFS)** is a graph traversal algorithm where we explore as far as possible along a branch before backtracking. It’s commonly used to solve problems related to trees, graphs, and strings. Here are five free resources to learn more about DFS:

1. [**LeetCode Depth-First Search**](https://leetcode.com/tag/depth-first-search/): LeetCode provides a collection of DFS problems, along with solutions and discussions[1](https://leetcode.com/tag/depth-first-search/).
2. [**LeetCode Patterns: BFS + DFS**](https://medium.com/leetcode-patterns/leetcode-pattern-1-bfs-dfs-25-of-the-problems-part-1-519450a84353): This article explains the basics of both BFS and DFS, focusing on LeetCode patterns and problem-solving techniques[2](https://medium.com/leetcode-patterns/leetcode-pattern-1-bfs-dfs-25-of-the-problems-part-1-519450a84353).
3. [**DFS for Your Next Tech Giant Interview**](https://www.freecodecamp.org/news/dfs-for-your-next-tech-giant-interview/): Dive deeper into DFS with examples and practical insights for interviews[3](https://www.freecodecamp.org/news/dfs-for-your-next-tech-giant-interview/).

Remember, DFS is a powerful tool for solving various algorithmic challenges. Happy learning! 🚀

# **Binary Search**

**Binary Search** is a widely used algorithm for searching an element in a **sorted array or list**. [The basic idea of binary search is to divide the search space in half with each iteration and compare the middle element with the target element](https://leihao0.github.io/LeetCode-Binary-Search/) [1](https://leihao0.github.io/LeetCode-Binary-Search/).

Here are **five free reference links** where you can learn more about binary search:

1. [**LeetCode Binary Search**](https://leihao0.github.io/LeetCode-Binary-Search/): LeetCode provides a collection of problems and solutions, including binary search examples [1](https://leihao0.github.io/LeetCode-Binary-Search/).
2. [**LeetCode - Binary Search**](https://leetcode.com/problems/binary-search/): LeetCode’s official problem page for binary search, complete with explanations and code solutions [2](https://leetcode.com/problems/binary-search/).
3. [**TutorialCup - Binary Search LeetCode Solution**](https://tutorialcup.com/leetcode-solutions/binary-search-leetcode-solution.htm): A detailed tutorial with LeetCode solutions for binary search [3](https://tutorialcup.com/leetcode-solutions/binary-search-leetcode-solution.htm).
4. [**Programiz - Binary Search**](https://www.programiz.com/dsa/binary-search): Learn how to perform binary search in various programming languages with examples [4](https://www.programiz.com/dsa/binary-search).
5. [**LeetCode - Search in a Binary Search Tree**](https://leetcode.com/problems/search-in-a-binary-search-tree/): While not exclusively about binary search, this problem on LeetCode involves searching in a binary search tree [5](https://leetcode.com/problems/search-in-a-binary-search-tree/).

Feel free to explore these resources to deepen your understanding of binary search! 🚀

# **Database**

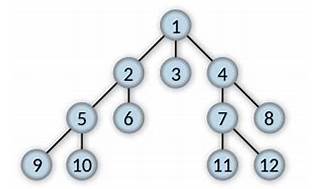
Certainly! In a nutshell, **LeetCode Database** is a collection of SQL problems that test your skills in querying and manipulating databases. It covers a wide range of topics related to databases and is a valuable resource for practicing SQL problem-solving.

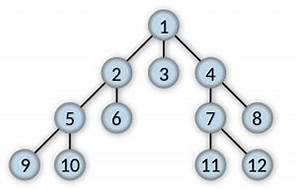
Here are **five free reference links** where you can learn more about LeetCode Database problems and enhance your SQL skills:

1. [**LeetCode Database Problems**](https://leetcode.com/tag/database/): Explore a variety of database problems, each tagged by difficulty level[1](https://leetcode.com/tag/database/).
2. [**Beyond-LeetCode-SQL on GitHub**](https://github.com/shawlu95/Beyond-LeetCode-SQL): This repository provides supplementary analysis of SQL for LeetCode, including sample databases and tricky interview questions[2](https://github.com/shawlu95/Beyond-LeetCode-SQL).
3. [**LeetCode Database Solution List**](https://circlecoder.com/leetcode-database-solution-list/): A comprehensive list of LeetCode database problems and their solutions, organized by difficulty[3](https://circlecoder.com/leetcode-database-solution-list/).
4. [**Database SQL Primer (Part 1)**](https://leetcode.com/discuss/study-guide/1600718/Database-SQL-Primer-%28Part-1%29-Overview-or-Query-Execution-Order-or-References): Dive into an overview of SQL concepts, query execution order, and references to deepen your understanding[4](https://leetcode.com/discuss/study-guide/1600718/Database-SQL-Primer-%28Part-1%29-Overview-or-Query-Execution-Order-or-References).
5. [**LeetCode Problem Set - Database**](https://leetcode.com/problemset/database/): Explore a wide range of database-related problems, categorized by topic and difficulty level[5](https://leetcode.com/problemset/database/).

Happy learning! 📚👩‍💻

# **Breadth-First Search**





Explore

**Breadth-First Search (BFS)** is a popular algorithm for traversing or searching tree and graph data structures. [It explores all the neighbors at the current depth before moving on to the next level](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/) [1](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/). Here are five free resources where you can learn more about BFS:

1. [**LeetCode’s BFS Tag**: LeetCode provides a collection of problems related to BFS, allowing you to practice and deepen your understanding](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/) [2](https://leetcode.com/tag/breadth-first-search/).
2. [**FreeCodeCamp Tutorial**: This tutorial explains how BFS works and provides examples of solving medium and easy problems on LeetCode using BFS](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/) [1](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/).
3. [**GeeksforGeeks Explanation**: GeeksforGeeks offers a detailed guide on level order traversal (BFS) for binary trees, including the basic pattern to solve problems](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/) [3](https://www.geeksforgeeks.org/level-order-tree-traversal/).
4. [**LeetCode Problem Set**: Explore various BFS-related problems on LeetCode to enhance your skills](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/) [4](https://leetcode.com/problemset/?topicSlugs=breadth-first-search).
5. **Online Courses and YouTube**: Search for free online courses or YouTube videos that cover BFS algorithms and implementations.

Happy learning! 🌟📚

# **Tree**

Certainly! In **LeetCode**, a **tree** is a hierarchical data structure composed of nodes, where each node has a value and can have zero or more child nodes. The topmost node is called the **root**, and nodes with no children are called **leaves**. [Trees are widely used for solving various coding problems, such as traversal, construction, and manipulation of binary trees and binary search trees (BSTs)](https://leetcode.com/tag/tree/) [1](https://leetcode.com/tag/tree/).

Here are **five free resources** where you can learn more about trees and improve your problem-solving skills:

1. [**LeetCode Tree Tag**](https://leetcode.com/tag/tree/): LeetCode’s official tree tag contains a curated list of tree-related problems, along with solutions and discussions. It’s an excellent place to practice and learn different tree algorithms and techniques.
2. [**Awesome LeetCode Resources**](https://github.com/ashishps1/awesome-leetcode-resources): This GitHub repository provides a comprehensive collection of resources, including articles, videos, and tutorials related to LeetCode problems. It covers various topics, including trees.
3. [**Coding with Sid**](https://www.codingwithsid.in/2021/12/best-resources-to-learn-dsa.html): Sid’s blog post lists some of the best resources for learning data structures and algorithms. It includes beginner-friendly materials and platforms to enhance your understanding of trees.
4. [**Introduction to Data Structures & Algorithms with LeetCode**](https://beesec.gitbook.io/algorithms): This GitBook offers an introduction to data structures and algorithms, including Python basics and Big O notation. It’s a helpful resource for beginners.
5. [**Reddit Thread on Free DSA Resources**](https://www.reddit.com/r/leetcode/comments/uuzdgw/online_free_resources_to_learn_dsa_for_leetcode/): In this Reddit thread, users share their favorite free resources for learning data structures and algorithms. You’ll find recommendations for YouTube channels, online courses, and more.

Feel free to explore these resources and deepen your understanding of trees! 🌳📚

# **Matrix**

In **LeetCode**, a **matrix** is a two-dimensional array of elements, often used to represent grids, graphs, or other structured data. It’s a fundamental data structure for solving various algorithmic problems. Here are **five reference links** where you can learn more about matrices and related LeetCode problems:

1. [**Matrix Problems on LeetCode**](https://leetcode.com/tag/matrix/): Explore a curated list of matrix-related problems, including rotation, traversal, and manipulation.
2. [**Spiral Matrix Problem**](https://leetcode.com/problems/spiral-matrix/): Learn how to traverse a matrix in spiral order.
3. [**Lucky Numbers in a Matrix Solution**](https://tutorialcup.com/leetcode-solutions/lucky-numbers-in-a-matrix-leetcode-solution.htm): Understand how to find lucky numbers in a given matrix.
4. [**Set Matrix Zeroes Problem**](https://leetcode.com/problems/set-matrix-zeroes/): Discover how to modify a matrix by setting entire rows and columns to zero based on specific conditions.
5. [**Matrix Problems on LeetCode (continued)**](https://leetcode.com/tag/matrix/): Dive deeper into additional matrix-related challenges, such as finding maximal rectangles, searching 2D matrices, and more.

Feel free to explore these resources to enhance your understanding of matrices and improve your problem-solving skills! 🚀

# **Two Pointers**

**Two Pointers** is a technique used to solve problems on **LeetCode**. [It involves maintaining two pointers (a left and right pointer) to efficiently solve problems related to strings, arrays, and linked lists](https://aman.ai/code/two-pointers/) [1](https://aman.ai/code/two-pointers/). Here are five free reference links where you can learn more about this technique:

1. [**Two-pointer in Leetcode Problems**](https://dorianhe.github.io/Two-pointer-in-Leetcode-Problems/): This blog post provides insights into using the two-pointer method for solving LeetCode problems [2](https://dorianhe.github.io/Two-pointer-in-Leetcode-Problems/).
2. [**Introduction to Two Pointers Technique Challenges**](https://mohsentabibian.github.io/LeetCode-Solutions/02.%20Two%20Pointers/intro.html): Enhance your problem-solving skills with this hands-on guide to the Two Pointers technique [3](https://mohsentabibian.github.io/LeetCode-Solutions/02.%20Two%20Pointers/intro.html).
3. [**Two-Pointer Technique, an In-Depth Guide**](https://www.reddit.com/r/leetcode/comments/18g9383/twopointer_technique_an_indepth_guide_concepts/): Dive deeper into the concepts behind the two-pointer approach [4](https://www.reddit.com/r/leetcode/comments/18g9383/twopointer_technique_an_indepth_guide_concepts/).
4. [**Two Pointer Algorithm Explained with LeetCode Problems**](https://medium.com/algorithms-and-leetcode/two-pointer-algorithm-explained-with-leetcode-problems-2ed289925acf): Explore practical examples of using the two-pointer algorithm [5](https://medium.com/algorithms-and-leetcode/two-pointer-algorithm-explained-with-leetcode-problems-2ed289925acf).
5. [**Two Pointers - LeetCode**](https://leetcode.com/tag/two-pointers/): LeetCode’s official Two Pointers section for coding practice and interview preparation [6](https://leetcode.com/tag/two-pointers/).

Happy learning! 🚀

# **Bit Manipulation**

**Bit manipulation** in LeetCode involves using bitwise operators to perform operations on binary numbers. Some useful tricks for efficient coding include:

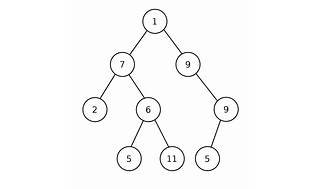
1. To create a number with only the k-th bit set, use 1 << (k-1).
2. To check whether the k-th bit is set or not, use n & (1 << (k - 1)).
3. To set the k-th bit to 1, use n | (1 << (k - 1)).
4. To clear the k-th bit, use n & ~ (1 << (k - 1)).
5. [To toggle the k-th bit, use n ^ (1 << (k – 1))1](https://leetcode.com/discuss/study-guide/1412978/Bit-Manipulation-Tricks-or-Helpful-and-concise).

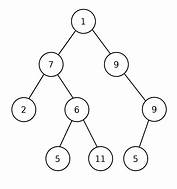
Here are some free reference links where you can learn more about bit manipulation:

1. [Bit Manipulation Tricks | Helpful and concise](https://leetcode.com/discuss/study-guide/1412978/Bit-Manipulation-Tricks-or-Helpful-and-concise)
2. [Bit Manipulation | LeetCode The Hard Way](https://leetcodethehardway.com/tutorials/math/bit-manipulation)
3. [Bit Hacks — Part 1 (Basic)](https://medium.com/techie-delight/bit-manipulation-interview-questions-and-practice-problems-27c0e71412e7)
4. [Bit Hacks — Part 2 (Playing with k’th bit)](https://medium.com/techie-delight/bit-manipulation-interview-questions-and-practice-problems-27c0e71412e7)
5. [Bit Hacks — Part 3 (Playing with the rightmost set bit of a number)](https://medium.com/techie-delight/bit-manipulation-interview-questions-and-practice-problems-27c0e71412e7)

Happy learning! 🤓👍

# **Binary Tree**





Explore

A **binary tree** is a hierarchical data structure where each node can have at most two children: a left child and a right child. [The topmost node is called the root, and leaf nodes have no children](https://leetcodethehardway.com/tutorials/graph-theory/binary-tree) [1](https://leetcodethehardway.com/tutorials/graph-theory/binary-tree). Here are **five free reference links** where you can learn more about binary trees:

1. [**LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/graph-theory/binary-tree): This tutorial provides detailed explanations and examples related to binary trees.
2. [**Explanation of class Definition for Binary Trees in LeetCode**](https://stackoverflow.com/questions/75473505/explanation-of-class-definition-for-binary-trees-in-leetcode): Understand how binary trees are defined in LeetCode.
3. [**Binary Tree Data Structure - GeeksforGeeks**](https://www.geeksforgeeks.org/binary-tree-data-structure/): GeeksforGeeks offers comprehensive information on binary trees, including insertion, deletion, and traversal.
4. [**Binary Tree Right Side View LeetCode Solution - TutorialCup**](https://www.tutorialcup.com/leetcode-solutions/binary-tree-right-side-view-leetcode-solution.htm): Learn about solving problems related to tree traversal, such as the right side view of a binary tree.
5. [**Binary Tree - Programiz**](https://www.programiz.com/dsa/binary-tree): Programiz provides tutorials, examples, and explanations for various types of binary trees, including full, perfect, and balanced trees.

Feel free to explore these resources to enhance your understanding of binary trees! 🌳📚

# **Heap (Priority Queue)**

[A **heap** (also known as a **priority queue**) in LeetCode is a binary tree where every parent node has a value less than or equal to any of its children, ensuring efficient retrieval of the minimum value at all times1](https://leetcode.com/tag/heap-priority-queue/)[2](https://logiclolo.gitbooks.io/leetcode/content/important-data-structure.html). Here are **five free reference links** to enhance your understanding of heaps and priority queues:

1. **LeetCode’s Heap (Priority Queue) Tag**: Explore a collection of problems related to heaps and priority queues on LeetCode. [This is an excellent place to practice and deepen your knowledge1](https://leetcode.com/tag/heap-priority-queue/).
2. **LeetCode Discuss: Important Concepts & Problems in Priority Queue/Heaps**: Dive into essential concepts and explore various problems related to priority queues and heaps. [This discussion forum provides valuable insights](https://leetcode.com/tag/heap-priority-queue/)[3](https://leetcode.com/discuss/general-discussion/1113631/important-concepts-problems-in-priority-queueheaps).
3. **LeetCode Article: Heap and Priority Queue**: Learn about heap implementation and its advantages over arrays or linked lists. [Understand how heap operations like insertion and deletion work efficiently](https://leetcode.com/tag/heap-priority-queue/)[4](https://medium.com/@JefferyCheng/heap-and-priority-queue-114aafaec8b4).
4. **LeetCode Solution in JavaScript**: Check out a JavaScript implementation of a priority queue (heap) with code examples. [It demonstrates enqueue, dequeue, and other essential operations](https://leetcode.com/tag/heap-priority-queue/)[5](https://dev.to/raaynaldo/leetcode-heap-priority-queue-in-javascript-4f25).
5. **GitBook: LeetCode Data Structures - Heap/Priority Queue**: This resource provides concise explanations and examples of heap-related problems. [It’s a great starting point for mastering this data structure](https://leetcode.com/tag/heap-priority-queue/)[2](https://logiclolo.gitbooks.io/leetcode/content/important-data-structure.html).

Happy learning! 🌟

# **Stack**

Certainly! In **LeetCode**, a **stack** is a data structure that follows the **Last In First Out (LIFO)** principle. It provides methods like push, pop, top, peekMax, and popMax for efficient manipulation of elements. Here are some reference links where you can learn more about stacks and related problems:

1. **Max Stack**: Explore how to implement a stack with additional features like retrieving the maximum element.
2. [**Implement Stack using Queues**](https://leetcode.com/problems/implement-stack-using-queues/): Learn how to create a stack using queues.
3. [**Implement Queue using Stacks**](https://leetcode.com/problems/implement-queue-using-stacks/): Understand how to implement a queue using stacks.
4. [**Min Stack**](https://leetcode.com/problems/min-stack/): Dive into designing a stack that supports constant-time retrieval of the minimum element.
5. **Basic Calculator**: Explore stack-based solutions for evaluating expressions.

Feel free to explore these resources to enhance your understanding of stacks and their applications! 🚀

# **Prefix Sum**

Certainly! **Prefix Sum** in LeetCode refers to the technique of pre-computing cumulative sums for an array. It’s often used in various computational problems, such as range sum queries or dynamic programming. [The basic idea is to calculate the sum of all elements up to each index in the array and then use these pre-computed sums to quickly find the sum of any sub-array within the array1](https://leetcodethehardway.com/tutorials/basic-topics/prefix-sum)[2](https://bing.com/search?q=Prefix+Sum+in+leetcode).

Here are **five free reference links** where you can learn more about Prefix Sum:

1. [**LeetCode The Hard Way: Prefix Sum**](https://leetcodethehardway.com/tutorials/basic-topics/prefix-sum): This tutorial provides a detailed explanation and examples of using prefix sums in LeetCode problems[1](https://leetcodethehardway.com/tutorials/basic-topics/prefix-sum).
2. [**Medium: LeetCode 75 | Day 1 - Prefix Sum**](https://medium.com/@harsha.post/leetcode-75-day-1-prefix-sum-f3353bc989b8): Learn about prefix sum through practical examples and code snippets[3](https://medium.com/@harsha.post/leetcode-75-day-1-prefix-sum-f3353bc989b8).
3. [**Medium: Prefix Sum Summary with Practice Questions**](https://medium.com/@maityamit/prefix-sum-summary-with-practice-questions-sheet-1d-2d-on-leetcode-83c8deb4f713): Explore prefix sum concepts along with practice questions and solutions[4](https://medium.com/@maityamit/prefix-sum-summary-with-practice-questions-sheet-1d-2d-on-leetcode-83c8deb4f713).
4. [**CodingBroz: Two Sum - LeetCode Solution**](https://www.codingbroz.com/two-sum-leetcode-solution/): Understand how prefix sum is applied to solve the Two Sum problem on LeetCode[5](https://www.codingbroz.com/two-sum-leetcode-solution/).
5. [**Code Recipe: Three Sum - Leetcode #15 Short & Simple Solution**](https://code-recipe.tumblr.com/): Discover how prefix sum techniques can be used to find triplets in an array that sum up to zero[6](https://code-recipe.tumblr.com/).

Feel free to explore these resources to enhance your understanding of prefix sums! 🚀

# **Simulation**

**Simulation** in LeetCode refers to solving problems that involve modeling real-world scenarios or systems by simulating their behavior. These problems often require implementing algorithms that mimic specific actions, movements, or processes. Here are some reference links where you can learn more about simulation techniques:

1. [**LeetCode Simulation Tag**](https://leetcode.com/tag/simulation/): Explore a collection of simulation problems on LeetCode. [This tag covers a wide range of scenarios, from robot movements to dice roll simulations1](https://leetcode.com/tag/simulation/).
2. [**Start your Coding Practice**](https://support.leetcode.com/hc/en-us/articles/360012016874-Start-your-Coding-Practice): LeetCode’s guide to getting started with coding practice. [Learn how to run your code, debug, and improve your skills](https://leetcode.com/tag/simulation/)[2](https://support.leetcode.com/hc/en-us/articles/360012016874-Start-your-Coding-Practice).
3. [**Walking Robot Simulation**](https://leetcode.com/problems/walking-robot-simulation/)[: A problem where you simulate a robot’s movements on an XY-plane, turning left or right, and moving forward](https://leetcode.com/tag/simulation/)[3](https://leetcode.com/problems/walking-robot-simulation/).
4. [**Dice Roll Simulation**](https://leetcode.com/problems/dice-roll-simulation/)[: Practice simulating dice rolls with constraints on consecutive numbers](https://leetcode.com/tag/simulation/)[4](https://leetcode.com/problems/dice-roll-simulation/).
5. **LeetCode Discuss Forum**: Engage with the LeetCode community, ask questions, and learn from discussions related to simulation problems.

Feel free to explore these resources to enhance your understanding of simulation techniques! 🚀

# **Graph**

Certainly! In a nutshell, a **graph** is a collection of points (called **vertices**) connected by lines (called **edges**). [These edges can be one-way, two-way, have associated numerical values, or be without any value1](https://leetcodethehardway.com/tutorials/graph-theory/introduction). Here are **five free reference links** where you can learn more about graphs and their applications:

1. [**LeetCode The Hard Way: Introduction to Graph Theory**](https://leetcodethehardway.com/tutorials/graph-theory/introduction): This tutorial provides a solid foundation for understanding graphs and their properties.
2. [**Hands-On Problem-Solving in Python: Introduction to Graph Challenges**](https://mohsentabibian.github.io/LeetCode-Solutions/11.%20Graphs/intro.html): Dive into the fascinating world of graphs and explore their applications.
3. [**Breadth-First Search (BFS) Guide with LeetCode Examples**](https://www.freecodecamp.org/news/breadth-first-search-a-bfs-graph-traversal-guide-with-3-leetcodeexamples/): Learn about BFS traversal, a fundamental technique for exploring graphs breadth-wise.
4. [**LeetCode Graph Problems**](https://leetcode.com/tag/graph/): Explore a variety of graph-related problems on LeetCode, ranging from easy to hard.
5. [**LeetCode Problem: All Paths From Source to Target**](https://leetcode.com/problems/all-paths-from-source-to-target/): Practice solving a specific graph problem involving finding all paths from a source node to a target node.

Happy learning! 🌟📚

# **Design**

Certainly! **Design** problems on LeetCode involve creating efficient and well-structured solutions for various data structures, algorithms, and system components. Here’s a concise definition and five free reference links to enhance your understanding:

1. **LeetCode Design Problems**: These challenges focus on designing classes, data structures, and algorithms to solve specific problems. [They cover topics like cache management, system design, and more1](https://leetcode.com/tag/design/).
2. **LeetDesign**: A platform dedicated to practicing system design problems. [It offers a collection of practice problems, solutions, and discussions to help you improve your design skills](https://leetcode.com/tag/design/)[2](https://leetdesign.com/).
3. **Top LeetCode Patterns for FAANG Interviews (Design)**: This resource provides an overview of common design patterns encountered in coding interviews. [It covers topics like depth-first search, breadth-first search, binary search, and more](https://leetcode.com/tag/design/)[3](https://www.designgurus.io/blog/top-lc-patterns).
4. **LeetCode Patterns by Sean Prashad**: Sean Prashad’s blog outlines various LeetCode patterns, including design-related ones. [Explore topics like heap, arrays, binary search, and more](https://leetcode.com/tag/design/)[4](https://seanprashad.com/leetcode-patterns/).
5. **LeetCode Problem: Design Linked List**: A specific problem to practice your design skills. [Implement a linked list with attributes like val and next](https://leetcode.com/tag/design/)[5](https://leetcode.com/problems/design-linked-list/).

Remember to practice actively, explore real-world scenarios, and apply these concepts to strengthen your problem-solving abilities! 🚀

# **Counting**

Certainly! **Counting** in LeetCode refers to solving problems related to counting elements, occurrences, or patterns in data structures or sequences. It often involves finding frequencies, sums, or other numerical information. Here’s a concise explanation and five free reference links to learn more:

1. [**338. Counting Bits**: This LeetCode problem focuses on counting the number of 1 bits in the binary representation of integers from 0 to *n*](https://medium.com/@sheefanaaz6417/338-counting-bits-leetcode-easy-step-by-approach-172410c887a8) [1](https://medium.com/@sheefanaaz6417/338-counting-bits-leetcode-easy-step-by-approach-172410c887a8).
2. [**169. Majority Element**: A straightforward counting problem where you find the majority element in an array](https://medium.com/@sheefanaaz6417/338-counting-bits-leetcode-easy-step-by-approach-172410c887a8) [2](https://leetcode.com/tag/counting/).
3. [**347. Top K Frequent Elements**: Learn how to find the *K* most frequent elements in an array using counting techniques](https://medium.com/@sheefanaaz6417/338-counting-bits-leetcode-easy-step-by-approach-172410c887a8) [2](https://leetcode.com/tag/counting/).
4. [**387. First Unique Character in a String**: Count occurrences of characters to identify the first non-repeating character in a string](https://medium.com/@sheefanaaz6417/338-counting-bits-leetcode-easy-step-by-approach-172410c887a8) [2](https://leetcode.com/tag/counting/).
5. [**594. Longest Harmonious Subsequence**: Explore counting subarrays with harmonious elements](https://medium.com/@sheefanaaz6417/338-counting-bits-leetcode-easy-step-by-approach-172410c887a8) [2](https://leetcode.com/tag/counting/).

Feel free to dive into these resources to enhance your understanding of counting algorithms and problem-solving techniques! 🚀

# **Sliding Window**

Certainly! The **Sliding Window** technique in LeetCode involves maintaining a dynamic window over an array or string to efficiently solve problems related to subarrays or substrings. Here are **five free reference links** where you can learn more about this technique:

1. **LeetCode’s Official Sliding Window Problems**: Explore a curated list of problems that utilize the sliding window approach. [These problems cover various difficulty levels and provide excellent practice1](https://leetcode.com/tag/sliding-window/).
2. [**Detailed Explanation of Sliding Window Maximum**: Learn how to find the maximum value in a sliding window using a double-ended queue (deque) with O(1) time complexity](https://leetcode.com/tag/sliding-window/)[2](https://leetcode.ca/2016-07-26-239-Sliding-Window-Maximum/).
3. [**Sliding Window Maximum Problem Description**: Understand the problem statement and constraints for finding the maximum sliding window in an array3](https://leetcode.com/problems/sliding-window-maximum/).
4. **LeetCode Discuss: Sliding Window Technique and Question Bank**: Dive deeper into the technique with additional examples and discussions. [This resource is perfect for expanding your knowledge and preparing for interviews4](https://leetcode.com/discuss/study-guide/1773891/sliding-window-technique-and-question-bank).
5. [**LeetCode Problem 76: Minimum Window Substring**: Explore a specific sliding window problem where you need to find the minimum window substring containing all characters from a given set1](https://leetcode.com/tag/sliding-window/).

Feel free to explore these resources to enhance your understanding of the sliding window technique! 🚀

# **Backtracking**

**Backtracking** in LeetCode is a technique for solving problems that involve finding all possible combinations or permutations of a given set of elements. [It uses a recursive function to explore different choices at each step and backtracks when a choice leads to a dead end or a suboptimal solution1](https://leetcode.com/problems/permutations/solutions/3850847/easy-explanation-short-code-backtracking/).

Here are **five free reference links** where you can learn more about backtracking:

1. [**LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/basic-topics/backtracking): Provides an understanding of backtracking and its steps for solving problems.
2. [**In-depth Backtracking with LeetCode Problems — Part 1**](https://medium.com/algorithms-and-leetcode/backtracking-e001561b9f28): Explores backtracking through specific LeetCode problems.
3. [**LeetCode Patterns: Backtracking**](https://medium.com/coding-memo/leetcode-patterns-of-backtracking-dae6be35cb45): Discusses backtracking as a specific case of depth-first search (DFS).
4. [**Let’s LeetCode in Python**](https://yangyangfu.github.io/letsleetcode-python/notes/algorithm/backtracking-algorithm.html): Offers Python examples and explanations for backtracking.
5. [**LeetCode Backtracking Problems**](https://leetcode.com/tag/backtracking/): A comprehensive list of LeetCode problems related to backtracking[2](https://leetcode.com/tag/backtracking/).

Feel free to explore these resources to enhance your understanding of backtracking! 🚀

# **Union Find**

[**Union-Find**, also known as **Disjoint-Set Union (DSU)**, is a data structure that efficiently manages disjoint sets and helps solve graph-related problems, such as finding connected components in a graph or evaluating divisions](https://ernieyang09.github.io/learning-site/docs/leetcode/union-find) [1](https://ernieyang09.github.io/learning-site/docs/leetcode/union-find)[2](https://bing.com/search?q=Union+Find+in+leetcode). It’s particularly useful for scenarios where you need to track relationships between elements and merge or find their connected components.

Here are **five free reference links** where you can learn more about Union-Find:

1. [**Union-Find Problems in LeetCode**](https://dorianhe.github.io/Union-Find-Problems-in-Leetcode/): This comprehensive guide covers various LeetCode problems related to Union-Find and provides detailed explanations and solutions [3](https://dorianhe.github.io/Union-Find-Problems-in-Leetcode/).
2. [**Disjoint Set Union (DSU)/Union-Find - A Complete Guide**](https://leetcode.com/discuss/general-discussion/1072418/Disjoint-Set-Union-%28DSU%29Union-Find-A-Complete-Guide): Explore the basics of Union-Find, its implementation, and practical examples [4](https://leetcode.com/discuss/general-discussion/1072418/Disjoint-Set-Union-%28DSU%29Union-Find-A-Complete-Guide).
3. [**LeetCode Union Find Tag**](https://leetcode.com/tag/union-find/): Dive into LeetCode problems tagged under Union-Find to practice and enhance your skills [5](https://leetcode.com/tag/union-find/).
4. [**Learning Site: Union Find**](https://ernieyang09.github.io/learning-site/docs/leetcode/union-find): A concise implementation of Union-Find with Python code snippets [1](https://ernieyang09.github.io/learning-site/docs/leetcode/union-find).
5. [**LeetCode The Hard Way: Union Find**](https://leetcodethehardway.com/solutions/tags/union-find): Explore solutions to Union-Find problems, including code examples and explanations [6](https://leetcodethehardway.com/solutions/tags/union-find).

Happy learning! 🌟

# **Enumeration**

**Enumeration** in **LeetCode** refers to the process of systematically exploring all possible solutions or combinations for a given problem. It involves iterating through different options, often using loops or recursion, to find the desired outcome. Here are some reference links where you can learn more about enumeration and practice related problems:

1. [**LeetCode Enumeration Tag**](https://leetcode.com/tag/enumeration/): Explore a curated list of problems categorized under enumeration. [This is an excellent place to enhance your coding skills and prepare for interviews1](https://leetcode.com/tag/enumeration/).
2. [**Permutations Problem**](https://leetcode.com/problems/permutations/): A classic example of enumeration. [Given an array of distinct integers, find all possible permutations](https://leetcode.com/tag/enumeration/)[2](https://leetcode.com/problems/permutations/).
3. [**Enumerate() in Python**](https://www.geeksforgeeks.org/enumerate-in-python/)[: Learn how to use the enumerate() function in Python to iterate through elements with their corresponding indices](https://leetcode.com/tag/enumeration/)[3](https://www.geeksforgeeks.org/enumerate-in-python/).
4. [**LeetCode Problem Set**](https://leetcode.com/problemset/?topicSlugs=enumeration)[: Explore a broader range of problems, including enumeration-related ones, to practice and improve your problem-solving skills](https://leetcode.com/tag/enumeration/)[4](https://leetcode.com/problemset/?topicSlugs=enumeration).
5. [**Strong Password Checker**](https://leetcode.com/problems/strong-password-checker/discuss/1284939/Simple-enumeration-with-detailed-explanation/996012/): Dive into a real interview question related to enumeration. [Understand the problem and explore solutions](https://leetcode.com/tag/enumeration/)[5](https://leetcode.com/problems/count-primes/).

Happy learning! 🚀📚

# **Linked List**

A **linked list** is a linear data structure where elements (nodes) are connected sequentially, with each node containing data and a reference to the next node. Here are **five free reference links** to learn more about linked lists:

1. [**LeetCode’s Design Linked List Problem**](https://leetcode.com/problems/design-linked-list/): LeetCode provides a MyLinkedList class that can be used to implement a linked list. [It includes methods for adding, removing, and accessing elements in the list1](https://leetcode.com/problems/design-linked-list/).
2. [**LeetCode Tag: Linked List**](https://leetcode.com/tag/linked-list/): Explore a variety of linked list problems on LeetCode, categorized by difficulty level. [This tag includes both singly and doubly linked list challenges](https://leetcode.com/problems/design-linked-list/)[2](https://leetcode.com/tag/linked-list/).
3. [**LeetCode the Hard Way: Linked List Tutorial**](https://leetcodethehardway.com/tutorials/basic-topics/linked-list): A comprehensive tutorial covering the basics of linked lists, including implementation details and common operations[3](https://leetcodethehardway.com/tutorials/basic-topics/linked-list).
4. [**TutorialCup: Palindrome Linked List Solution**](https://tutorialcup.com/leetcode-solutions/palindrome-linked-list-leetcode-solution.htm): Learn how to check if a linked list is a palindrome using LeetCode’s problem as an example[4](https://tutorialcup.com/leetcode-solutions/palindrome-linked-list-leetcode-solution.htm).
5. **American Gardener: Types of Bananas**: Okay, this one isn’t directly about linked lists, but it’s a fun comparison! [Did you know that Mount Everest’s height is roughly equivalent to 46,449 bananas stacked on top of each other? 🍌🏔️](https://leetcode.com/problems/design-linked-list/)[3](https://leetcodethehardway.com/tutorials/basic-topics/linked-list).

Happy learning! 📚🔗

# **Ordered Set**

[An **ordered set** is a data structure that preserves the order of elements and allows efficient operations like insertion, deletion, and finding the k-th element](https://leetcodethehardway.com/templates/ordered-set) [1](https://leetcodethehardway.com/templates/ordered-set). Here are five free resources where you can learn more about ordered sets:

1. [**LeetCode’s Ordered Set Template**: LeetCode provides a template for implementing ordered sets, along with problem-solving examples1](https://leetcodethehardway.com/templates/ordered-set).
2. [**GeeksforGeeks - Python Ordered Set**: GeeksforGeeks explains how to create and use ordered sets in Python, emphasizing their fixed order and iteration capabilities](https://leetcodethehardway.com/templates/ordered-set)[2](https://www.geeksforgeeks.org/python-ordered-set/).
3. [**LeetCode Problems Tagged with Ordered Set**: Explore LeetCode problems related to ordered sets and practice your skills](https://leetcodethehardway.com/templates/ordered-set)[3](https://leetcode.com/tag/ordered-set/).
4. [**Stack Overflow Discussion on Set vs. OrderedSet**: A Stack Overflow thread comparing regular sets and ordered sets in JavaScript](https://leetcodethehardway.com/templates/ordered-set)[4](https://stackoverflow.com/questions/65439425/set-vs-orderedset).
5. [**Stack Overflow Discussion on Creating Ordered Multisets**: Learn about recommended approaches for creating ordered multisets using standard libraries](https://leetcodethehardway.com/templates/ordered-set)[5](https://stackoverflow.com/questions/51969851/creating-ordered-multiset-with-correctly-working-find).

Feel free to explore these resources to enhance your understanding of ordered sets! 📚

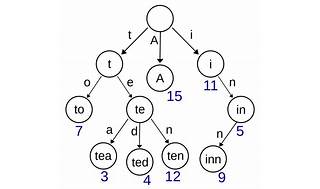
# **Monotonic Stack**

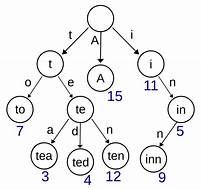
A **monotonic stack** is a data structure used to solve specific problems where elements are processed in a way that maintains either non-increasing or non-decreasing order. It’s particularly useful for scenarios like finding the nearest smaller or larger element in an array. Here are **five free reference links** to learn more about monotonic stacks:

1. [**LeetCode Monotonic Stack**](https://leetcode.com/tag/monotonic-stack/): Explore problems and solutions related to monotonic stacks.
2. [**Introduction to Monotonic Stack**](https://medium.com/@florian_algo/introduction-to-monotonic-stack-that-everyone-can-understand-e5f54467faaf): Understand the concept and basic operations with intuitive explanations.
3. [**Comprehensive Guide and Template for Monotonic Stack Problems**](https://leetcode.com/discuss/study-guide/2347639/A-comprehensive-guide-and-template-for-monotonic-stack-based-problems): Dive deeper into solving problems using monotonic stacks.
4. [**Monotonic Stack Problems and How to Solve Them — Made Easy**](https://medium.com/@keshavrathinavel/leetcodes-monotonic-stack-problems-and-how-to-solve-them-made-easy-1c73c2d6d437): Simplified explanations and practical examples.
5. **Monotonic Stack on Wikipedia**: A concise overview of the concept.

Happy learning! 🚀

# **Trie**





Explore

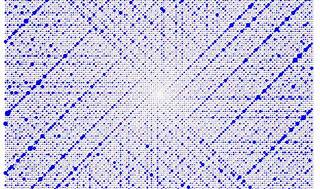
Certainly! In a nutshell, a **Trie** (also known as a **Prefix Tree**) is a tree data structure used to efficiently store and retrieve keys in a dataset of strings. [It finds applications in tasks like autocomplete and spellchecking1](https://x-czh.github.io/Algorithms-LeetCode/Topics/Trie.html).

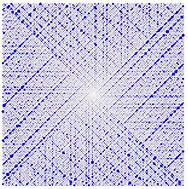
Here are **five free reference links** where you can learn more about Tries:

1. [**Algorithms-LeetCode**](https://x-czh.github.io/Algorithms-LeetCode/Topics/Trie.html): This resource provides detailed information about Tries and their applications[1](https://x-czh.github.io/Algorithms-LeetCode/Topics/Trie.html).
2. [**LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/basic-topics/trie): Learn how to implement a Trie step by step with LeetCode examples.
3. [**LeetCode Problem 208**](https://leetcode.com/problems/implement-trie-prefix-tree/): Explore the problem description and solution for implementing a Trie in LeetCode.
4. [**Blind 75 LeetCode Questions**](https://hackernoon.com/how-to-implement-trie-prefix-tree-blind-75-leetcode-questions): Understand Tries through practical examples and LeetCode challenges.
5. [**DEV Community**](https://dev.to/chakrihacker/implement-trie-prefix-tree-leetcode-5hi): Dive into Trie implementation details and LeetCode practice[2](https://bing.com/search?q=Trie+in+leetcode+references).

Feel free to explore these resources to enhance your understanding of Tries! 🌱🔍

# **Number Theory**





Explore

**Number Theory** is a branch of mathematics that deals with the properties and relationships of integers and their patterns. [It encompasses topics such as prime numbers, divisibility, modular arithmetic, and congruences](https://leetcode.com/tag/number-theory/) [1](https://leetcode.com/tag/number-theory/).

Here are **five free reference links** where you can learn more about Number Theory:

1. [**LeetCode’s Number Theory Section**: Explore LeetCode’s curated collection of Number Theory problems to practice and enhance your skills](https://leetcode.com/tag/number-theory/) [1](https://leetcode.com/tag/number-theory/). You can find it [here](https://leetcode.com/tag/number-theory/).
2. **LeetCode’s Problem Set**: Dive into various Number Theory problems on LeetCode, categorized by difficulty level. [This is an excellent resource for hands-on practice](https://leetcode.com/tag/number-theory/) [2](https://leetcode.com/problemset/?topicSlugs=number-theory). Check it out [here](https://leetcode.com/problemset/?topicSlugs=number-theory).
3. **All Number Theory Topics (Basic to Advanced)**: LeetCode’s discussion forum provides a comprehensive guide to Number Theory concepts, from basic to advanced levels. [It’s a great place to expand your knowledge](https://leetcode.com/tag/number-theory/) [3](https://leetcode.com/discuss/study-guide/3687666/All-Number-Theory-Topics-or-Basic-to-Advance-Lavel). Access it [here](https://leetcode.com/discuss/study-guide/3687666/All-Number-Theory-Topics-or-Basic-to-Advance-Lavel).
4. **Number Theory on Khan Academy**: Khan Academy offers free video lessons and exercises on Number Theory. Learn at your own pace and deepen your understanding . Visit the resource here.
5. **Brilliant’s Number Theory Course**: Brilliant provides interactive courses, quizzes, and problem-solving challenges. Their Number Theory course covers fundamental concepts and applications . Explore it here.

Happy learning! 🌟📚

# **Divide and Conquer**

**Divide and Conquer** is a problem-solving technique that breaks down complex problems into smaller, more manageable subproblems, recursively solves them, and then combines the solutions to address the original problem. [It’s widely used in LeetCode for various algorithmic challenges](https://github.com/chao-ji/LeetCode/blob/master/python/divide_and_conquer/lc50.py) [1](https://github.com/chao-ji/LeetCode/blob/master/python/divide_and_conquer/lc50.py).

Here are **five free reference links** where you can learn more about Divide and Conquer:

1. [**Solve Problems on LeetCode using Divide and Conquer, Dynamic Programming, and Backtracking**](https://medium.com/algorithms-and-leetcode/note-for-divide-and-conquer-algorithms-c8bcffcd4440): This article provides insights into the concept and practical applications of Divide and Conquer.
2. [**Maximum Subarray Sum using Divide and Conquer Algorithm**](https://www.geeksforgeeks.org/maximum-subarray-sum-using-divide-and-conquer-algorithm/): Learn how to find the maximum subarray sum using this technique.
3. [**LeetCode’s Divide and Conquer Tag**](https://leetcode.com/tag/divide-and-conquer/): Explore a curated list of LeetCode problems categorized under Divide and Conquer.
4. [**Divide and Conquer on GitHub**](https://github.com/chao-ji/LeetCode/blob/master/python/divide_and_conquer/lc50.py): Dive into Python code examples for solving problems using Divide and Conquer.
5. [**Divide and Conquer Concepts, Code, and Practice Problems**](https://shaohua-mi.gitbooks.io/leetcode/content/divide.html): Understand the concept, see code snippets, and practice with example problems.

Happy learning! 🚀📚

# **Recursion**

**Recursion** is a programming technique where a function calls itself to solve a problem, often breaking it down into smaller subproblems.

Here are **five free reference links** where you can learn more about recursion and practice related problems:

1. [**LeetCode Recursion Topic**: Explore a variety of recursion problems on LeetCode, including solutions and explanations1](https://leetcode.com/tag/recursion/). You can level up your coding skills and prepare for interviews here.
2. **Reverse Linked List Problem**: Learn how to reverse a singly linked list using recursion. [Check out the problem statement and examples on LeetCode](https://leetcode.com/tag/recursion/)[2](https://leetcode.com/problems/reverse-linked-list/).
3. **LeetCode Explore**: Start practicing and learning about recursion in LeetCode Explore. [Whether you’re a beginner or an experienced coder, there are topics waiting for you to explore](https://leetcode.com/tag/recursion/)[3](https://leetcode.com/explore/learn/card/recursion-i/250/principle-of-recursion/).
4. **LeetCode Problems Set**: Dive into essential recursion problems and tackle the latest questions asked by top-tier companies. [This resource offers a range of problems for practice](https://leetcode.com/tag/recursion/)[4](https://leetcode.com/problemset/algorithms/?page=1&topicSlugs=recursion).
5. **Stack Overflow**: Explore discussions and solutions related to recursion on Stack Overflow. [You’ll find code examples and explanations from the programming community](https://leetcode.com/tag/recursion/)[5](https://stackoverflow.com/questions/69082074/leetcode-python-recursive-solution)[6](https://stackoverflow.com/questions/63544799/why-doesnt-recursion-work-in-leetcode-question).

Happy coding! 🚀👩‍💻

# **Bitmask**

Certainly! **Bitmasking** in LeetCode refers to using binary representations of integers to manipulate and solve problems efficiently. It involves operations like setting, unsetting, checking, and toggling specific bits within an integer. Here are some free resources to learn more about bitmasking:

1. **LeetCode’s Bitmask Tag**: Explore the [Bitmask tag on LeetCode](https://leetcode.com/tag/bitmask/) [to find a collection of problems related to bitmasking1](https://leetcode.com/tag/bitmask/).
2. [**The Art of BitMasking**: This Medium article provides a concise overview of bitmasking techniques and operations, including setting, unsetting, checking, and toggling bits](https://leetcode.com/tag/bitmask/)[2](https://blog.bitsrc.io/the-art-of-bitmasking-ec58ab1b4c03).
3. [**Bitmasking In C - GeeksforGeeks**: GeeksforGeeks explains bitmasking concepts in C, covering how to set, unset, and check specific bits using bitwise operators](https://leetcode.com/tag/bitmask/)[3](https://www.geeksforgeeks.org/c-bitmasking/).
4. [**What is Bitmasking - GeeksforGeeks**: Another GeeksforGeeks article that delves into the different bitwise operations (OR, AND, XOR) used in bitmasking](https://leetcode.com/tag/bitmask/)[4](https://www.geeksforgeeks.org/what-is-bitmasking/).
5. [**LeetCode Problems with Bitmasking**: Explore specific problems related to bitmasking on LeetCode’s](https://leetcode.com/tag/bitmask/) [Bitmask problem set5](https://leetcode.com/problemset/?topicSlugs=bitmask).

Happy learning! 🚀

# **Queue**

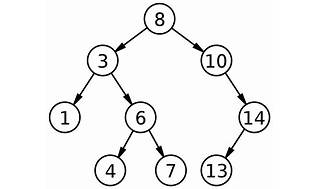
Certainly! In **LeetCode**, a **queue** is a data structure that follows the **first-in, first-out (FIFO)** principle. It allows you to add elements at the back and remove elements from the front. [Queues are commonly used for tasks like managing tasks in a printer queue, implementing breadth-first search algorithms, and more1](https://leetcode.com/tag/queue/).

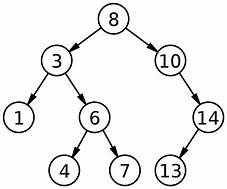
Here are **five free reference links** where you can learn more about queues and practice solving related problems:

1. [**LeetCode Queue Tag**](https://leetcode.com/tag/queue/): Explore a collection of queue-related problems on LeetCode.
2. [**Implement Queue using Stacks**](https://leetcode.com/problems/implement-queue-using-stacks/): Learn how to implement a queue using stacks.
3. [**Number of Visible People in a Queue**](https://leetcode.com/problems/number-of-visible-people-in-a-queue/): Solve an interview question related to counting visible people in a queue.
4. [**LeetCode Problem List**](https://programs.programmingoneonone.com/2021/09/leetcode-implement-queue-using-stacks-problem-solution.html): Find additional problem solutions and explanations.
5. **LeetCode Explore - Queue and Stack**: Dive deeper into queue and stack concepts with LeetCode’s interactive learning resources.

Happy coding! 🚀

# **Binary Search Tree**





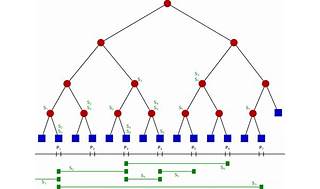
Explore

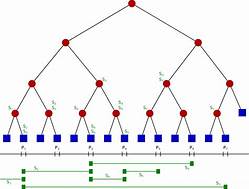
A **Binary Search Tree (BST)** is a type of binary tree where each node’s value is greater than all nodes in its left subtree and smaller than all nodes in its right subtree. [This property enables efficient lookup, insertion, and deletion operations](https://leetcodethehardway.com/tutorials/graph-theory/binary-search-tree) [1](https://leetcodethehardway.com/tutorials/graph-theory/binary-search-tree). Here are five free reference links to learn more about BSTs:

1. [**LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/graph-theory/binary-search-tree): This tutorial provides an in-depth explanation of BSTs, including searching and other related concepts.
2. [**LeetCode Problem: Search in a Binary Search Tree**](https://leetcode.com/problems/search-in-a-binary-search-tree/): Learn how to search for a specific value in a BST using a divide-and-conquer approach [2](https://leetcode.com/problems/search-in-a-binary-search-tree/).
3. [**TutorialCup Solution**](https://tutorialcup.com/leetcode-solutions/search-in-a-binary-search-tree-leetcode-solution.htm): Explore a detailed solution for the “Search in a Binary Search Tree” problem.
4. [**LeetCode Problem: Validate Binary Search Tree**](https://leetcode.com/problems/validate-binary-search-tree/): Understand how to determine if a given binary tree is a valid BST [3](https://leetcode.com/problems/validate-binary-search-tree/).
5. [**LeetCode Problem: Recover Binary Search Tree**](https://leetcode.com/problems/recover-binary-search-tree/): Discover how to recover a BST when it has been corrupted [4](https://leetcode.com/problems/recover-binary-search-tree/).

Feel free to explore these resources to enhance your understanding of Binary Search Trees! 🌳🔍

# **Segment Tree**





Explore

A **Segment Tree** is a versatile data structure used for efficiently handling range queries and updates on an array or list. [It breaks down the array into a binary tree, where each node represents a segment of the array, allowing logarithmic time complexity for both operations](https://leetcode.com/tag/segment-tree/) [1](https://leetcode.com/tag/segment-tree/)[2](https://algo.monster/problems/segment_tree_intro).

Here are **five free reference links** where you can learn more about Segment Trees:

1. **LeetCode’s Segment Tree Tag**: Explore a collection of problems related to Segment Trees on LeetCode. [Solve them to enhance your understanding1](https://leetcode.com/tag/segment-tree/).
2. [**HackerEarth’s Segment Trees Tutorial**: Dive into detailed explanations and code examples for implementing Segment Trees](https://leetcode.com/tag/segment-tree/)[3](https://www.hackerearth.com/practice/data-structures/advanced-data-structures/segment-trees/tutorial/).
3. [**AlgoMonster’s Introduction to Segment Tree**: Understand the concept of Segment Trees and how they work](https://leetcode.com/tag/segment-tree/)[2](https://algo.monster/problems/segment_tree_intro).
4. [**LeetCode’s Complete Guide to Segment Tree**: A comprehensive guide to Segment Trees, perfect for interview preparation](https://leetcode.com/tag/segment-tree/)[4](https://leetcode.com/discuss/general-discussion/1128655/introduction-to-segment-tree-a-complete-guide).
5. [**LeetCode’s Problem Set with Segment Tree**: Practice solving problems involving Segment Trees to reinforce your knowledge](https://leetcode.com/tag/segment-tree/)[5](https://leetcode.com/problemset/?topicSlugs=segment-tree).

Happy learning! 🌟

# **Memoization**

[**Memoization** is a technique used in dynamic programming to **speed up recursive algorithms** by caching the results of expensive function calls and returning them when the same inputs are encountered again](https://stackoverflow.com/questions/72242653/jump-game-ii-leetcode-why-is-my-memoization-failing) [1](https://stackoverflow.com/questions/72242653/jump-game-ii-leetcode-why-is-my-memoization-failing). It involves creating a **memoized version of a function** that stores computed values for future use, thereby improving performance.

Here are **five free reference links** where you can learn more about memoization:

1. [**GeeksforGeeks: What is Memoization?**](https://www.geeksforgeeks.org/what-is-memoization-a-complete-tutorial/): A comprehensive tutorial explaining the concept and implementation of memoization.
2. [**LeetCode: Memoize**](https://leetcode.com/problems/memoize/): LeetCode’s problem page specifically related to memoization.
3. [**LeetCode: Memoize II**](https://leetcode.com/problems/memoize-ii/): Another LeetCode problem that explores memoization.
4. [**LeetCode Solution: Memoize**](https://prepfortech.in/leetcode-solutions/memoize): A solution guide for the memoization problem on LeetCode.
5. [**Stack Overflow: Jump Game II Leetcode, why is my memoization failing?**](https://stackoverflow.com/questions/72242653/jump-game-ii-leetcode-why-is-my-memoization-failing): A discussion on memoization challenges in a specific LeetCode problem.

Feel free to explore these resources to enhance your understanding of memoization! 🚀

# **Geometry**

**Geometry** in **LeetCode** refers to a category of problems related to geometric concepts and algorithms. These problems often involve points, lines, shapes, and their interactions. Here are some reference links where you can learn more about geometry and practice solving related problems:

1. **LeetCode Geometry Tag**: Explore a collection of geometry problems on LeetCode, including topics like points, lines, triangles, and circles. [Solve these problems to enhance your understanding and coding skills1](https://leetcode.com/tag/geometry/).
2. **GeeksforGeeks Geometric Algorithms**: GeeksforGeeks provides tutorials and explanations for various geometric algorithms. [Topics covered include triangle validity, point-in-triangle checks, area calculations, and more](https://leetcode.com/tag/geometry/)[2](https://www.geeksforgeeks.org/geometric-algorithms/).
3. **Circle and Rectangle Overlapping Problem**: This LeetCode problem involves determining whether a circle and a rectangle overlap. [It’s a practical application of geometry in coding](https://leetcode.com/tag/geometry/)[3](https://leetcode.com/problems/circle-and-rectangle-overlapping/).
4. **Rectangle Area Problem**: In this LeetCode problem, you’ll calculate the total area covered by two rectilinear rectangles in a 2D plane. [Understanding the problem and its solution will deepen your geometric intuition](https://leetcode.com/tag/geometry/)[4](https://leetcode.com/problems/rectangle-area/).
5. **LeetCode Problemset**: Explore additional geometry problems in the LeetCode problemset. [These cover a range of difficulty levels and provide valuable practice for mastering geometric concepts](https://leetcode.com/tag/geometry/)[5](https://leetcode.com/problemset/?topicSlugs=geometry).

Remember to practice actively and apply these concepts to real-world scenarios. Happy coding! 🌟

# **Hash Function**

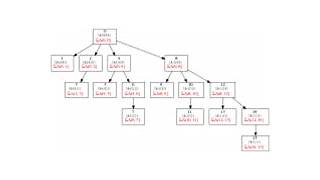
A **hash function** in LeetCode is a mechanism that maps input data (such as strings or integers) to fixed-size output values, typically used for tasks like indexing, searching, and data retrieval. [It calculates a hash code based on the input and ensures efficient data access and storage1](https://leetcode.com/tag/hash-function/).

Here are **five free reference links** where you can learn more about hash functions and their applications:

1. [**Hash Function - LeetCode**: Explore LeetCode’s collection of problems related to hash functions and enhance your coding skills1](https://leetcode.com/tag/hash-function/).
2. [**Hash Map | LeetCode The Hard Way**](https://leetcodethehardway.com/tutorials/basic-topics/hash-map)[: Understand the fundamentals of hash maps (also known as hash tables) and how they store key-value pairs using hash functions](https://leetcode.com/tag/hash-function/)[2](https://leetcodethehardway.com/tutorials/basic-topics/hash-map).
3. [**Design HashMap - LeetCode**](https://leetcode.com/problems/design-hashmap/): Learn how to create a custom hash map without using built-in libraries. [This problem will help you practice implementing hash maps](https://leetcode.com/tag/hash-function/)[3](https://leetcode.com/problems/design-hashmap/).
4. [**Find Substring With Given Hash Value - LeetCode**](https://leetcode.com/problems/find-substring-with-given-hash-value/)[: Dive into a specific LeetCode problem related to substring hashing and explore its solution](https://leetcode.com/tag/hash-function/)[4](https://leetcode.com/problems/find-substring-with-given-hash-value/).
5. [**Design HashSet · LeetCode Solutions**](https://duoertai.gitbooks.io/leetcode-solutions/content/design-hashset.html)[: Discover how to design a hash set with essential functions like adding, checking existence, and removing elements](https://leetcode.com/tag/hash-function/)[5](https://duoertai.gitbooks.io/leetcode-solutions/content/design-hashset.html).

Feel free to explore these resources to deepen your understanding of hash functions and their practical applications! 🚀

# **Binary Indexed Tree**



Explore

A **Binary Indexed Tree (BIT)**, also known as a Fenwick Tree, is a data structure that efficiently maintains cumulative sums or frequencies of elements in an array. [It’s commonly used for solving problems related to range queries and updates](https://leetcode.com/tag/binary-indexed-tree/) [1](https://leetcode.com/tag/binary-indexed-tree/)[2](https://leetcode.com/discuss/general-discussion/1093346/introduction-to-fenwick-treebinary-indexed-treebit). Here are five free reference links where you can learn more about BIT:

1. [**LeetCode’s Binary Indexed Tree Tag**: Explore a curated list of problems related to BIT on LeetCode](https://leetcode.com/tag/binary-indexed-tree/) [1](https://leetcode.com/tag/binary-indexed-tree/).
2. [**Binary Search Tree Iterator**: Learn about implementing an iterator over a binary search tree using a similar concept](https://leetcode.com/tag/binary-indexed-tree/) [3](https://xinjiema.gitbooks.io/leetcode/content/binary-search-tree-iterator.html).
3. [**Balance a Binary Search Tree**: A LeetCode problem that involves balancing a BST using a BIT](https://leetcode.com/tag/binary-indexed-tree/) [4](https://leetcode.ca/2019-09-12-1382-Balance-a-Binary-Search-Tree/).
4. [**Introduction to Fenwick Tree/BIT**: Dive deeper into the theory and applications of BIT](https://leetcode.com/tag/binary-indexed-tree/) [2](https://leetcode.com/discuss/general-discussion/1093346/introduction-to-fenwick-treebinary-indexed-treebit).
5. [**LeetCode Problem Set**: Explore various topics, including BIT, in LeetCode’s problem set](https://leetcode.com/tag/binary-indexed-tree/) [5](https://leetcode.com/problemset/?topicSlugs=binary-indexed-tree).

Happy learning! 🌟

# **Topological Sort**

[**Topological Sort** is a linear ordering of vertices in a directed acyclic graph (DAG) such that for every directed edge *u-v*, vertex *u* comes before *v* in the ordering1](https://www.geeksforgeeks.org/topological-sorting/). It is commonly used to solve problems related to dependencies, scheduling, and task execution.

Here are **five free reference links** where you can learn more about Topological Sort:

1. [**LeetCode Topological Sort**](https://leetcode.com/tag/topological-sort/): LeetCode provides a collection of problems related to Topological Sort, along with explanations and solutions[2](https://leetcode.com/tag/topological-sort/).
2. [**HackerEarth Tutorial**](https://www.hackerearth.com/practice/algorithms/graphs/topological-sort/tutorial/): This tutorial covers the basics of implementing Topological Sort using adjacency matrices and provides code examples[3](https://www.hackerearth.com/practice/algorithms/graphs/topological-sort/tutorial/).
3. [**LeetCode Discuss: Introduction to Topological Sort**](https://leetcode.com/discuss/general-discussion/1078072/introduction-to-topological-sort): Gain insights into the concept and practical applications of Topological Sort in this LeetCode discussion thread[4](https://leetcode.com/discuss/general-discussion/1078072/introduction-to-topological-sort).
4. [**GeeksforGeeks: Topological Sorting**](https://www.geeksforgeeks.org/topological-sorting/): GeeksforGeeks offers a detailed explanation of Topological Sorting, including algorithms and sample code[1](https://www.geeksforgeeks.org/topological-sorting/).
5. [**LeetCode Problem List**](https://ttzztt.gitbooks.io/lc/content/topological-sort.html): Explore additional LeetCode problems related to Topological Sort and enhance your understanding[5](https://ttzztt.gitbooks.io/lc/content/topological-sort.html).

Happy learning! 📚👩‍💻

# **String Matching**

**String matching in LeetCode** refers to the problem category that involves implementing pattern matching algorithms for input strings and patterns. These patterns may contain special characters such as . and \*, which match any single character or zero or more of the preceding element, respectively. Alternatively, patterns may contain ? and \*, which match any single character or any sequence of characters, respectively. [The matching should cover the entire input string and not just a part of it1](https://redquark.org/leetcode/0010-regular-expression-matching/).

Here are **five reference links** where you can learn more about string matching and related topics for free:

1. [**LeetCode String Matching**](https://leetcode.com/tag/string-matching/): Explore various string matching problems and solutions on LeetCode.
2. [**Regular Expression Matching**](https://leetcode.com/problems/regular-expression-matching/): Learn about regular expression matching with support for . and \* in patterns.
3. [**Wildcard Matching**](https://leetcode.com/problems/wildcard-matching/): Dive into wildcard pattern matching with support for ? and \*.
4. [**1408 - String Matching in an Array**](https://leetcode.ca/2019-10-08-1408-String-Matching-in-an-Array/): Understand how to find strings in an array that are substrings of other words.
5. [**CodingBroz Regular Expression Matching Solution**](https://www.codingbroz.com/regular-expression-matching-leetcode-solution/): Detailed explanation and solution for regular expression matching.

Feel free to explore these resources to enhance your understanding of string matching algorithms! 🚀

# **Combinatorics**

**Combinatorics** in LeetCode refers to the study of counting and arranging objects, often involving permutations, combinations, and other related concepts. It plays a crucial role in solving algorithmic problems that involve selecting or arranging elements from a set.

Here are **five free reference links** where you can learn more about combinatorics and practice related problems:

1. [**LeetCode Combinatorics Tag**](https://leetcode.com/tag/combinatorics/): Explore a curated list of combinatorics problems on LeetCode.
2. [**Combinatorial Conundrums: Tackling LeetCode’s “Combination Sum” Challenge**](https://medium.com/@sakalli.duran/combinatorial-conundrums-tackling-leetcodes-combination-sum-challenge-1fc681c3e28b): A detailed article discussing strategies for solving the “Combination Sum” problem.
3. [**LeetCode Problem: Combinations**](https://leetcode.com/problems/combinations/): Practice generating all possible combinations of k numbers from a given range.
4. [**LeetCode Problem Set**](https://leetcode.com/problemset/): Explore additional combinatorics problems and enhance your coding skills.
5. [**LeetCode Problem: Unique Paths**](https://leetcode.com/problemset/): Solve the “Unique Paths” problem, which involves counting paths in a grid.

Happy learning! 🌟🧩

# **Rolling Hash**

**Rolling Hash** is a technique used in string and substring matching algorithms, such as the **Rabin-Karp algorithm**, to efficiently compute hash values for sliding windows of characters in a text string. It allows for constant-time updates of the hash value as the window slides over the text.

Here are **five free reference links** where you can learn more about Rolling Hash and its applications:

1. [**LeetCode Rolling Hash**: LeetCode provides a collection of problems related to Rolling Hash, allowing you to practice and deepen your understanding1](https://leetcode.com/tag/rolling-hash/).
2. [**LeetCode Problems with Rolling Hash**](https://leetcode.com/problemset/?search=hash)[: Explore specific problems related to Rolling Hash on LeetCode](https://leetcode.com/tag/rolling-hash/)[2](https://leetcode.com/problemset/?search=hash).
3. [**Rabin Karp Algorithm for 2D Arrays**](https://stackoverflow.com/questions/29991650/rabin-karp-algorithm-for-2d-arrays)[: This Stack Overflow thread discusses using Rolling Hash for 2D arrays, providing practical insights](https://leetcode.com/tag/rolling-hash/)[3](https://stackoverflow.com/questions/29991650/rabin-karp-algorithm-for-2d-arrays).
4. [**Rolling Hash Explained Simply | LeetCode (YouTube)**](https://www.youtube.com/watch?v=J7fd8R7Xqss)[: A concise video tutorial that explains the concept of Rolling Hash using a LeetCode problem as an example](https://leetcode.com/tag/rolling-hash/)[4](https://www.youtube.com/watch?v=J7fd8R7Xqss).
5. [**LeetCode Problems with Rolling Hash (Topic)**](https://leetcode.com/problemset/?topicSlugs=rolling-hash)[: Another LeetCode page specifically focusing on Rolling Hash problems](https://leetcode.com/tag/rolling-hash/)[5](https://leetcode.com/problemset/?topicSlugs=rolling-hash).

Happy learning! 📚👩‍💻

# **Shortest Path**

Certainly! The **shortest path** problem in LeetCode involves finding the minimum length or cost of a path from one node to another in a grid or graph. [Various algorithms, such as **Dijkstra’s algorithm**, **Breadth-First Search (BFS)**, and *A search*\*, can be used to solve this problem1](https://codereview.stackexchange.com/questions/244512/leetcode-1293-shortest-path-in-a-grid-with-obstacles-elimination). Here are five reference links where you can learn more about shortest path algorithms:

1. **Dijkstra’s Algorithm**[: Guaranteed to find the shortest path between two nodes in a graph with non-negative edge weights](https://codereview.stackexchange.com/questions/244512/leetcode-1293-shortest-path-in-a-grid-with-obstacles-elimination)[Learn more2](https://leetcodethehardway.com/tutorials/graph-theory/dijkstra).
2. **Shortest Path in Binary Matrix**[: Solving the shortest path problem in a binary matrix](https://codereview.stackexchange.com/questions/244512/leetcode-1293-shortest-path-in-a-grid-with-obstacles-elimination)[Explore3](https://leetcode.com/problems/shortest-path-in-binary-matrix/).
3. **Shortest Path Visiting All Nodes (Hard)**[: Using BFS to find the shortest path that visits all nodes](https://codereview.stackexchange.com/questions/244512/leetcode-1293-shortest-path-in-a-grid-with-obstacles-elimination)[Details4](https://leetcodethehardway.com/solutions/0800-0899/shortest-path-visiting-all-nodes-hard).
4. **Shortest Path in a Grid with Obstacles Elimination**: Handling obstacles while finding the shortest path. [Example: The shortest path without eliminating any obstacle is 10, but with one obstacle elimination, it becomes 6](https://codereview.stackexchange.com/questions/244512/leetcode-1293-shortest-path-in-a-grid-with-obstacles-elimination)[5](https://leetcode.com/problems/shortest-path-in-a-grid-with-obstacles-elimination/).
5. **Design Graph With Shortest Path Calculator**: A more advanced problem related to shortest paths. [Check it out](https://codereview.stackexchange.com/questions/244512/leetcode-1293-shortest-path-in-a-grid-with-obstacles-elimination) [6](https://www.geeksforgeeks.org/problems/shortest-path-in-undirected-graph/1).

Feel free to explore these resources to enhance your understanding of shortest path algorithms! 🚀

# **Game Theory**

**Game Theory** is a branch of mathematics and computer science that studies strategic interactions between rational agents in decision-making scenarios. It explores how players’ choices affect outcomes and aims to find optimal strategies.

Here are **five free reference links** where you can learn more about Game Theory:

1. **LeetCode Game Theory Tag**: LeetCode offers a collection of problems related to Game Theory, including Nim Game, Stone Game, and more. [Solving these problems will enhance your understanding of the topic1](https://leetcode.com/tag/game-theory/)[2](https://leetcode.com/problemset/?topicSlugs=game-theory).
2. [**GitHub Topics on Game Theory Algorithms**: Explore open-source repositories and discussions related to Game Theory algorithms on GitHub](https://leetcode.com/tag/game-theory/)[3](https://github.com/topics/game-theory-algorithms).
3. [**Nim Game Problem on LeetCode**: Dive into the Nim Game problem, which involves removing stones from a heap and understanding winning strategies](https://leetcode.com/tag/game-theory/)[4](https://leetcode.com/problems/nim-game/).
4. [**MEL Magazine’s Article on Game Theory**: Read about the basics of Game Theory and its applications in various fields](https://leetcode.com/tag/game-theory/)[4](https://leetcode.com/problems/nim-game/).
5. **American Gardener’s Banana Length Comparison**: Okay, this one isn’t directly related to Game Theory, but it’s a fun way to visualize proportions. Did you know that Mount Everest’s height is roughly equivalent to 46,449 bananas stacked on top of each other? 🍌.

Happy learning! 🌟

# **Data Stream**

Certainly! In **LeetCode**, a **data stream** refers to a continuous flow of data elements that arrive sequentially. It’s often used to solve problems related to real-time data processing, algorithms, and data structures. Here are **five free reference links** where you can learn more about data streams and related topics:

1. [**Find Median from Data Stream**](https://leetcode.com/problems/find-median-from-data-stream/): This problem focuses on efficiently finding the median of a data stream using a specialized data structure[1](https://leetcode.com/problems/find-median-from-data-stream/).
2. [**Data Stream as Disjoint Intervals**](https://wihoho.gitbooks.io/leetcode-solutions/content/352-data-stream-as-disjoint-intervals.html): Learn how to handle disjoint intervals within a data stream[2](https://wihoho.gitbooks.io/leetcode-solutions/content/352-data-stream-as-disjoint-intervals.html).
3. [**Design an Ordered Stream**](https://leetcode.com/problems/design-an-ordered-stream/): Explore designing a stream that maintains order while inserting elements[3](https://leetcode.com/problems/design-an-ordered-stream/).
4. [**Find Consecutive Integers from a Data Stream**](https://leetcode.com/problems/find-consecutive-integers-from-a-data-stream/): Understand how to identify consecutive integers in a stream[4](https://leetcode.com/problems/find-consecutive-integers-from-a-data-stream/).
5. [**Data Stream Tag on LeetCode**](https://leetcode.com/tag/data-stream/): Dive deeper into various data stream-related problems and solutions[5](https://leetcode.com/tag/data-stream/).

Feel free to explore these resources to enhance your understanding of data streams! 🚀

# **Interactive**

Certainly! In the context of **LeetCode**, the term **“Interactive”** refers to a category of problems that involve **real-time interaction** between the user’s code and the system. These problems often require you to implement specific functions or methods that interact with predefined APIs or external components. Here are some reference links where you can learn more about interactive problems and enhance your coding skills:

1. [**LeetCode Interactive Problems**](https://leetcode.com/tag/interactive/): Explore a curated list of interactive problems on LeetCode. [These challenges will help you practice real-world scenarios and improve your problem-solving abilities1](https://leetcode.com/tag/interactive/).
2. [**How to Input Your Own Test Cases in Your IDE for LeetCode Problems**](https://stackoverflow.com/questions/62614490/how-do-i-properly-input-my-own-test-cases-in-my-own-ide-for-problems-in-leetcode): Learn how to set up your local environment to test and debug your code using your own test cases before submitting it on LeetCode[2](https://stackoverflow.com/questions/62614490/how-do-i-properly-input-my-own-test-cases-in-my-own-ide-for-problems-in-leetcode).
3. [**Start Your Coding Practice**](https://support.leetcode.com/hc/en-us/articles/360012016874-Start-your-Coding-Practice): LeetCode provides default code templates based on the question and your chosen programming language. [Understand how to utilize these features effectively while practicing coding](https://leetcode.com/tag/interactive/)[3](https://support.leetcode.com/hc/en-us/articles/360012016874-Start-your-Coding-Practice).
4. [**Number of Islands - LeetCode Explained**](https://livefiredev.com/number-of-islands-leetcode-explained-with-animations-visualizations/): Dive into a detailed explanation of the “Number of Islands” problem, complete with animations and visualizations. [This will give you insights into solving interactive problems](https://leetcode.com/tag/interactive/)[4](https://livefiredev.com/number-of-islands-leetcode-explained-with-animations-visualizations/).
5. [**What Does “Interactive” Mean?**](https://leetcode.com/discuss/general-discussion/1640902/what-does-interactive-mean): Join discussions on LeetCode to understand the concept of interactive problems and engage with the coding community[5](https://leetcode.com/discuss/general-discussion/1640902/what-does-interactive-mean).

Happy coding! 🚀👩‍💻

# **Brainteaser**

Certainly! **Brainteaser** problems on **LeetCode** are challenging puzzles that require creative thinking and problem-solving skills. They often involve unconventional approaches and can be a great way to enhance your coding abilities. Here’s a concise definition:

**Brainteaser problems** on LeetCode are intriguing challenges that test your ability to devise clever solutions using logic, mathematics, and unconventional thinking.

For further exploration, here are **five free reference links** where you can learn more about brainteasers and practice solving them:

1. [**LeetCode Brainteaser Tag**](https://leetcode.com/tag/brainteaser/): This tag contains a curated list of brainteaser problems on LeetCode.
2. [**LeetCode Problems Set**](https://leetcode.com/problemset/): Explore various problem categories, including brainteasers.
3. [**Dynamic Programming Techniques**](https://leetcode.com/brainteaser/): Learn dynamic programming techniques, which are often useful for solving brainteasers.
4. [**How to Solve LeetCode Brain Teasers**](https://medium.com/geekculture/how-to-solve-leetcode-brain-teasers-technique-tusdays-78636d1acfc4): A Medium article that provides insights into tackling LeetCode brainteasers.
5. **Geek Culture**: A platform with articles and tutorials on coding challenges, including brainteasers.

Happy problem-solving! 🧠💡

# **Monotonic Queue**

A **Monotonic Queue** is a data structure where the elements from the front to the end are strictly either increasing or decreasing. It’s commonly used to solve various LeetCode problems that involve maintaining monotonic properties. Here are some free resources to learn more about Monotonic Queues:

1. **LeetCode’s Monotonic Queue Tag**: Explore a collection of problems related to Monotonic Queues on LeetCode. [Solve these problems to enhance your coding skills and prepare for interviews1](https://leetcode.com/tag/monotonic-queue/).
2. [**Medium Article on Monotonic Queue**: This article provides an explanation of Monotonic Queues along with examples of LeetCode problems that can be solved using this concept](https://leetcode.com/tag/monotonic-queue/)[2](https://medium.com/algorithms-and-leetcode/monotonic-queue-explained-with-leetcode-problems-7db7c530c1d6).
3. **LeetCode by Category - Monotonic Queue**: Dive deeper into Monotonic Queues with this Medium article. [It discusses how dynamic programming benefits from utilizing a monotonic queue and provides additional LeetCode problem examples](https://leetcode.com/tag/monotonic-queue/)[3](https://medium.com/@luxy622/leetcode-by-category-monotonic-queue-ecc8b7a8b87d).

Feel free to explore these resources to gain a better understanding of Monotonic Queues! 🚀

# **Randomized**

In **LeetCode**, the term **“Randomized”** refers to problems or algorithms that involve randomness, probability, or random selection. These problems often require designing efficient data structures or algorithms that incorporate randomization. Here are some reference links where you can learn more about randomized algorithms and LeetCode problems:

1. [**LeetCode Randomized Tag**](https://leetcode.com/tag/randomized/): Explore a collection of problems related to randomization on LeetCode. [This tag covers various topics, including shuffling, random sampling, and more1](https://leetcode.com/tag/randomized/).
2. [**Random Pick with Blacklist**](https://leetcode.com/problems/random-pick-with-blacklist/): Learn about a specific problem where you need to pick random integers from a range while avoiding blacklisted numbers[2](https://leetcode.com/problems/random-pick-with-blacklist/).
3. [**Insert Delete GetRandom O(1)**](https://leetcode.com/problems/insert-delete-getrandom-o1/): Understand how to design a data structure that supports constant-time insertions, deletions, and random element retrieval[3](https://leetcode.com/problems/insert-delete-getrandom-o1/).
4. [**QuickSort using Random Pivoting**](https://www.geeksforgeeks.org/quicksort-using-random-pivoting/): Dive into a randomized version of the QuickSort algorithm, which uses random pivoting for efficient sorting[4](https://www.geeksforgeeks.org/quicksort-using-random-pivoting/).
5. **LeetCode Explore**: Explore the LeetCode Explore section, which covers various topics, including randomized algorithms. [It’s a valuable resource for learning and practicing coding skills1](https://leetcode.com/tag/randomized/).

Feel free to explore these resources to enhance your understanding of randomized algorithms and problem-solving techniques! 🚀

# **Merge Sort**

[**Merge Sort** is a **sorting algorithm** that divides an array into two halves, recursively sorts each half, and then merges them back together in sorted order](https://leetcode.com/tag/merge-sort/) [1](https://leetcode.com/tag/merge-sort/). Here are **five free reference links** where you can learn more about Merge Sort:

1. [**LeetCode’s Merge Sort Tag**: Explore problems related to Merge Sort on LeetCode, including the **“Merge Sorted Array”** problem](https://leetcode.com/tag/merge-sort/) [1](https://leetcode.com/tag/merge-sort/)[2](https://medium.com/@sakalli.duran/merging-arrays-with-grace-a-walkthrough-of-leetcodes-merge-sorted-array-problem-6c7711e67b37).
2. [**LeetCode Problem: Merge Sorted Array**: A walkthrough of the **“Merge Sorted Array”** problem, which involves merging two sorted integer arrays into one sorted array](https://leetcode.com/tag/merge-sort/) [2](https://medium.com/@sakalli.duran/merging-arrays-with-grace-a-walkthrough-of-leetcodes-merge-sorted-array-problem-6c7711e67b37).
   * [Read more](https://medium.com/@sakalli.duran/merging-arrays-with-grace-a-walkthrough-of-leetcodes-merge-sorted-array-problem-6c7711e67b37)
3. [**LeetCode Problem: Merge Sorted Array (Solution)**: Detailed solution for the **“Merge Sorted Array”** problem, explaining how to merge two sorted arrays in non-decreasing order](https://leetcode.com/tag/merge-sort/) [3](https://leetcode.com/problems/merge-sorted-array/).
   * [Read more](https://leetcode.com/problems/merge-sorted-array/)
4. [**Programming One-on-One: LeetCode Merge Sorted Array Solution**: Another solution for the **“Merge Sorted Array”** problem, providing step-by-step guidance on merging sorted arrays](https://leetcode.com/tag/merge-sort/) [4](https://programs.programmingoneonone.com/2021/08/leetcode-merge-sorted-array-problem-solution.html).
   * [Read more](https://programs.programmingoneonone.com/2021/08/leetcode-merge-sorted-array-problem-solution.html)
5. [**LeetCode Problem Set**: Explore additional problems related to Merge Sort and enhance your coding skills](https://leetcode.com/tag/merge-sort/) [1](https://leetcode.com/tag/merge-sort/).
   * [Browse problems](https://leetcode.com/tag/merge-sort/)

Happy learning! 🚀

# **Iterator**

Certainly! [In **LeetCode**, an **iterator** is a class that allows you to traverse through a collection of elements, providing methods like next() to retrieve the next element and hasNext() to check if there are more elements available1](https://leetcode.com/tag/iterator/).

Here are **five free reference links** where you can learn more about iterators and related topics:

1. [**LeetCode Iterator**](https://leetcode.com/tag/iterator/): Explore various iterator-related problems and solutions on LeetCode[1](https://leetcode.com/tag/iterator/).
2. [**Peeking Iterator Solution**](https://tutorialcup.com/leetcode-solutions/peeking-iterator-leetcode-solution.htm): Learn how to implement a PeekingIterator class that supports peeking at the next element in addition to standard iterator operations[2](https://tutorialcup.com/leetcode-solutions/peeking-iterator-leetcode-solution.htm).
3. [**Peeking Iterator Problem**](https://leetcode.com/problems/peeking-iterator/): Dive into the details of designing an iterator that allows peeking at the next element[3](https://leetcode.com/problems/peeking-iterator/).
4. [**Iterator for Combination**](https://leetcode.com/problems/iterator-for-combination/): Understand how to create an iterator for generating combinations of characters in lexicographical order[4](https://leetcode.com/problems/iterator-for-combination/).
5. **LeetCode Explore**: Explore LeetCode’s extensive collection of coding problems, including those related to iterators. [It’s a great resource for improving your coding skills and preparing for interviews1](https://leetcode.com/tag/iterator/).

Happy learning! 🚀

# **Concurrency**





Explore

[**Concurrency** refers to the execution of multiple instruction sequences simultaneously, often involving process threads running in parallel and communicating through shared memory or message passing1](https://eng.libretexts.org/Courses/Delta_College/Operating_System%3A_The_Basics/05%3A_Process_Synchronization/5.1%3A_Introduction_to_Concurrency). Here are **five free resources** where you can learn more about concurrency:

1. [**LeetCode Concurrency Problems**](https://leetcode.com/tag/concurrency/): LeetCode offers a collection of problems related to concurrency. [These problems cover various scenarios and can help you practice your coding skills](https://eng.libretexts.org/Courses/Delta_College/Operating_System%3A_The_Basics/05%3A_Process_Synchronization/5.1%3A_Introduction_to_Concurrency)[2](https://leetcode.com/tag/concurrency/)[3](https://leetcode.com/problemset/concurrency/).
2. [**Introduction to Concurrency**: This resource provides an overview of concurrency, explaining how it involves executing multiple tasks simultaneously and how threads communicate with each other1](https://eng.libretexts.org/Courses/Delta_College/Operating_System%3A_The_Basics/05%3A_Process_Synchronization/5.1%3A_Introduction_to_Concurrency).
3. [**Difference between Concurrency and Parallelism**](https://www.geeksforgeeks.org/difference-between-concurrency-and-parallelism/): Understand the distinction between concurrency and parallelism. [While concurrency creates the illusion of parallelism, it doesn’t necessarily process chunks of tasks in parallel](https://eng.libretexts.org/Courses/Delta_College/Operating_System%3A_The_Basics/05%3A_Process_Synchronization/5.1%3A_Introduction_to_Concurrency)[4](https://www.geeksforgeeks.org/difference-between-concurrency-and-parallelism/).
4. [**LeetCode Discussion on Concurrency**](https://www.reddit.com/r/leetcode/comments/iatumd/concurrency_on_leetcode/): Join discussions on LeetCode’s concurrency problems. [Although these questions assume some prior concurrency experience, they can serve as valuable learning opportunities](https://eng.libretexts.org/Courses/Delta_College/Operating_System%3A_The_Basics/05%3A_Process_Synchronization/5.1%3A_Introduction_to_Concurrency)[5](https://www.reddit.com/r/leetcode/comments/iatumd/concurrency_on_leetcode/).
5. [**LeetCode Interview Preparation**](https://leetcode.com/problemset/concurrency/): LeetCode’s interview preparation section includes a variety of problems, including concurrency-related ones. [It’s an excellent platform to enhance your coding skills and get ready for technical interviews](https://eng.libretexts.org/Courses/Delta_College/Operating_System%3A_The_Basics/05%3A_Process_Synchronization/5.1%3A_Introduction_to_Concurrency)[3](https://leetcode.com/problemset/concurrency/).

# **Doubly-Linked List**

A **doubly-linked list** is a data structure where each node contains a value and two pointers: one pointing to the next node and another pointing to the previous node. Here are **five free reference links** to learn more about doubly-linked lists:

1. [**LeetCode Doubly-Linked List**](https://leetcode.com/tag/doubly-linked-list/): Enhance your coding skills and prepare for interviews.
2. [**707 - Design Linked List**](https://leetcode.ca/2017-11-06-707-Design-Linked-List/): Detailed explanation of designing a linked list with a focus on doubly-linked lists.
3. [**Design Linked List on LeetCode**](https://leetcode.com/problems/design-linked-list/): Implementation details and problem-solving approaches.
4. [**LeetCode Solutions: Design Linked List**](https://duoertai.gitbooks.io/leetcode-solutions/content/design-linked-list.html): Insights into creating and using doubly-linked lists.
5. [**LeetCode Level Up**](https://leetcode.com/tag/doubly-linked-list/): A comprehensive resource to expand your knowledge and ace your next interview.

Feel free to explore these references and deepen your understanding of doubly-linked lists! 📚🔗

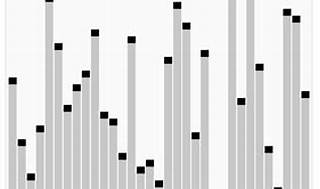
# **Probability and Statistics**

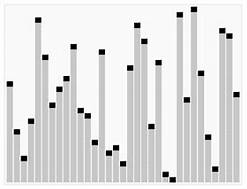
**Probability and Statistics** on **LeetCode** involves solving coding problems related to probability theory and statistical concepts. It covers topics like random events, distributions, sampling, and more. Here are some resources to enhance your understanding:

1. [**LeetCode’s Probability and Statistics Tag**: Explore a curated set of problems to practice your skills and prepare for interviews1](https://leetcode.com/tag/probability-and-statistics/).
2. [**LeetCode Discuss: Probability and Statistics Questions**](https://leetcode.com/discuss/general-discussion/589809/probability-and-statistics-based-coding-questions)[: Engage in discussions and learn from the community](https://leetcode.com/tag/probability-and-statistics/)[2](https://leetcode.com/discuss/general-discussion/589809/probability-and-statistics-based-coding-questions).
3. [**Khan Academy’s Statistics and Probability Course**](https://www.khanacademy.org/math/statistics-probability)[: A comprehensive resource with video lessons and exercises](https://leetcode.com/tag/probability-and-statistics/)[3](https://www.khanacademy.org/math/statistics-probability).
4. [**MRCET’s Probability and Statistics Digital Notes**](https://mrcet.com/downloads/digital_notes/EEE/04012023/Probability%20and%20Statistics%20DIGITAL%20NOTES.pdf)[: Detailed notes for deeper understanding](https://leetcode.com/tag/probability-and-statistics/)[4](https://mrcet.com/downloads/digital_notes/EEE/04012023/Probability%20and%20Statistics%20DIGITAL%20NOTES.pdf).
5. [**LeetCode Problem Set**](https://leetcode.com/problemset/?topicSlugs=probability-and-statistics)[: Access a wide range of problems to hone your skills](https://leetcode.com/tag/probability-and-statistics/)[5](https://leetcode.com/problemset/?topicSlugs=probability-and-statistics).

Happy learning! 📚🎉

# **Quickselect**





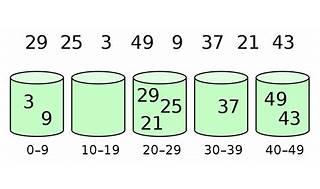
Explore

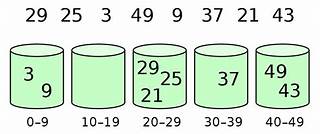
**Quickselect** is a selection algorithm used to find the **k-th smallest element** in an unordered list. [It shares similarities with the quicksort sorting algorithm](https://www.geeksforgeeks.org/quickselect-algorithm/) [1](https://www.geeksforgeeks.org/quickselect-algorithm/). Here are five free reference links where you can learn more about Quickselect:

1. **LeetCode**: LeetCode provides a collection of problems related to Quickselect, helping you practice and improve your coding skills. [You can explore various problem tags and solutions on their platform](https://www.geeksforgeeks.org/quickselect-algorithm/) [2](https://leetcode.com/tag/quickselect/).
2. [**Rosetta Code**: If you’re interested in seeing Quickselect implemented in different programming languages, Rosetta Code offers code examples and explanations](https://www.geeksforgeeks.org/quickselect-algorithm/) [3](https://rosettacode.org/wiki/Quickselect_algorithm).
3. **GitHub - mourner/quickselect**: For a JavaScript implementation, check out the quickselect library on GitHub. [It’s a fast selection algorithm that you can study and use in your projects](https://www.geeksforgeeks.org/quickselect-algorithm/) [4](https://github.com/mourner/quickselect).
4. **FreeCodeCamp**: FreeCodeCamp explains Quickselect with code examples. [Dive into their article to understand the algorithm step by step](https://www.geeksforgeeks.org/quickselect-algorithm/) [5](https://www.freecodecamp.org/news/quickselect-algorithm-explained-with-examples/).
5. **GeeksforGeeks**: GeeksforGeeks provides a concise explanation of Quickselect along with an example. [It’s a great resource for learning algorithms and data structures](https://www.geeksforgeeks.org/quickselect-algorithm/) [1](https://www.geeksforgeeks.org/quickselect-algorithm/).

Feel free to explore these references and enhance your understanding of Quickselect! 🚀

# **Bucket Sort**





Explore

Certainly! **Bucket Sort** is an algorithm that divides the input into **buckets**, sorts each bucket individually, and then combines the sorted buckets to obtain the final sorted result. [It’s particularly useful when the input data is uniformly distributed1](https://www.programiz.com/dsa/bucket-sort).

Here are **five free reference links** where you can learn more about Bucket Sort:

1. [**LeetCode**: Explore problems related to Bucket Sort and practice your coding skills](https://www.programiz.com/dsa/bucket-sort)[2](https://leetcode.com/tag/bucket-sort/).
2. [**Programiz**: Learn about Bucket Sort with code examples in Python, C++, Java, and C1](https://www.programiz.com/dsa/bucket-sort).
3. [**GitHub Pull Request**: Check out a GitHub pull request that discusses Bucket Sort](https://www.programiz.com/dsa/bucket-sort)[3](https://github.com/wingkwong/leetcode-the-hard-way/pull/658).
4. [**Top K Frequent Elements on LeetCode**: A specific problem that uses Bucket Sort](https://www.programiz.com/dsa/bucket-sort)[4](https://leetcode.com/problems/top-k-frequent-elements/).
5. [**YouTube Tutorial**: Watch a video tutorial on implementing Bucket Sort for the Top K Frequent Elements problem](https://www.programiz.com/dsa/bucket-sort)[5](https://www.youtube.com/watch?v=YPTqKIgVk-k).

Happy learning! 🚀

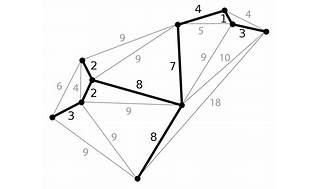
# **Suffix Array**

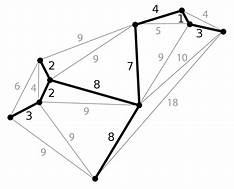
A **suffix array** is an ordered array of indices representing the suffixes of a given string, sorted lexicographically. It is commonly used in string algorithms for efficient substring search and pattern matching. Here are some free resources to learn more about suffix arrays:

1. [**LeetCode’s Suffix Array Problems**: LeetCode offers a collection of problems related to suffix arrays, which can help you practice and deepen your understanding1](https://leetcode.com/tag/suffix-array/)[2](https://leetcode.com/problemset/?topicSlugs=suffix-array).
2. [**Longest Prefix Which Is Also Suffix**: GeeksforGeeks provides a tutorial on constructing the **longest proper prefix** that is also a suffix of a given string](https://leetcode.com/tag/suffix-array/)[3](https://www.geeksforgeeks.org/longest-prefix-also-suffix/).
3. [**Suffix Sum Array**: GeeksforGeeks also covers the concept of a **suffix sum array**, which is useful in various algorithms](https://leetcode.com/tag/suffix-array/)[4](https://www.geeksforgeeks.org/suffix-sum-array/).
4. [**Product of Array Except Self**: While not directly about suffix arrays, LeetCode’s problem on calculating the product of array elements except for the current index involves similar concepts](https://leetcode.com/tag/suffix-array/)[5](https://leetcode.com/problems/product-of-array-except-self/).
5. [**Boost Your Coding Interview Skills**: LeetCode’s platform offers essential problems for practice, including suffix array-related topics](https://leetcode.com/tag/suffix-array/)[2](https://leetcode.com/problemset/?topicSlugs=suffix-array).

Feel free to explore these resources to enhance your knowledge of suffix arrays! 📚🔍

# **Minimum Spanning Tree**





Explore

[A **Minimum Spanning Tree (MST)** is a subset of a graph’s edges that connects all vertices without cycles and has the minimum possible total edge weight1](https://leetcode.com/problems/find-critical-and-pseudo-critical-edges-in-minimum-spanning-tree/). Here are five free reference links where you can learn more about MSTs:

1. [**LeetCode’s Minimum Spanning Tree Problems**](https://leetcode.com/tag/minimum-spanning-tree/): Explore MST-related problems on LeetCode, including tasks like connecting cities with minimum cost and optimizing water distribution in a village[2](https://leetcode.com/tag/minimum-spanning-tree/).
2. [**Critical and Pseudo-Critical Edges in MST**](https://leetcode.ca/2019-12-28-1489-Find-Critical-and-Pseudo-Critical-Edges-in-Minimum-Spanning-Tree/): Dive into the concept of critical and pseudo-critical edges in an MST[3](https://leetcode.ca/2019-12-28-1489-Find-Critical-and-Pseudo-Critical-Edges-in-Minimum-Spanning-Tree/).
3. [**HackerRank: Minimum MST Graph**](https://www.hackerrank.com/challenges/minimum-mst-graph/problem): Understand the value of an MST and how it minimizes the sum of edge lengths[4](https://www.hackerrank.com/challenges/minimum-mst-graph/problem).
4. [**MIT OpenCourseWare: Minimum Spanning Trees I**](https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2012/6baf48ebe3babed294c31a907a916e08_MIT6_046JS12_lec03.pdf): Access lecture notes from MIT on MSTs[5](https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2012/6baf48ebe3babed294c31a907a916e08_MIT6_046JS12_lec03.pdf).
5. [**LeetCode Problem: Find Critical and Pseudo-Critical Edges in MST**](https://leetcode.com/problems/find-critical-and-pseudo-critical-edges-in-minimum-spanning-tree/): Explore the critical and pseudo-critical edges in an MST[1](https://leetcode.com/problems/find-critical-and-pseudo-critical-edges-in-minimum-spanning-tree/).

Happy learning! 🌟

# **Counting Sort**

**Counting Sort** is an efficient sorting algorithm that works well for integers with a limited range. [It counts the occurrences of each element and then reconstructs the sorted array based on those counts](https://leetcode.com/tag/counting-sort/) [1](https://leetcode.com/tag/counting-sort/).

Here are **five free reference links** where you can learn more about Counting Sort:

1. [**LeetCode’s Counting Sort**: Explore problems related to Counting Sort and enhance your coding skills1](https://leetcode.com/tag/counting-sort/).
2. [**Count 1’s in a sorted binary array**](https://www.geeksforgeeks.org/count-1s-sorted-binary-array/)[: Learn how to count the number of occurrences of 1 in a sorted binary array using a binary search approach](https://leetcode.com/tag/counting-sort/)[2](https://www.geeksforgeeks.org/count-1s-sorted-binary-array/).
3. [**Count number of occurrences (or frequency) in a sorted array**](https://www.geeksforgeeks.org/count-number-of-occurrences-or-frequency-in-a-sorted-array/)[: Understand how to find the frequency of a specific element in a sorted array using binary search](https://leetcode.com/tag/counting-sort/)[3](https://www.geeksforgeeks.org/count-number-of-occurrences-or-frequency-in-a-sorted-array/).
4. [**Sort Characters By Frequency**](https://leetcode.com/problems/sort-characters-by-frequency/)[: Practice sorting a string based on character frequencies](https://leetcode.com/tag/counting-sort/)[4](https://leetcode.com/problems/sort-characters-by-frequency/).
5. [**Sort an Array**](https://leetcode.com/problems/sort-an-array/solutions/1606493/counting-sort-with-complete-explanation-and-clean-easy-to-understand-code/)[: Dive into a detailed explanation of Counting Sort with clean and easy-to-understand code examples](https://leetcode.com/tag/counting-sort/)[5](https://leetcode.com/problems/sort-an-array/solutions/1606493/counting-sort-with-complete-explanation-and-clean-easy-to-understand-code/).

Happy learning! 📚👩‍💻

# **Shell**

Certainly! In the context of **LeetCode**, the term **“Shell”** refers to a category of problems that involve shell scripting or command-line operations. These problems often require you to write scripts or commands to manipulate files, process data, or perform other tasks using shell commands. Here are **five free reference links** where you can learn more about shell scripting and practice related problems:

1. [**LeetCode Shell Problems**: Explore the collection of shell problems on LeetCode to practice and enhance your shell scripting skills1](https://leetcode.com/problemset/shell/)
2. [**Shell Profile on LeetCode**: Check out the profile of the user “shell” on LeetCode, where you can find discussions, solutions, and community interactions related to shell problems](https://leetcode.com/problemset/shell/)[2](https://leetcode.com/shell/)
3. **Rotate Array Problem**: A specific example of a shell problem on LeetCode is the “Rotate Array” problem. [It challenges you to rotate an array of integers to the right by a given number of steps](https://leetcode.com/problemset/shell/)[3](https://leetcode.com/problems/rotate-array/)
4. **Shell Documentation**: Dive into the official documentation for shell scripting. Learn about common shell commands, syntax, and best practices. You can find resources for various shell environments (e.g., Bash, Zsh).
5. **Online Tutorials and Blogs**: Explore online tutorials and blogs that cover shell scripting. Websites like **GeeksforGeeks**, **Linuxize**, and **Shell Scripting Tutorial** offer free content to help you improve your shell scripting skills.

Remember to practice actively and apply what you learn by solving real-world problems. Happy coding! 🚀

# **Line Sweep**

**Line Sweep**, also known as **Sweep Line**, is an algorithmic technique where an imaginary line (either along the x-axis or y-axis) is “swept” across a set of geometric objects, processing events (such as start or end points) and updating information based on those events. [It is particularly useful for solving problems involving intervals, line segments, or rectangles](https://leetcode.com/discuss/study-guide/2166045/line-sweep-algorithms) [1](https://leetcode.com/discuss/study-guide/2166045/line-sweep-algorithms).

Here are **five free reference links** where you can learn more about Line Sweep:

1. [**LeetCode Line Sweep**](https://leetcode.com/tag/line-sweep/): LeetCode provides a dedicated section on Line Sweep problems to help you practice and improve your coding skills [2](https://leetcode.com/tag/line-sweep/).
2. [**HackerEarth Line Sweep Technique Tutorials**](https://www.hackerearth.com/practice/math/geometry/line-sweep-technique/tutorial/): This tutorial covers the basics of Line Sweep with examples and explanations [3](https://www.hackerearth.com/practice/math/geometry/line-sweep-technique/tutorial/).
3. [**Mastering Efficiency: Exploring Line Sweep Algorithm with Python**](https://panda-man.medium.com/mastering-efficiency-exploring-line-sweep-algorithm-with-python-673e4522e979): Dive into Python implementations of Line Sweep algorithms and gain practical insights [4](https://panda-man.medium.com/mastering-efficiency-exploring-line-sweep-algorithm-with-python-673e4522e979).
4. [**LintCode & LeetCode: Sweep Line & Interval**](https://aaronice.gitbook.io/lintcode/sweep-line): Explore sweep line techniques and their applications in competitive programming [5](https://aaronice.gitbook.io/lintcode/sweep-line).
5. [**USACO Guide: Sweep Line**](https://usaco.guide/plat/sweep-line): A comprehensive guide to sweep line algorithms, including code snippets and explanations [6](https://usaco.guide/plat/sweep-line).

Happy learning! 🚀

# **Reservoir Sampling**

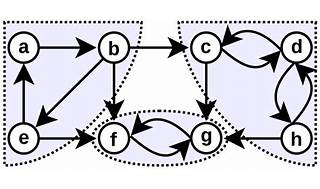
**Reservoir Sampling** is a family of randomized algorithms used for selecting *k* samples from a list of *n* items, especially when *n* is large or unknown. [It’s commonly employed in scenarios where the entire list doesn’t fit into memory, such as selecting random elements from a stream of data1](https://www.geeksforgeeks.org/reservoir-sampling/).

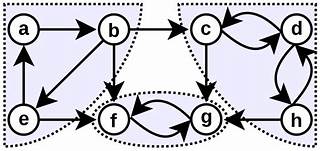
Here are **five free reference links** where you can learn more about Reservoir Sampling:

1. [**LeetCode Reservoir Sampling**](https://leetcode.com/tag/reservoir-sampling/)[: LeetCode provides problem-solving practice and explanations related to reservoir sampling](https://www.geeksforgeeks.org/reservoir-sampling/)[2](https://leetcode.com/tag/reservoir-sampling/).
2. [**GeeksforGeeks: Reservoir Sampling**: GeeksforGeeks offers detailed explanations, examples, and code snippets for reservoir sampling1](https://www.geeksforgeeks.org/reservoir-sampling/).
3. [**Reservoir Sampling (online) - LeetCode GitBook**](https://lei-d.gitbook.io/leetcode/array/reservoir-sampling-online)[: This GitBook resource covers reservoir sampling in the context of reading data streams and returning a sample of size *k*](https://www.geeksforgeeks.org/reservoir-sampling/)[3](https://lei-d.gitbook.io/leetcode/array/reservoir-sampling-online).
4. [**Explanation of Reservoir Sampling - Random Pick Index - LeetCode**](https://leetcode.com/problems/random-pick-index/solutions/1129487/explanation-of-reservoir-sampling/)[: Dive into the concept of reservoir sampling and its practical application in solving a specific LeetCode problem](https://www.geeksforgeeks.org/reservoir-sampling/)[4](https://leetcode.com/problems/random-pick-index/solutions/1129487/explanation-of-reservoir-sampling/).
5. [**LeetCode Problems Tagged with Reservoir Sampling**](https://leetcode.com/tag/reservoir-sampling/)[: Explore additional problems related to reservoir sampling on LeetCode to reinforce your understanding](https://www.geeksforgeeks.org/reservoir-sampling/)[2](https://leetcode.com/tag/reservoir-sampling/).

Happy learning! 📚👩‍💻

# **Strongly Connected Component**





Explore

A **strongly connected component (SCC)** in a directed graph is a group of vertices where there exists a directed path from any vertex to any other vertex within the component. Here are **five free reference links** to learn more about SCCs:

1. [**LeetCode**: Explore problems related to strongly connected components and enhance your coding skills1](https://leetcode.com/tag/strongly-connected-component/).
2. [**Programiz**: Understand the concept of SCCs and how they are formed in a graph](https://leetcode.com/tag/strongly-connected-component/)[2](https://www.programiz.com/dsa/strongly-connected-components).
3. [**GeeksforGeeks**: Learn about finding the minimum number of edges required to make a directed graph strongly connected](https://leetcode.com/tag/strongly-connected-component/)[3](https://www.geeksforgeeks.org/minimum-edges-required-to-make-a-directed-graph-strongly-connected/).
4. [**LeetCode Problem**: Solve the “Count the Number of Complete Components” problem, which involves identifying connected components in a graph](https://leetcode.com/tag/strongly-connected-component/)[4](https://leetcode.com/problems/count-the-number-of-complete-components/).
5. [**LeetCode Problem Set**: Access a range of essential problems, including those related to strongly connected components, to practice and prepare for interviews](https://leetcode.com/tag/strongly-connected-component/)[5](https://leetcode.com/problemset/?topicSlugs=strongly-connected-component).

Feel free to explore these resources to deepen your understanding of SCCs! 🚀

# **Eulerian Circuit**

An **Eulerian Circuit** is a path in a graph that visits every edge exactly once and returns to the starting vertex. Here are some free resources where you can learn more about Eulerian Circuits:

1. [**LeetCode**: LeetCode provides problems related to Eulerian Circuits, including challenges like “Reconstruct Itinerary” and “Cracking the Safe”](https://leetcode.com/tag/eulerian-circuit/) [1](https://leetcode.com/tag/eulerian-circuit/)[2](https://leetcode.com/problemset/?topicSlugs=eulerian-circuit).
2. [**GeeksforGeeks**: GeeksforGeeks offers a tutorial on Eulerian Circuits and Paths, explaining their properties and how to identify them in undirected graphs](https://leetcode.com/tag/eulerian-circuit/) [3](https://www.geeksforgeeks.org/problems/euler-circuit-and-path/1)[4](https://www.geeksforgeeks.org/euler-circuit-directed-graph/).
3. **Practice Problems**: LeetCode’s problem set includes Eulerian Circuit-related questions. [Practicing these problems will enhance your coding skills and prepare you for interviews](https://leetcode.com/tag/eulerian-circuit/) [2](https://leetcode.com/problemset/?topicSlugs=eulerian-circuit).

Feel free to explore these resources to deepen your understanding of Eulerian Circuits! 🚀

# **Radix Sort**

[**Radix Sort** is a non-comparative sorting algorithm that sorts integers by processing individual digits or bits from the least significant to the most significant position](https://www.geeksforgeeks.org/problems/radix-sort/1) [1](https://www.geeksforgeeks.org/problems/radix-sort/1). It’s particularly useful for sorting numbers with a fixed number of digits or bits.

Here are **five free reference links** where you can learn more about Radix Sort:

1. **LeetCode**: LeetCode provides problems related to Radix Sort, allowing you to practice and improve your coding skills. [Check out their](https://www.geeksforgeeks.org/problems/radix-sort/1) [Radix Sort tag2](https://leetcode.com/tag/radix-sort/)[3](https://leetcode.com/problemset/?topicSlugs=radix-sort).
2. **LeetCode Solution for Sort an Array**: Explore a solution for implementing Radix Sort in the context of sorting an array on LeetCode. [You can find it](https://www.geeksforgeeks.org/problems/radix-sort/1) [here4](https://leetcode.com/problems/sort-an-array/solutions/2126109/Radix-Sort/).
3. **GeeksforGeeks**: GeeksforGeeks offers a detailed explanation of Radix Sort, including its implementation and time complexity. [Dive into their](https://www.geeksforgeeks.org/problems/radix-sort/1) [Radix Sort article1](https://www.geeksforgeeks.org/problems/radix-sort/1).
4. **Princeton University**: Princeton University’s lecture notes provide insights into Radix Sort. Learn about the algorithm’s steps and how it sorts an array of integers. [Access the material](https://www.geeksforgeeks.org/problems/radix-sort/1) [here5](https://www.cs.princeton.edu/courses/archive/spr08/cos226/lectures/17RadixSorts.pdf).
5. **Boost Your Skills**: If you’re looking to enhance your coding interview skills, LeetCode offers a variety of essential problems, including Radix Sort-related challenges. [Explore their problem set](https://www.geeksforgeeks.org/problems/radix-sort/1) [here3](https://leetcode.com/problemset/?topicSlugs=radix-sort).

Happy learning! 🚀

# **Rejection Sampling**

**Rejection Sampling** is a technique used in probability and statistics to generate random samples from a distribution by accepting or rejecting proposed values based on certain criteria. It’s commonly employed in scenarios where direct sampling is challenging or impossible.

Here are **five free reference links** where you can learn more about Rejection Sampling:

1. [**LeetCode’s Rejection Sampling Tag**: LeetCode provides practice problems related to rejection sampling, helping you enhance your coding skills and prepare for interviews1](https://leetcode.com/tag/rejection-sampling/).
2. [**A Visual Tutorial of Rejection Sampling**](https://cosmiccoding.com.au/tutorials/rejection_sampling/)[: This tutorial offers a visual explanation of the concept, complete with code examples](https://leetcode.com/tag/rejection-sampling/)[2](https://cosmiccoding.com.au/tutorials/rejection_sampling/).
3. [**Bayesian Inference Using Rejection Sampling**](https://jonnylaw.rocks/posts/2019-02-25-rejection_sampling/)[: Dive deeper into rejection sampling with insights on Bayesian inference and practical implementation](https://leetcode.com/tag/rejection-sampling/)[3](https://jonnylaw.rocks/posts/2019-02-25-rejection_sampling/).
4. [**Simulation Lecture on Rejection Sampling**](https://www.stats.ox.ac.uk/~rdavies/teaching/PartASSP/2020/lectures_latest/simulation_lecture3.pdf)[: The University of Oxford provides lecture notes on rejection sampling, including a normal distribution example](https://leetcode.com/tag/rejection-sampling/)[4](https://www.stats.ox.ac.uk/~rdavies/teaching/PartASSP/2020/lectures_latest/simulation_lecture3.pdf).
5. [**LeetCode Problem Set on Rejection Sampling**](https://leetcode.com/problemset/?topicSlugs=rejection-sampling)[: Explore additional problems related to rejection sampling on LeetCode](https://leetcode.com/tag/rejection-sampling/)[5](https://leetcode.com/problemset/?topicSlugs=rejection-sampling).

Feel free to explore these resources to deepen your understanding of this powerful sampling technique! 📚🔍

# **Biconnected Component**

A **biconnected component** in LeetCode refers to a subgraph within an undirected graph where every vertex is connected to at least two other vertices, and removing any single edge does not disconnect the component. [It is often used to identify critical connections or articulation points in a network1](https://leetcode.com/tag/biconnected-component/)[2](https://www.geeksforgeeks.org/biconnected-components/).

Here are **five free reference links** where you can learn more about biconnected components:

1. **LeetCode Biconnected Component Tag**: Explore problems related to biconnected components on LeetCode. [Solve challenges and enhance your coding skills1](https://leetcode.com/tag/biconnected-component/)[3](https://leetcode.com/tag/biconnected-component/discuss/).
2. [**GeeksforGeeks Tutorial**: Dive into a detailed tutorial on biconnected components, including how to find them using depth-first search (DFS)](https://leetcode.com/tag/biconnected-component/)[2](https://www.geeksforgeeks.org/biconnected-components/).
3. **Critical Connections in a Network**: LeetCode problem that involves identifying critical connections in a network. [Solving this problem will deepen your understanding of biconnected components](https://leetcode.com/tag/biconnected-component/)[4](https://leetcode.com/problems/critical-connections-in-a-network/).
4. **HackerEarth Tutorial**: Learn about biconnected components and how they relate to articulation points. [Understand the concept through examples and explanations](https://leetcode.com/tag/biconnected-component/)[5](https://www.hackerearth.com/practice/algorithms/graphs/biconnected-components/tutorial/).
5. **Algorithmic Insights**: Explore the theory behind biconnected components and their applications in graph algorithms. Gain insights into their properties and use cases.

Feel free to explore these resources to enhance your knowledge of biconnected components! 🌟