

02. Grokking Recursion

01. Basic Sum

Problem Statement

Calculate the Sum of the First N Natural Numbers Using a Recursive Approach.

The sum of first N natural numbers is equal to $N + (N-1) + (N-2) + \dots + (3) + (2) + (1)$. The following table shows a sample input/output description table:

Input (s)	Output (s)	Explanation
$N = 5$	Sum = 15	The first 5 natural numbers are 1, 2, 3, 4, and 5. The sum of these numbers is $1 + 2 + 3 + 4 + 5 = 15$.
$N = 10$	Sum = 55	The first 10 natural numbers are 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. The sum of these numbers is $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55$.
$N = 1$	Sum = 1	The first natural number is 1. The sum of this number is 1.

02. Factorial

Problem Statement

Calculate the Factorial of a Positive Number Using Recursion.

The factorial of a non-negative integer N , denoted as $N!$, is the product of all positive integers less than or equal to N . The factorial of 0 is defined as 1.

Here is what the example input/output looks like:

Input	Expected Output	Explanation
Number = 5	Factorial = 120	The factorial of 5 is calculated as $5 \times 4 \times 3 \times 2 \times 1 = 120$.
Number = 7	Factorial = 5040	The factorial of 7 is calculated as $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5040$.
Number = 1	Factorial = 1	The factorial of 1 is 1 itself.

03. Greatest Common Divisor

Problem Statement

Write recursive code to calculate the Greatest Common Divisor (GCD) of Two Positive Numbers.

The greatest common divisor (GCD) of two positive integers A and B is the largest positive integer that divides both A and B without leaving a remainder.

04. Converting Decimal to Binary

Problem Statement

Write a Recursive Procedure to Convert a Decimal Number to a Binary Equivalent.

Given a decimal number, we need to convert it to its binary representation

05. Check Prime

Problem Statement

Write a Recursive Solution to Check if a Given Number is a Prime Number or Not.

Given a positive integer, we need to determine whether it is a prime number or not. A prime number is a number greater than 1 that has no positive divisors other than 1 and the number itself.

06. Perfect Square

Problem Statement

Write a Recursive Solution to Check if a Given Number is a Perfect Square or Not.

The problem is to determine whether a given positive number is a perfect square or not. A square number or perfect square is an integer that is the square of an integer; in other words, it is the product of some integer with itself.

Examples

07. Number Frequency

Problem Statement

Write a Recursive Solution to Count occurrences of an Element in an Array.

Given an array of integers and a key element, write a recursive solution to count the occurrences of the key element in the array.

Examples:

Sr#	Array	Input Key	Output	Description
1	[2, 4, 6, 8, 4]	4	2	The key element 4 occurs twice in the array.

08. Pascal's Triangle

Problem Statement:

Write a Recursive Solution to Generate Pascal's Triangle.

Write a recursive function to generate Pascal's Triangle up to a given number of rows. Pascal's Triangle is a triangular array of binomial coefficients, where each number is the sum of the two numbers directly above it.

Example

09. Binary Search

Problem Statement

Write Recursive Approach to Implement Binary Search Algorithm.

The problem is to implement the binary search algorithm using recursion. Given a sorted array and a target key, the algorithm should determine whether the key is present in the array or not.

Examples

Sr #	Array	Input Key	Output
1	[1, 2, 3, 4, 5]	4	True
2	[2, 4, 6, 8, 10]	5	False
3	[3, 6, 9, 12, 15]	15	True

10. Inserting a new node in a BST

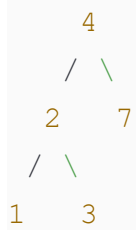
Problem Statement

Write Recursive Approach to Insert New Node in a Binary Search Tree.

Given a binary search tree (BST) and a value to be inserted, write a recursive algorithm to insert a new node with the given value into the BST while maintaining its properties.

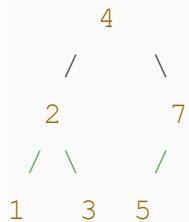
Examples

1. BST Before Insertion:



Input Node: 5

Output BST:



Explanation: The input node with value 5 is inserted as the left child of node 7.

11. BST Inorder Traversal

Problem Statement

Write Recursive Approach for Inorder Traversal of Binary Tree.

Given a binary tree, write a recursive algorithm to perform an inorder traversal of the tree and return the elements in the order they were visited.

12. Merge Sort

Problem Statement

Write Recursive Approach for Merge Sort.

The problem is to implement the Merge Sort algorithm using recursion. Merge Sort is an efficient sorting algorithm that follows the divide-and-conquer approach. It divides the input array into two halves, recursively sorts each half, and then merges the sorted halves to obtain the final sorted array.

13. Quick Sort

Problem Statement

Write Recursive Approach for Quick Sort

Given an array of integers, sort it in ascending order using the Quick Sort algorithm.

Examples

Sr#	Input Array	Output	Description
1	[4, 2, 6, 8, 3]	[2, 3, 4, 6, 8]	The array is sorted in ascending order.
2	[10, 5, 3, 7, 2, 8, 6]	[2, 3, 5, 6, 7, 8, 10]	The array is sorted in ascending order.

14. Depth First Search

Problem Statement

Write Recursive Approach for Depth First Search (DFS).

Given a graph, perform Depth First Search (DFS) traversal on the graph using a recursive approach.

Example 1:

Graph:



Output: 1 2 5 4 3

Explanation: Starting from node 1, we visit its adjacent nodes in order: 2, 5, and 4. From node 4, we visit node 3.

Example 2:

Graph:



Output: 0 1 3 2

Explanation: Starting from node 0, we visit its adjacent nodes in order: 1 and 2

15. Removing Nodes From Linked List

Problem Statement

Write Recursive Approach for Removing Nodes From Linked List.

Given a singly linked list and a target value, write a recursive algorithm to remove all nodes from the linked list that have the target value.

Examples:

Sr #	Input	Expected Output	Description
1	1 -> 2 -> 3 -> 4 -> 2	1 -> 3 -> 4	Remove all nodes with value 2 from the list.

16. Fibonacci Series Using Memoization

Problem Statement

Print Fibonacci Series Using Memoization and Recursion.

Given a positive integer n , print the Fibonacci series up to the n th term using memoization and recursion.

Examples:

Sr#	Input	Output	Explanation
1	5	0, 1, 1, 2, 3	The Fibonacci series up to the 5th term is 0, 1, 1, 2, 3

17. Good Number

Problem Statement

Write a Recursive Approach to Check if a Given Digit String Represents a Good Number.

A digit string is good if the digits (0-indexed) at even indices are even and the digits at odd indices are prime ((2, 3, 5, or 7).

18. Split BST

Problem Statement

Write a Recursive Approach to Split BST.

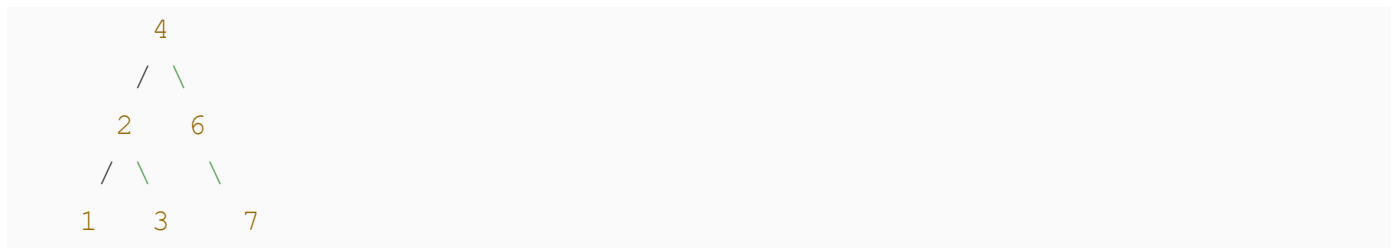
Given a Binary Search Tree (BST) and a target value, split the BST into two subtrees where one subtree contains nodes with values less than the target value, and the other subtree contains nodes with values greater than or equal to the target value. Return the two root nodes of the resulting subtrees.

Examples

Example 1:

- Input:

- Binary Search Tree:



-Target: 5

19. Pow(x,n)

Problem Statement

Write a Recursive Approach to Calculate Power of Integer to N Pow(x,n).

Given an integer and an integer , write a recursive function to calculate the power of to the th power.

Example

Sr#	x	n	Output	Description
1	2	5	32	2 raised to the power of 5 equals 32.
2	3	4	81	3 raised to the power of 4 equals 81.
