Module 6 - Transform and Conquer Algorithm

1. Understanding Transform and Conquer Approach
Concepts:

Definition: A problem-solving approach that involves transforming a problem into another form, solving the transformed version, and then interpreting the solution in the context of the original problem.

Three Variations:

Instance Simplification: Transforming the problem into a simpler or more convenient instance of the same problem.

Representation Change: Changing the representation of the problem to make it easier to solve.

Problem Reduction: Reducing the problem to another problem whose algorithm is already known.

Examples:

- **Presorting**
- **Gaussian Elimination**
- **Heaps and Heap Sort**
- **Horner's Rule for Polynomial Evaluation**
- **Balanced Search Trees (AVL Trees)**
- **Disjoint Set Union-Find**

Instance Simplification

Concepts:

Description: Simplifying the input to reduce the complexity of solving the problem.

Example: Presorting

Sorting the input data as a preprocessing step to simplify subsequent operations.

Representation Change

Concepts:

Description: Changing the way data is represented to simplify the problem-solving process.

Example: Heaps and Heap Sort

A heap is a binary tree-based data structure where the parent node satisfies a specific ordering property (min-heap or max-heap).

Problem Reduction
Concepts:

Description: Transforming a problem into another problem whose solution is already known.