Heaps

- Heap sort algorithm is based on **transform and conquer technique.**
- This technique is based on the idea of *transformation*.

Stages of Transform and Conquer

1. **Modifying the Problem**: Problem is modified to get the solution.
2. **Solve the transformed problem**: In this stage the solution is obtained to the transformed problem.

   Variants of transformation
1. **Instance simplification:** Problem is converted into a simpler version.
2. **Representation change:** The problem is transformed to a different representation.
3. **Problem reduction:** This method is very helpful when there is already a solution to the reduced version of the problem.

- A **heap** is a well-organized data structure and it has many useful applications in **priority queues, selection algorithms, graph algorithms**.
- It is a specialised binary tree.
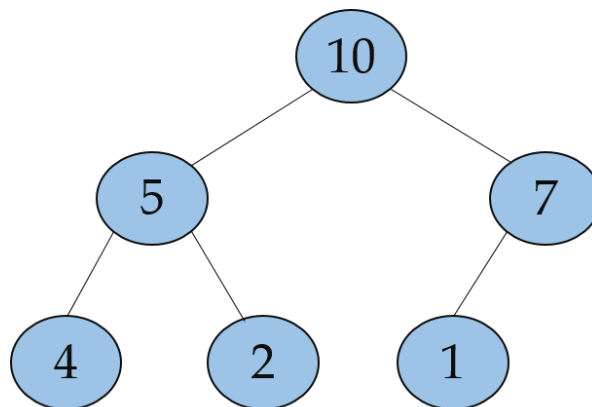
- **Conditions for specialized binary tree**
1. **Shape property**: The binary tree should be essentially complete. All the leaves must be at the same level at least up to last but one level.
2. **Parental dominance**: The value of each parent node should be greater than the value of both of its child-nodes.

Properties of Heap

- There exists only one heap with n-nodes. Height of the tree = $\log_2 n$
- Root of a heap will have the largest value.
- A node of a heap along with all its descendants is also a heap.
- A heap can be implemented as an array by recording its elements in the top-down, left-to-right fashion.
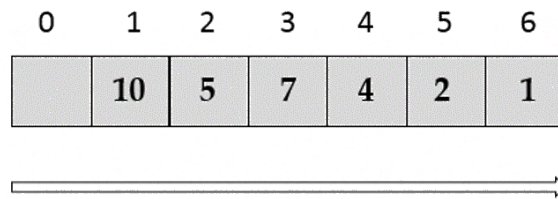
- Store the heap elements starting from index – 1 and leave zero-index unused or put a value greater than the index-1 value.