HEAP SORT

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Heap Sort is a comparison based sorting technique based on Binary Heap data structure.

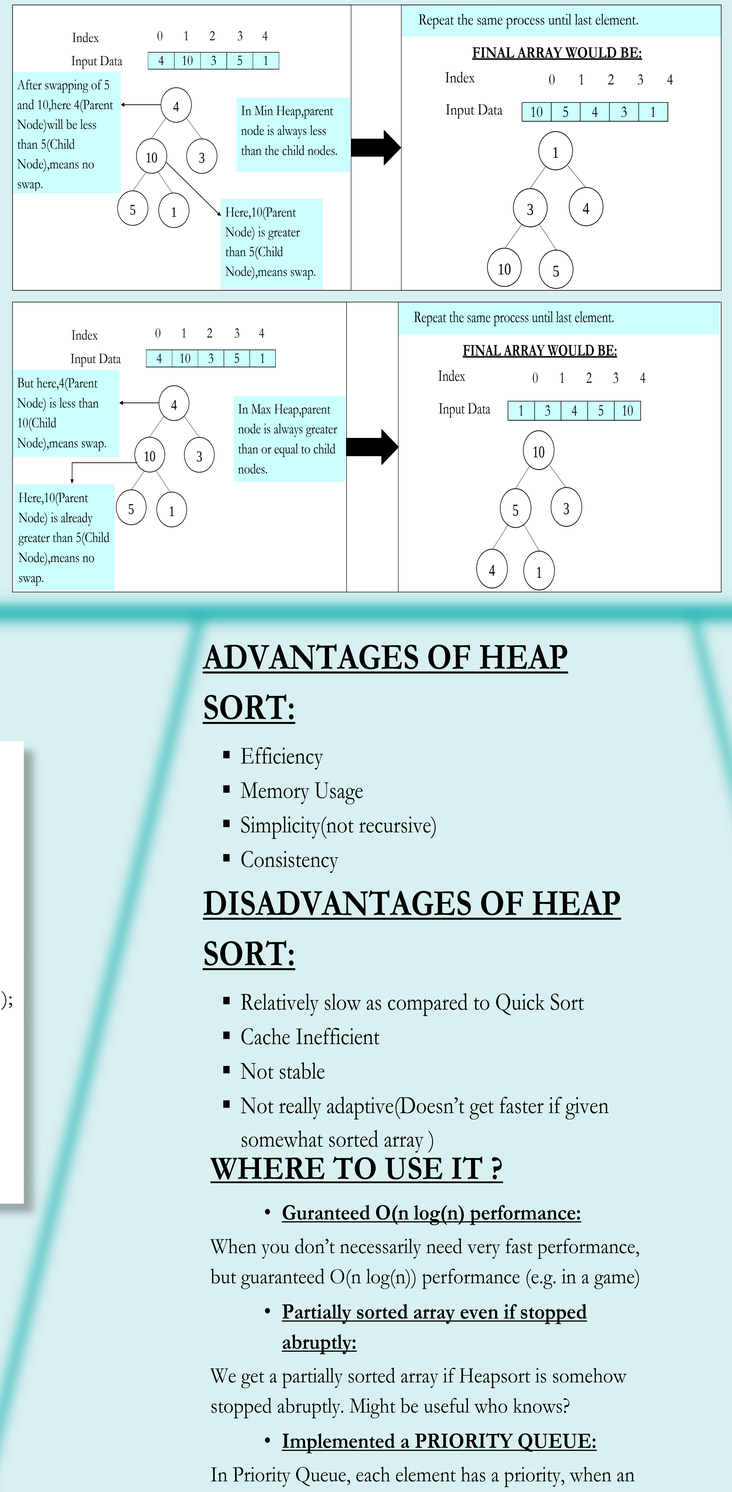
BINARY HEAP:

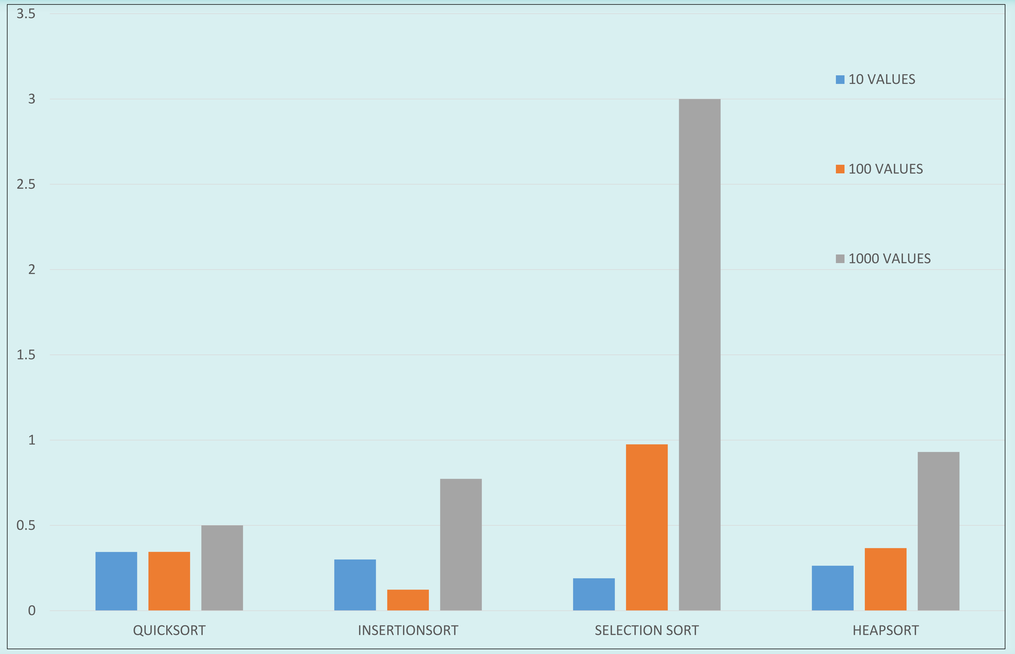
For Binary Heap,first we have to define a Complete Binary Tree.A Complete Binary Tree is a binary tree in which every level,except possibly the last,is completely filled and all node are as far left as possible.

A Binary Heap is a complete Binary Tree where items are sorted in a special order such that value in a parent node is greater(or smaller)than the values in its children nodes.A sorting for Heap Sort can be in:

- Increasing order(max)
  In Increasing order,Parent Node is always greater than or equal to the child node.
- Decreasing order(min)
  In Decreasing order,Parent Node is always less than the child node.

WORKING





PSEUDOCODE

```
PARENT(i)
 return[i/2]
 LEFT(i)
  return2i
RIGHT(i)
 return 2i +1

Build_heap(A,N)
{
 for(i=[n/2];i>=1;i--)
{
    heapify (A,I,N)
}
  }
```

```
MAX-HEAPIFY(A,i)
1. L=left(i)
2. R=right(i)
3. If L<=A.heap-size
   && A[L]>A[i]
4. Largest=L
5. Else largest=i
6. If R<=A.heap-size
   && A[R]>A[Largest]
7. Largest=R
8. If largest!=i
9. Exchange A[i] with
   A[Largest]
10.MAX-
   HEAPIFY(A,Largest
   )
```

```
Heap_sort(A,N)
{
Build_heap(A,N);
For(k=n;k>=1;k--)
{
Interchange(A[1],A[k]);
Heapify(A,1,k_1);
}
}
```

CHARACTERSTICS OF HEAPSORT

- O(n log(n))time best , average , worst case performance
- O(1) extra memory.

COMPLEXITY OF HEAP SORT ALGORITHM

- Worst Case : O(n log(n))
- Best Case : O(n log(n))
- Average Case : O(n log(n))

ADVANTAGES OF HEAP SORT:

- Efficiency
- Memory Usage
- Simplicity(not recursive)
- Consistency

DISADVANTAGES OF HEAP SORT:

- Relatively slow as compared to Quick Sort
- Cache Inefficient
- Not stable
- Not really adaptive(Doesn't get faster if given somewhat sorted array)

WHERE TO USE IT ?

- **Guranteed O(n log(n)) performance:**

When you don't necessarily need very fast performance, but guaranteed O(n log(n)) performance (e.g. in a game)

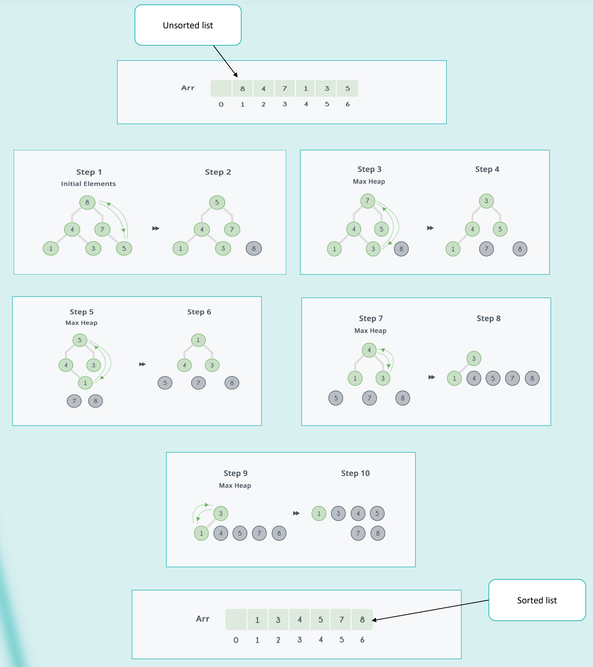
- **Partially sorted array even if stopped abruptly:**

We get a partially sorted array if Heapsort is somehow stopped abruptly. Might be useful who knows?

- **Implemented a PRIORITY QUEUE:**

In Priority Queue, each element has a priority, when an element is removed it must be the element on the queue with the highest priority.

STIMULATION



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