ASSIGNMENT 1

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Qs4 Why Algorithm Analysis is important both in terms of running time and Space Complexity?

An Algorithm is determined by 2 factors – Space and Time.
Time Complexity determines how much time an algorithm takes with respect to input size.
Space Complexity determines how much space has been taken by an algorithm.

If for small values, an algorithm **"A1" takes less time** and **time increases very large** (exponential maybe) as the **input size increases** – algorithm "A1" cannot be said as GOOD ALGORITHM.
On the other hand, if an **algorithm "A2" takes more time when compared to "A1" for small value of input but takes less time for large input size** – Algorithm "A2" can be stated as better algorithm than "A1".

Therefore, Time complexity helps us to better understand which algorithm performs better.
Space complexity is helpful as computer system has limited memory and it becomes crucial to use that memory wisely.

For example – Suppose we want to find if an element exist in particular sorted array arr[].

Two Approaches –

1st Approcah – Linear Search

```
Linear Search(int arr[]){
for(int i=0;i<n;i++)
    {
        If(arr[i] == element)
                Return true;
    }
}
```

2nd Approcah – Binary Search

```
Binary(int arr[], int element){
        While(low <= high){
                int mid = low+(high-low)/2;
                if(arr[mid] == elment){
                        return true;
                }
                If(arr[mid] , element){
                        low = mid+1;
                }
                Else{
                        Low = mid -1;
                }
        }
        Return -1;
}
```

Both Approach1 and Approach2 will give the desired answer, but binary search will take less time to execute than linear search. Therefore, Binary Search Algorithm is better than Linear Search in this case.

Qs3 What is the difference between Permutation and Combination, give examples of each.

Permutation – Permutation determines the number of possible arrangements in a collection of items when order of arrangement matters.

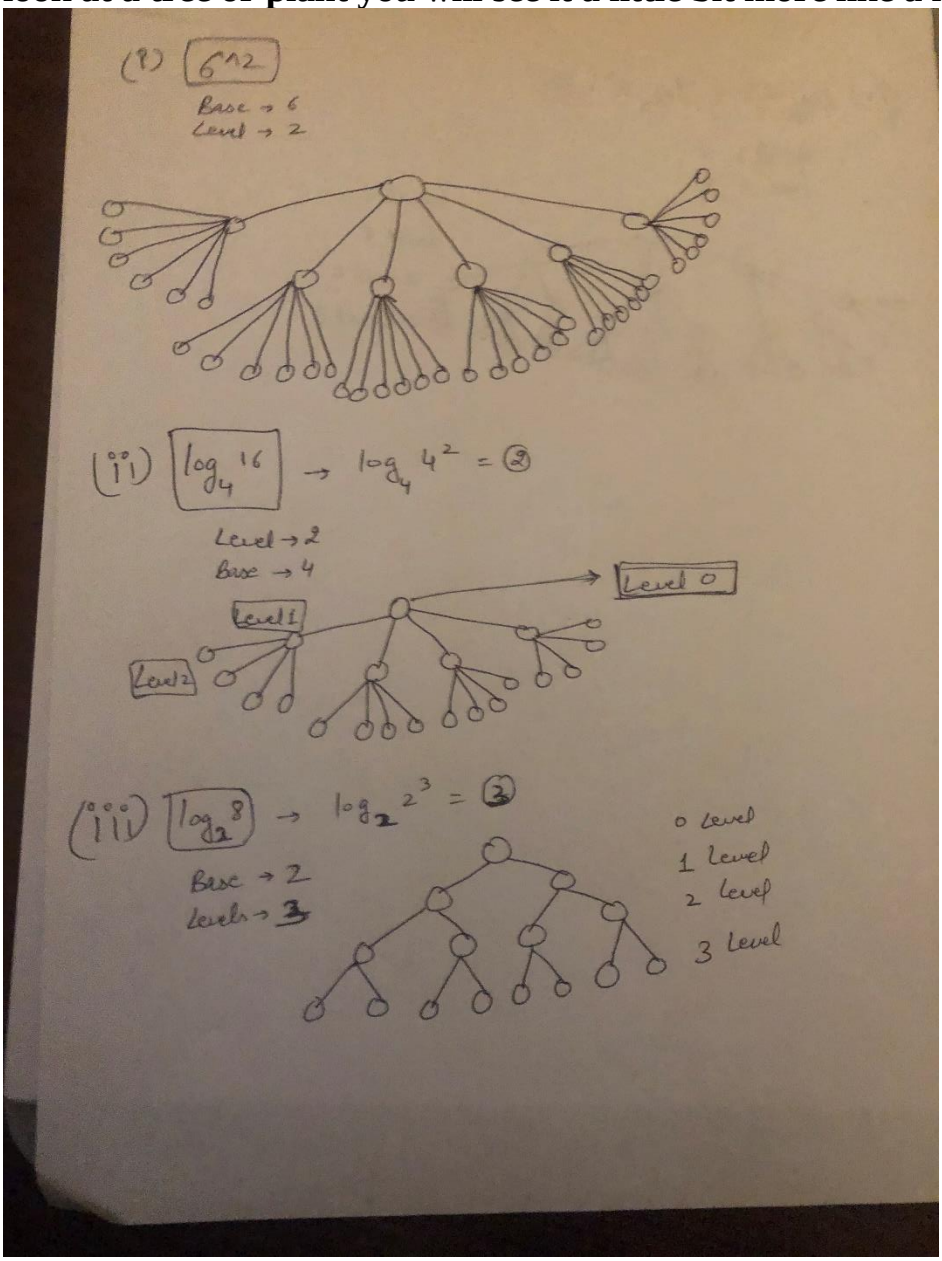
Combination - Combination determines the number of possible arrangements in a collection of items when order of arrangement does not matter.

Therefore, the only difference between permutations and combinations is the order of arrangement.

For example – your locker password is "3456"- if you try to enter "6543" – the locker won't open – THAT IS PERMUTATION – where order of arrangement matter.

On the other hand, suppose I have 3 blue balls and I want to assign it to 3 people – if I give first ball to "A", second ball to "B" and third ball to "C", it's the same as giving first, second and third ball to "C"," B", "A" respectively – ORDER DOESNOT MATTER.

Qs3 Formulate problem concerning exponents and logarithms such as 6^2 or log4 16, log2 8, log3 27. Draw the tree to solve it. Hopefully, the next time you look at a tree or plant you will see it a little bit more like a mathematician.



(iv) $\log_3 27 = \log_3 3^3 = 3$

levels = 3
base = 3