Permutation Generation using swap from first position (left to right)

Input : [a,b,c]

-- At p1 : we can place all 3 chars at p1

-- At p2 : we can place remaining 2 chars at p2

-- At p3 : we can place last remaining char at p3.

Swap-operation fixes the char at any given position.

Example fixing the position P1 in [a,b,c]

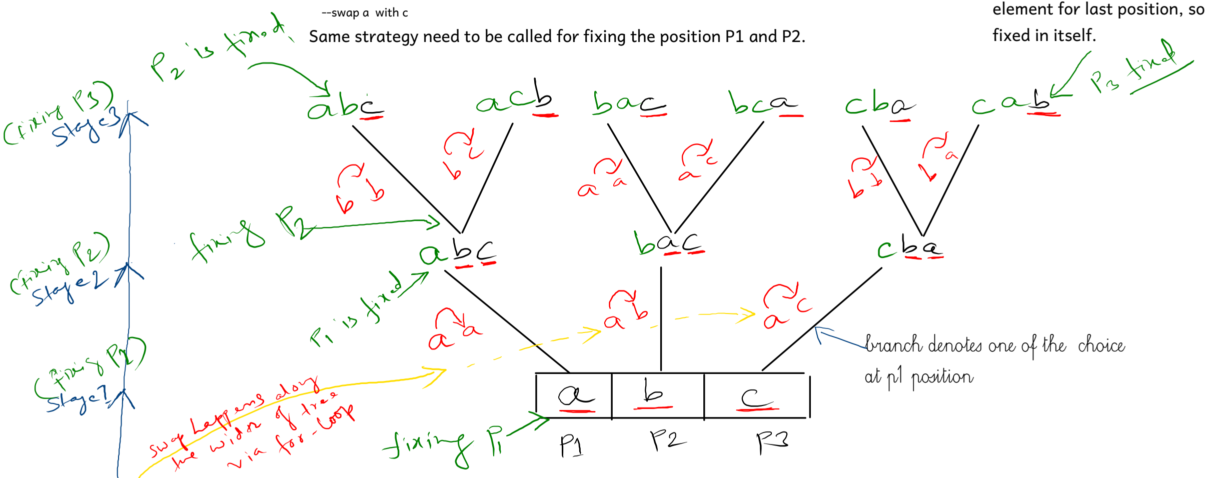
--swap a with a

--swap a with b

--swap a with c

Same strategy need to be called for fixing the position P1 and P2.

since we are just left with single element for last position, so it is fixed in itself.



```java
for (int i = position; i < input.length; i++) {
    swap(input, position, i);
    permuteArray1(input, position + 1);
    swap(input, position, i);
}
```

Time Complexity :

Approximate :Depth of the tree is equal to the size of the input i.e. n. Thus, to reach each leaf node we need to traverse n steps.There are factorial-n leaf nodes (as permuation of n elements is n!) . Time Complexity = O(n*n!)

Accurate :

Let's assume each recursive method invocation represents 1 unit of task. Then total number of method invocation would represent the time-complexity.

--Total number of leaf-nodes = n! = n!/1;

--Total number of nodes at 1 level below leaf-nodes = n!/2 = n!/1*2

--Total number of nodes at 2 level below leaf-nodes = (n!/2)/3 = n!/1*2*3

--Total number of nodes at 3 level below leaf-nodes = ((n!/2)/3)4 = n!/1*2*3*4

--So, total number of nodes in the tree = n! + n!/1*2 + n!/1*2*3 + n!/1*2*3*4 + .. + n!/n!

= n!(1 + 1/1*2 + 1/1*2*3 + 1/1*2*3*4 + .. +1/n!)

=~ n!(1+1) = 2n!

Time Complexity =~ O(2n!)

Space Complexity = O(1)

Permutation Generation using swap from last position (right to left)

Algorithm is similar to swap from first postion(left to right)

Input : [a,b,c]

-- At p3 : we can place all 3 chars at p3

-- At p2 : we can place remaining 2 chars at p2

-- At p1 : we can place last remaining char at p1.

Swap-operation fixes the char at any given position.

Example fixing the position P3 in [a,b,c]

--swap c with c

--swap c with b

--swap c with a

Same strategy need to be called for fixing the position P1 and P2.