Write a program to print all permutations of a given string

Difficulty Level : Medium • Last Updated : 04 Jun, 2021

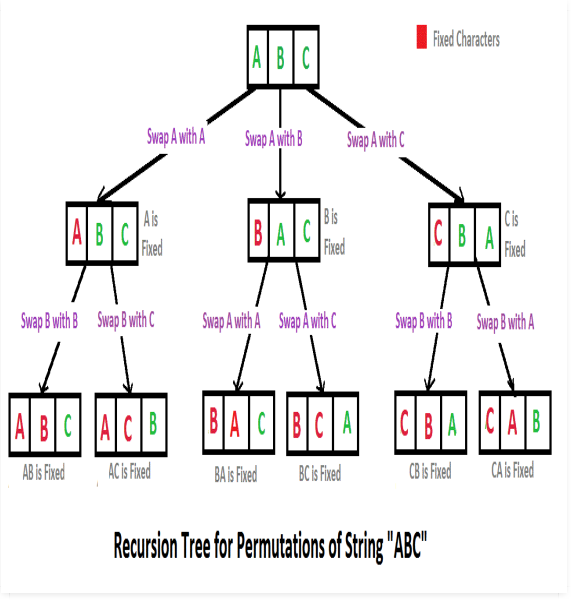
A permutation, also called an "arrangement number" or "order," is a rearrangement of the elements of an ordered list S into a one-to-one correspondence with S itself. A string of length n has n! permutation.

Source:
Mathword(http://mathworld.wolfram.com/Permutation.html)

Below are the permutations of string ABC.
ABC ACB BAC BCA CBA CAB

Recommended: Please solve it on "***PRACTICE***" first, before moving

Here is a solution that is used as a basis in backtracking.



C++

```
// C++ program to print al
// permutations with duplic
#include <bits/stdc++.h>
using namespace std;


// Function to print permut
// This function takes thre
// 1. String
// 2. Starting index of the
// 3. Ending index of the s
void permute(string a, int
{
    // Base case
    if (l == r)
        cout<<a<<endl;
    else
    {
        // Permutations mac
        for (int i = l; i
        {

            // Swapping dor
            swap(a[l], a[i

            // Recursion ca
            permute(a, l+1,

            //backtrack
            swap(a[l], a[i
        }
    }
}

// Driver Code
int main()
{
    string str = "ABC";
    int n = str.size();
    permute(str, 0, n-1);
    return 0;
}

// This is code is contribu
```

C

```c
// C program to print all p
#include <stdio.h>
#include <string.h>

/* Function to swap values
void swap(char *x, char *y
{
    char temp;
    temp = *x;
    *x = *y;
    *y = temp;
}

/* Function to print permut
This function takes three p
1. String
2. Starting index of the st
3. Ending index of the str
void permute(char *a, int
{
int i;
if (l == r)
    printf("%s\n", a);
else
{
    for (i = l; i <= r; i+
    {
        swap((a+l), (a+i))
        permute(a, l+1, r)
        swap((a+l), (a+i))
    }
}
}

/* Driver program to test a
int main()
{
    char str[] = "ABC";
    int n = strlen(str);
    permute(str, 0, n-1);
    return 0;
}
```

Java

```java
// Java program to print al
// given string.
public class Permutation
```

```
{
    public static void mai
    {
        String str = "ABC",
        int n = str.length
        Permutation permuta
        permutation.permute
    }

    /**
    * permutation function
    * @param str string to
    * @param l starting inc
    * @param r end index
    */
    private void permute(S
    {
        if (l == r)
            System.out.prir
        else
        {
            for (int i = l
            {
                str = swap
                permute(str
                str = swap
            }
        }
    }

    /**
    * Swap Characters at po
    * @param a string value
    * @param i position 1
    * @param j position 2
    * @return swapped strir
    */
    public String swap(Str
    {
        char temp;
        char[] charArray =
        temp = charArray[i]
        charArray[i] = char
        charArray[j] = temp
        return String.value
    }

}

// This code is contributed
```

Python

```
# Python program to print a
# duplicates allowed

def toString(List):
    return ''.join(List)

# Function to print permuta
# This function takes three
# 1. String
# 2. Starting index of the
# 3. Ending index of the st
def permute(a, l, r):
    if l==r:
        print toString(a)
    else:
        for i in xrange(l,
            a[l], a[i] = a
            permute(a, l+1,
            a[l], a[i] = a

# Driver program to test th
string = "ABC"
n = len(string)
a = list(string)
permute(a, 0, n-1)

# This code is contributed
```

C#

```
// C# program to print all
// permutations of a given
using System;

class GFG
{
    /**
    * permutation function
    * @param str string to
    calculate permutation
    * @param l starting inc
    * @param r end index
    */
    private static void pe

    {
```

```
            if (l == r)
                Console.WriteL:
            else
            {
                for (int i = l
                {
                    str = swap
                    permute(st:
                    str = swap
                }
            }
        }

        /**
        * Swap Characters at p
        * @param a string valu
        * @param i position 1
        * @param j position 2
        * @return swapped stri
        */
        public static String s

        {
            char temp;
            char[] charArray =
            temp = charArray[i
            charArray[i] = cha
            charArray[j] = tem
            string s = new str
            return s;
        }

    // Driver Code
    public static void Main()
    {
        String str = "ABC";
        int n = str.Length;
        permute(str, 0, n-1);
    }
    }

    // This code is contribute
```

PHP

```
<?php
// PHP program to print al
// permutations of a given
```

```
/**
* permutation function
* @param str string to
* calculate permutation fo
* @param l starting index
* @param r end index
*/
function permute($str, $l,
{
    if ($l == $r)
        echo $str. "\n";
    else
    {
        for ($i = $l; $i <
        {
            $str = swap($s
            permute($str, 
            $str = swap($s
        }
    }
}

/**
* Swap Characters at posit
* @param a string value
* @param i position 1
* @param j position 2
* @return swapped string
*/
function swap($a, $i, $j)
{
    $temp;
    $charArray = str_split
    $temp = $charArray[$i]
    $charArray[$i] = $char
    $charArray[$j] = $temp
    return implode($charAr
}

// Driver Code
$str = "ABC";
$n = strlen($str);
permute($str, 0, $n - 1);

// This code is contribute
?>
```

Output:

```
ABC
ACB
BAC
BCA
CBA
CAB
```

Algorithm Paradigm: Backtracking

Time Complexity: O(n*n!) Note that there are n! permutations and it requires O(n) time to print a permutation.

Note : The above solution prints duplicate permutations if there are repeating characters in input string. Please see below link for a solution that prints only distinct permutations even if there are duplicates in input.
Print all distinct permutations of a given string with duplicates.
Permutations of a given string using STL

Another approach:

C++

```
#include <bits/stdc++.h>
#include <string>
using namespace std;

void permute(string s , st
{
    if(s.length() == 0)
    {
        cout<<answer<<"  ",
        return;
    }
    for(int i=0 ; i<s.leng
    {
        char ch = s[i];
        string left_substr
        string right_subst
        string rest = left_
        permute(rest , ans
    }

}

int main()
{
    string s;
    string answer="";

    cout<<"Enter the strin
    cin>>s;

    cout<<"\nAll possible
    permute(s , answer);
    return 0;
}
```

Java

```
import java.util.*;

class GFG{

static void permute(String
{
    if (s.length() == 0)
    {
        System.out.print(a
        return;
    }

    for(int i = 0 ;i < s.l
    {
        char ch = s.charAt
        String left_substr
        String right_subst
        String rest = left_
        permute(rest, answ
    }
}

// Driver code
public static void main(St
{
    Scanner scan = new Sca

    String s;
    String answer="";

    System.out.print("Ente
    s = scan.next();

    System.out.print("\nAl
    permute(s, answer);
}
}

// This code is contribute
```

Python3

```
def permute(s, answer):
    if (len(s) == 0):
        print(answer, end =
        return

    for i in range(len(s))
        ch = s[i]
        left_substr = s[0:
        right_substr = s[i
        rest = left_substr
        permute(rest, answe

# Driver Code
answer = ""

s = input("Enter the strin

print("All possible string
permute(s, answer)

# This code is contributed
```

```
Output:
Enter the string : abc
All possible strings are :
```

Time Complexity: O(n*n!) The time complexity is the same as the above approach, i.e. there are n! permutations and it requires O(n) time to print a permutation.

Please write comments if you find the above codes/algorithms incorrect, or find other ways to solve the same problem.

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