

25/03/2023

Generate Parantheses

We are given n pair of parantheses, write a function to generate all combinations of well formed parantheses.

$n = 1 \rightarrow ()$ } only 1 option

$n = 2 \rightarrow (()), ()()$ } only 2 options

$n = 3 \rightarrow ((()), (()()), ()()(), ()(()), (() ())$
5 options are there

We can observe that if we are having n , then total brackets are $2 \times n$.

$n = 3$

$\left. \begin{array}{l} (\rightarrow 3 \\) \rightarrow 3 \end{array} \right\} 3 + 3 = 6 \text{ } \} 2 \times 3 = 6$

The above question is based on the include and exclude pattern.

output \rightarrow " " , 2 , 2 \rightarrow Open \rightarrow close

include open \rightarrow " (" , 1 , 2 \rightarrow include close \times

include open \rightarrow " ((" , 0 , 2 \rightarrow include close \rightarrow ") " , 1 , 1

include open \rightarrow " (() " , 0 , 1 \rightarrow include close \rightarrow " () (" , 0 , 1 \times

We can only including the closing bracket, if on left count of opening bracket $>$ count of closing bracket. But this has an issue that we will have to count on the left & hence we need to think of some condition in terms of remaining brackets. In left part formulae will be $open > close$ & then only we will be including the closed bracket but in right part $close > open$ & hence we will be using the closing bracket. When $close == open$, we don't have to add closing bracket.

Code

```
void solve (vector <string > &ans, int n, int open,
            int close, string output) {
    // Base case - Both brackets have finished
    if (open == 0 & & close == 0) {
        ans.push_back (output);
        return;
    }
    // Include opening bracket if they exist.
    if (open > 0) {
        output.push_back ('('); // Push opening bracket
        solve (ans, n, open-1, close, output);
        // Backtracking - create original state
        output.pop_back ();
    }
    // Can we put closing bracket?
    if (close > open) {
        output.push_back (')'); // Push closing bracket
        solve (ans, n, open, close-1, output);
        // Reduced count of closing brackets
    }
}
```



```
// Backtracking
Output.pop-back();
```

```
}
```

```
}
```

```
// Printing ans vector in main function
```

```
In main() print the ans vector of strings.
```

Note →

Understanding the close > open condition

1) This close & open is of the remaining brackets.

This is very important to understand

On Left side

✓ open < close

(()) → invalid

✓ open == close

(()) → no need to add bracket

✓ open > close

((→ closing bracket can be added now

((

left side → right side

remaining closing bracket = 1 } close > open
remaining opening bracket = 0 }

Hence we need to add the closing bracket & that's why close > open condition needs to be mentioned.

→ Asked a lot in D.E. Show & Arcesium

Letter combination of phone number

Given a string containing digits from 2-9 inclusive, return all possible letter combinations that number could represent. Return answer in any order.

2 → abc

3 → def

4 → ghi

5 → jkl

6 → mno

7 → pqrs

8 → tuv

9 → wxyz

mapping

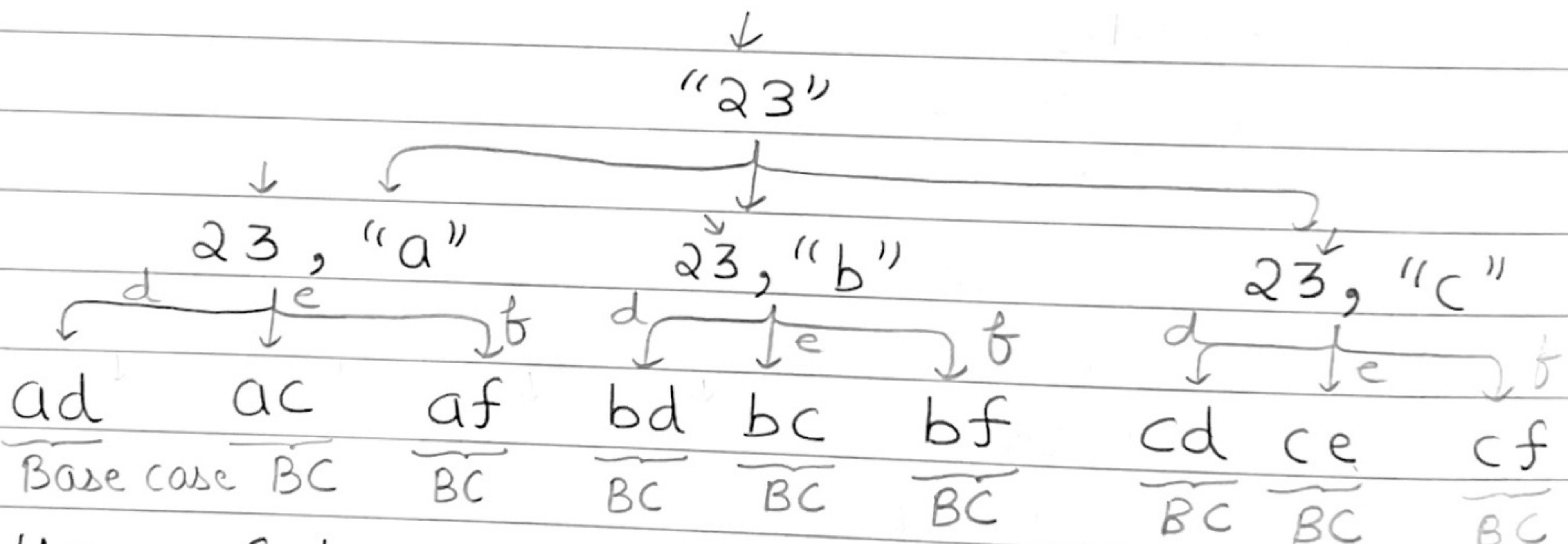
i/p → "2"

```

graph TD
    2["2"] --> a
    2 --> b
    2 --> c
  
```

} 3 possible combinations

i/p → "23"



Hence 9 possible combinations are possible.

Code

```

void solve (vector <string> &ans, int index,
            string, output, string digits,
            vector <string> &mapping) {

```

Can be handled in main function

```

    if (digits.length() == 0) // Empty digits string
        return;

```

```

    if (index >= digits.length()) {
        ans.push_back(output);
        return;
    }

```

}

Base case

// Solve 1 case & then recursion handles it

int digit = digits[index] - '0';

character

used to convert
to integer

string value = mapping[digit]; // Store the
mapping

// Traverse the mapping

for (int i = 0; i < value.length(); i++) {

char ch = value[i]; // Store char of
mapping in ch.

output.push_back(ch); // Push that in
o/p string.

solve(ans, index+1, output, digits, mapping);
↳ move forward in mapping

// Backtracking

output.pop_back(); // If we have used
push back, then use pop-back also.

}

}