

■■ Count and Say

Describe what you see — run-length encoding on strings

● String

■ MEDIUM

■ What You Will Learn

- What 'run-length encoding' means
- How to build the next term from the current one
- Using `StringBuilder` for efficient string building
- Iterative sequence generation pattern

■ Intuition First

Start with '1'. Describe it: 'one 1' → '11'. Describe '11': 'two 1s' → '21'. Describe '21': 'one 2, one 1' → '1211'. Each term is literally a verbal description of the previous term's digits. Count consecutive same digits, then say the count followed by the digit.

```
n=1: '1'
n=2: 'one 1'      → '11'
n=3: 'two 1s'     → '21'
n=4: 'one 2, one 1' → '1211'
n=5: 'one 1, one 2, two 1s' → '111221'
```

How to generate next from current:

```
current = '1211'
i=0: '1' appears 1 time → append '1','1'
i=1: '2' appears 1 time → append '1','2'
i=2: '1' appears 2 times → append '2','1'
next = '111221' ✓
```

■ Java Code

```
1  class Solution {
2      public String countAndSay(int n) {
3          String result = "1";
4
5          for (int i = 1; i < n; i++) {
6              result = getNext(result);
7          }
8          return result;
9      }
10
11     private String getNext(String s) {
12         StringBuilder sb = new StringBuilder();
```

```

13     int i = 0;
14
15     while (i < s.length()) {
16         char digit = s.charAt(i);
17         int count = 0;
18
19         // Count consecutive same digits
20         while (i < s.length() && s.charAt(i) == digit) {
21             count++;
22             i++;
23         }
24         sb.append(count).append(digit);
25     }
26     return sb.toString();
27 }
28 }

```

■ Complexity

Type	Value	Meaning
Time	$O(n * 2^n)$	String length roughly doubles each step; n steps total
Space	$O(2^n)$	StringBuilder for current term

■ Common Mistakes

■ Mistake

Using String concatenation (+) inside loops. Each + creates a new String object. Always use StringBuilder for building strings in loops.

■ Pro Tips

■ Pattern

This is run-length encoding — a real compression technique! RLE is used in image compression (BMP, TIFF). Count and Say is just RLE applied to itself recursively.

■ Quick Revision

✓	Start with '1', build each term from previous
✓	Scan consecutive same chars, count them
✓	Append count then digit to StringBuilder
✓	Repeat n-1 times to get nth term

