App Academy

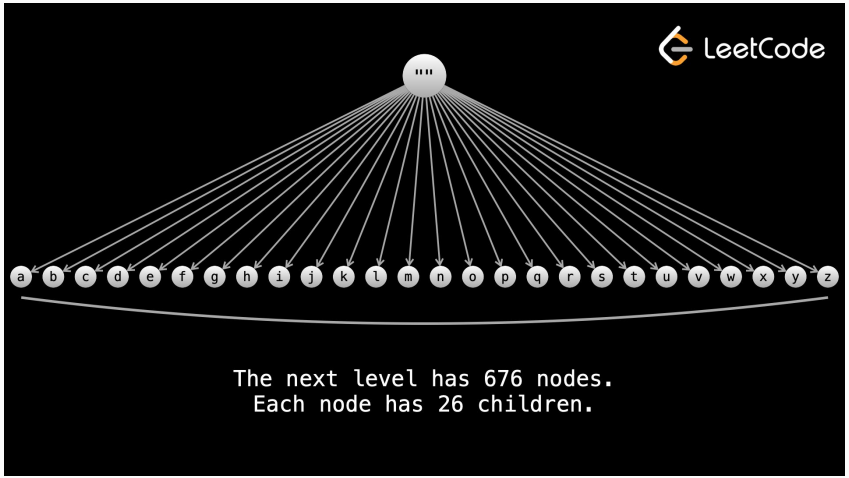
Backtracking

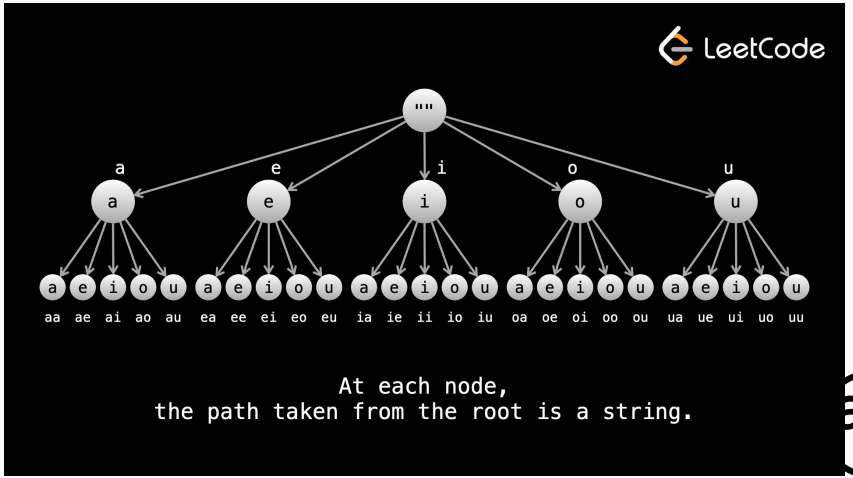
Backtracking

- Backtracking is a algorithmic technique where we solve problems recursively by “building candidates” for solutions and then abandon those candidates (“backtrack”) once we determine that candidate can no longer yield a valid solution.
- Optimization of “exhaustive search”, where we search through all possible candidates.
- This is an important concept because some problems can only be (reasonably) solved via backtracking.
- Most common type of problem that can be solved with backtracking is "find all possible ways to do something”
- Backtracking problems run in exponential runtime.

Example

Let's take a simple example where we're building all possible strings with a length of n. To check all possible strings, we'd be running a $O(26^n)$ runtime. But what if vowels-only was a constraint? We can discard all non-vowel subtrees and improve runtime to $O(5^n)$.



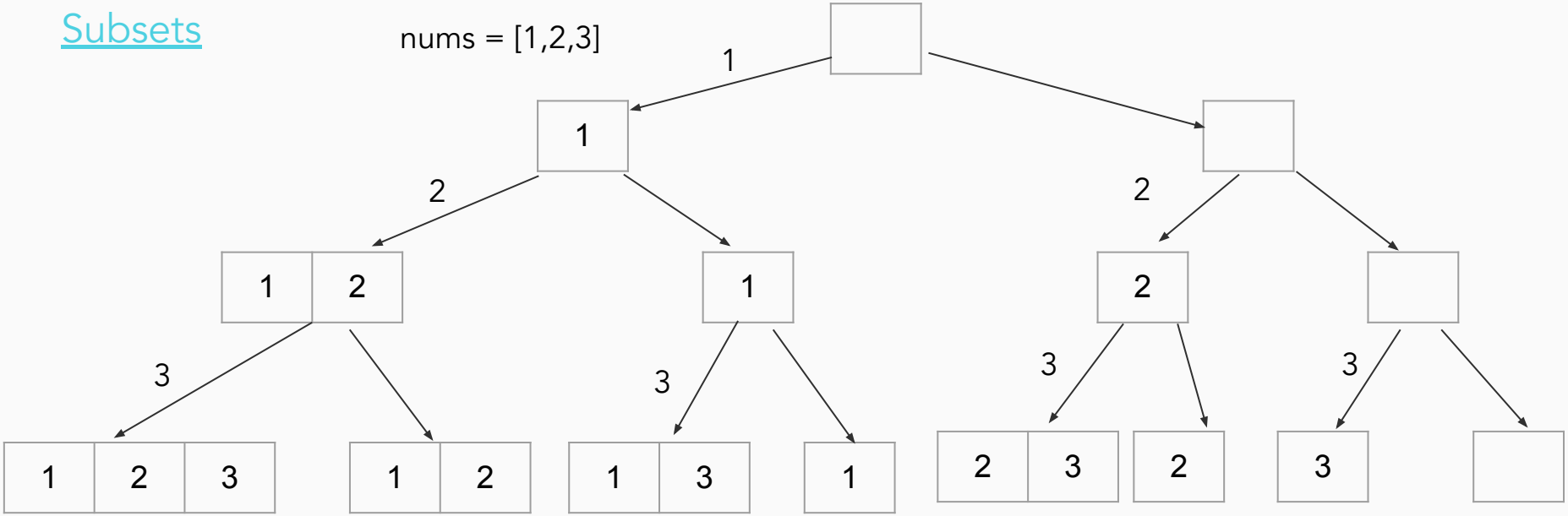


Backtracking skeleton

```
// let curr represent the thing you are building
// it could be an array or a combination of variables

function backtrack(curr) {
    if (base case) {
        Increment or add to answer
        return
    }

    for (iterate over input) {
        Modify curr
        backtrack(curr)
        Undo whatever modification was done to curr
    }

}
```

Demo

Subsets



For each node, there are two different paths we can take.
Either add nums[i] or skip it

Questions?

Let's practice!

- Review
  - Combination Sum
- Bonus
  - N-Queens