

# 096. Unique Binary Search Trees

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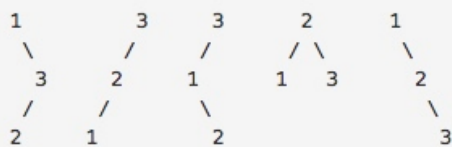
- Dynamic Programming + tree

### Description

Given an integer  $n$ , generate all structurally unique **BST's** (binary search trees) that store values  $1 \dots n$ .

For example,

Given  $n = 3$ , your program should return all 5 unique BST's shown below.



### 1. Thought line

1, 2, ..., n

Binary Search Tree: left child < node < right child

$n=1: \{1\} = 1$

$n=2: \{1, 2\} = 2$

(1) ① | 2

(2) 1 | ②

$n=3: \{1, 2, 3\} = 5$

(1) ① | 2, 3

(2) 1, ② | 3

(3) 1, 2, ③

$n=4: \{1, 2, 3, 4\} = 14$

(1) ① | 2, 3, 4

5

(2) 1, ② | 3, 4

2

(3) 1, 2, ③ | 4

2

(4) 1, 2, 3, ④

5

$\Rightarrow 1, 2, 3, \textcircled{i}, i+1, \dots, n$

$i-1$

$n - (i+1) + 1 = n - i - 1 + 1 = n - i$

## 2. Dynamic Programming + tree

```
class Solution {
public:
    int numTrees(int n) {
        vector<int> uniqueBST(n+1, 1);

        for (int i=2; i<=n; ++i){
            int uniqueBSTofCurrentNode = 0;
            for (int node = 1; node<=i; ++node){
                int leftNodeNum = node-1, rightNodeNum = i-node;
                uniqueBSTofCurrentNode += uniqueBST[leftNodeNum]*uniqueBST[rightNodeNum];
            }
            uniqueBST[i] = uniqueBSTofCurrentNode;
        }
        return uniqueBST[n];
    }
};
```

