



## DOMAIN WINTER WINNING CAMP 2024

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**Semester:** 6th

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### VERY EASY

#### 1. Generate Numbers with a Given Sum

Generate all numbers of length  $n$  whose digits sum up to a target value  $sum$ , The digits of the number will be between 0 and 9, and we will generate combinations of digits such that their sum equals the target.

**Example 1:**

**Input:**  $n = 2$  and  $sum = 5$

**Output:** 14 23 32 41 50

**Constraints:**

**$1 \leq n \leq 9$ : The number of digits must be between 1 and 9.**

**$1 \leq sum \leq 100$ : The sum of the digits must be between 1 and 100.**

**The first digit cannot be zero if  $n > 1$ .**

**CODE:**

```
#include <iostream>
#include <vector>
using namespace std;

void generateNumbers(int n, int sum, string current, vector<string> &result) {
    if (n == 0 && sum == 0) {
        result.push_back(current);
        return;
    }
    if (n == 0 || sum < 0) return;

    int start = current.empty() ? 1 : 0;
    for (int i = start; i <= 9; ++i) {
        generateNumbers(n - 1, sum - i, current + to_string(i), result);
    }
}

int main() {
    int n = 2, sum = 5;
    vector<string> result;
    generateNumbers(n, sum, "", result);
    for (const string &num : result) {
        cout << num << " ";
    }
}
```

```
}  
return 0;  
}
```

## Output

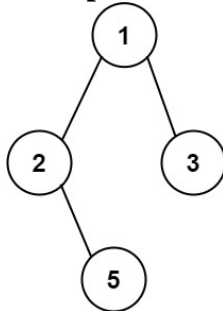
14 23 32 41 50

### Easy

## 2. Binary Tree Paths

Given the root of a binary tree, return all root-to-leaf paths in any order.  
A leaf is a node with no children.

**Example 1:**



**Input:** root = [1,2,3,null,5] **Output:** ["1->2->5", "1->3"]

**Example 2:**

**Input:** root = [1] **Output:** ["1"]

**Constraints:**

The number of nodes in the tree is in the range [1, 100].

-100 <= Node.val <= 100

**CODE:**

```
#include <iostream>  
#include <vector>  
#include <string>  
using namespace std;
```

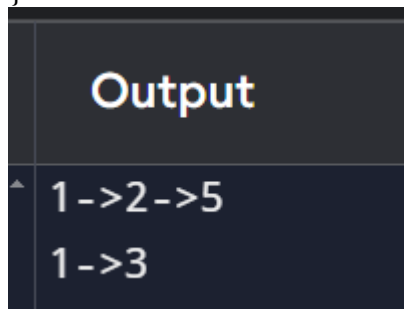
```
struct TreeNode {  
    int val;  
    TreeNode *left, *right;  
    TreeNode(int x) : val(x), left(nullptr), right(nullptr) {}  
};
```

```
void dfs(TreeNode *root, string path, vector<string> &paths) {
    if (!root) return;
    path += to_string(root->val);
    if (!root->left && !root->right) {
        paths.push_back(path);
        return;
    }
    path += "->";
    dfs(root->left, path, paths);
    dfs(root->right, path, paths);
}
```

```
vector<string> binaryTreePaths(TreeNode *root) {
    vector<string> paths;
    dfs(root, "", paths);
    return paths;
}
```

```
int main() {
    TreeNode *root = new TreeNode(1);
    root->left = new TreeNode(2);
    root->right = new TreeNode(3);
    root->left->right = new TreeNode(5);

    vector<string> result = binaryTreePaths(root);
    for (const string &path : result) {
        cout << path << endl;
    }
    return 0;
}
```



**Output**

```
1->2->5
1->3
```

**Medium:**

### 3. Combinations

Given two integers n and k, return all possible combinations of k numbers chosen from the range [1, n].

You may return the answer in any order.



## Example 1:

**Input:**  $n = 4, k = 2$

**Output:** `[[1,2],[1,3],[1,4],[2,3],[2,4],[3,4]]`

**Explanation:** There are 4 choose 2 = 6 total combinations.

Note that combinations are unordered, i.e., [1,2] and [2,1] are considered to be the same combination.

## Example 2:

**Input:**  $n = 1, k = 1$

**Output:** `[[1]]`

**Explanation:** There is 1 choose 1 = 1 total combination.

## Constraints:

$1 \leq n \leq 20$

$1 \leq k \leq n$

## CODE:

```
#include <iostream>
```

```
#include <vector>
```

```
using namespace std;
```

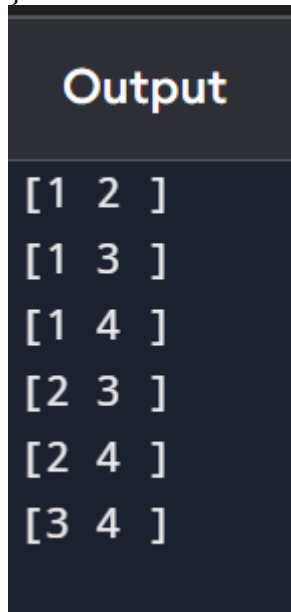
```
void combineHelper(int start, int n, int k, vector<int> &current, vector<vector<int>> &result) {  
    if (k == 0) {  
        result.push_back(current);  
        return;  
    }  
    for (int i = start; i <= n; ++i) {  
        current.push_back(i);  
        combineHelper(i + 1, n, k - 1, current, result);  
        current.pop_back();  
    }  
}
```

```
vector<vector<int>> combine(int n, int k) {  
    vector<vector<int>> result;  
    vector<int> current;  
    combineHelper(1, n, k, current, result);  
    return result;  
}
```

```
int main() {  
    int n = 4, k = 2;  
    vector<vector<int>> result = combine(n, k);  
    for (const auto &comb : result) {  
        cout << "[";  
        for (int num : comb) cout << num << " ";  
        cout << "]" << endl;  
    }  
}
```

return 0;

}



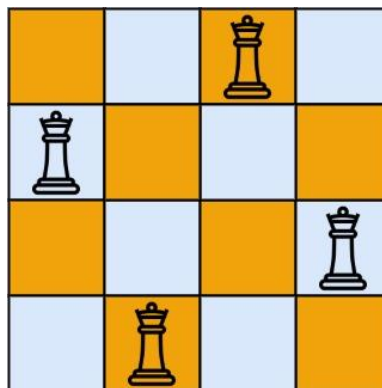
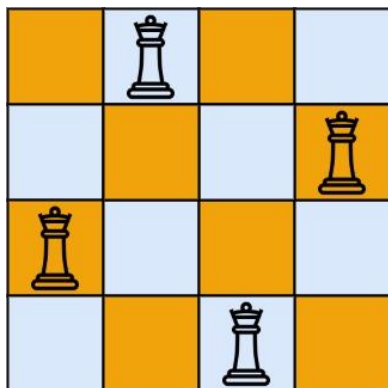
**Hard:**

#### 4. N-Queens II

The n-queens puzzle is the problem of placing n queens on an n x n chessboard such that no two queens attack each other.

Given an integer n, return the number of distinct solutions to the n-queens puzzle.

**Example 1:**



**Input: n = 4**

**Output: 2**

**Explanation:** There are two distinct solutions to the 4-queens puzzle as shown.

**Example 2:**

**Input: n = 1**

**Output: 1**



## Constraints:

$1 \leq n \leq 9$

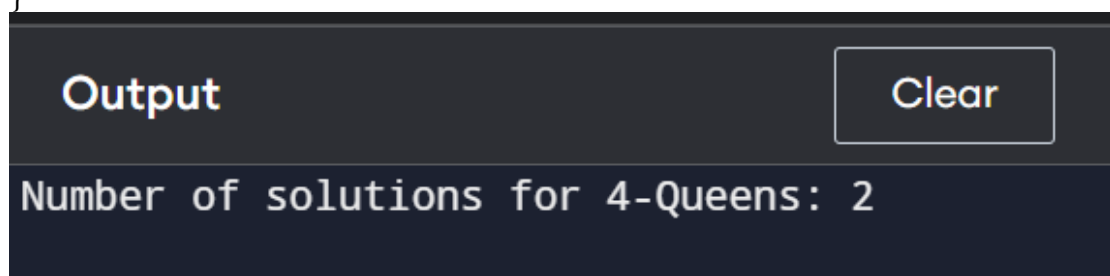
## CODE:

```
#include <iostream>
#include <vector>
using namespace std;
```

```
void solve(int row, int n, vector<int> &cols, vector<int> &diags1, vector<int> &diags2, int
&count) {
    if (row == n) {
        ++count;
        return;
    }
    for (int col = 0; col < n; ++col) {
        if (cols[col] || diags1[row - col + n - 1] || diags2[row + col]) continue;
        cols[col] = diags1[row - col + n - 1] = diags2[row + col] = 1;
        solve(row + 1, n, cols, diags1, diags2, count);
        cols[col] = diags1[row - col + n - 1] = diags2[row + col] = 0;
    }
}
```

```
int totalNQueens(int n) {
    vector<int> cols(n, 0), diags1(2 * n - 1, 0), diags2(2 * n - 1, 0);
    int count = 0;
    solve(0, n, cols, diags1, diags2, count);
    return count;
}
```

```
int main() {
    int n = 4;
    cout << "Number of solutions for " << n << "-Queens: " << totalNQueens(n) << endl;
    return 0;
}
```



## Very Hard:

## 5. Word Ladder II

A transformation sequence from word `beginWord` to word `endWord` using a dictionary `wordList` is a sequence of words `beginWord -> s1 -> s2 -> ... -> sk` such that: Every adjacent pair of words differs by a single letter.



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Every  $s_i$  for  $1 \leq i \leq k$  is in wordList. Note that beginWord does not need to be in wordList.  $sk == endWord$

Given two words, beginWord and endWord, and a dictionary wordList, return all the shortest transformation sequences from beginWord to endWord, or an empty list if no such sequence exists. Each sequence should be returned as a list of the words [beginWord,  $s_1$ ,  $s_2$ , ...,  $s_k$ ].

## Example 1:

**Input:** beginWord = "hit", endWord = "cog", wordList =

["hot","dot","dog","lot","log","cog"]

**Output:** [["hit","hot","dot","dog","cog"],["hit","hot","lot","log","cog"]]

**Explanation:** There are 2 shortest transformation sequences:

"hit" -> "hot" -> "dot" -> "dog" -> "cog"

"hit" -> "hot" -> "lot" -> "log" -> "cog"

## Example 2:

**Input:** beginWord = "hit", endWord = "cog", wordList = ["hot","dot","dog","lot","log"]

**Output:** []

**Explanation:** The endWord "cog" is not in wordList, therefore there is no valid transformation sequence.

## Constraints:

$1 \leq \text{beginWord.length} \leq 5$

$\text{endWord.length} == \text{beginWord.length}$

$1 \leq \text{wordList.length} \leq 500$

$\text{wordList}[i].\text{length} == \text{beginWord.length}$

beginWord, endWord, and wordList[i] consist of lowercase English letters.

$\text{beginWord} \neq \text{endWord}$

All the words in wordList are unique.

The sum of all shortest transformation sequences does not exceed 105.

## CODE:

```
#include <iostream>
```

```
#include <vector>
```

```
#include <unordered_set>
```

```
#include <queue>
```

```
using namespace std;
```

```
vector<vector<string>> findLadders(string beginWord, string endWord, vector<string>> &wordList) {
```

```
    unordered_set<string> dict(wordList.begin(), wordList.end());
```

```
    vector<vector<string>> result;
```

```
    if (dict.find(endWord) == dict.end()) return result;
```

```
    queue<vector<string>> paths;
```

```
    paths.push({beginWord});
```

```
    int level = 1, minLevel = INT_MAX;
```

```
    unordered_set<string> visited;
```

```
    while (!paths.empty()) {
```

```
        vector<string> path = paths.front();
```

```
paths.pop();
if (path.size() > level) {
    for (const string &word : visited) dict.erase(word);
    visited.clear();
    level = path.size();
    if (level > minLevel) break;
}

string last = path.back();
for (int i = 0; i < last.size(); ++i) {
    string next = last;
    for (char c = 'a'; c <= 'z'; ++c) {
        next[i] = c;
        if (!dict.count(next)) continue;
        visited.insert(next);
        vector<string> newPath = path;
        newPath.push_back(next);
        if (next == endWord) {
            result.push_back(newPath);
            minLevel = level;
        } else {
            paths.push(newPath);
        }
    }
}
}
return result;
}

int main() {
    string beginWord = "hit", endWord = "cog";
    vector<string> wordList = {"hot", "dot", "dog", "lot", "log", "cog"};
    vector<vector<string>> result = findLadders(beginWord, endWord, wordList);
    for (const auto &path : result) {
        for (const string &word : path) {
            cout << word << " ";
        }
        cout << endl;
    }
    return 0;
}
```

## Output

```
hit hot dot dog cog
hit hot lot log cog
```





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