1639. Number of Ways to Form a Target String Given a Dictionary

Hard | Topics | Companies | Hint

You are given a list of strings of the **same length** `words` and a string `target`.

Your task is to form `target` using the given `words` under the following rules:

- `target` should be formed from left to right.
- To form the `i^th` character (**0-indexed**) of `target`, you can choose the `k^th` character of the `j^th` string in `words` if `target[i] = words[j][k]`.
- Once you use the `k^th` character of the `j^th` string of `words`, you **can no longer** use the `x^th` character of any string in `words` where `x <= k`. In other words, all characters to the left of or at index `k` become unusuable for every string.
- Repeat the process until you form the string `target`.

Notice that you can use **multiple characters** from the **same string** in `words` provided the conditions above are met.

Return *the number of ways to form* `target` *from* `words`. Since the answer may be too large, return it **modulo** `10^9 + 7`.

words:

w_1 : $a_1 a_2 \cdots a_n$

w_2 : $b_1 b_2 \cdots b_n$

:

w_m : $m_1 m_2 \cdots m_n$.

if len(target) > len(words[0])

return 0

multi backtracking ? NG.

Example 1:

```
Input: words = ["acca","bbbb","caca"], target = "aba"
Output: 6
Explanation: There are 6 ways to form target.
"aba" -> index 0 ("acca"), index 1 ("bbbb"), index 3 ("caca")
"aba" -> index 0 ("acca"), index 2 ("bbbb"), index 3 ("caca")
"aba" -> index 0 ("acca"), index 1 ("bbbb"), index 3 ("acca")
"aba" -> index 0 ("acca"), index 2 ("bbbb"), index 3 ("acca")
"aba" -> index 1 ("caca"), index 2 ("bbbb"), index 3 ("acca")
"aba" -> index 1 ("caca"), index 2 ("bbbb"), index 3 ("caca")
```

aba

acca

bbbb

caca

① aba — acca, caca

2 * 2 * 2 = 8

② aba — bbbb

- if caca (aba) → 8 - 2 = 6

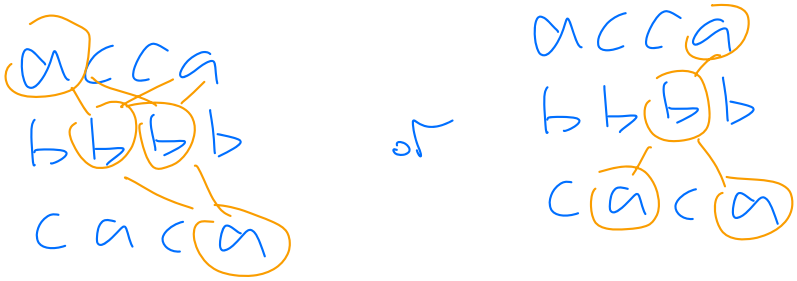
bbbb only

③ aba — acca, caca

th2 : greedy / DP

acca
bbbb
caca

aba



or

4 + 2 = 6

1° precompute freq of each char.

2° DP

GPT4o

Python Code:

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```
def numWays(words, target):
    MOD = 10**9 + 7
    m, n = len(words[0]), len(target)

    # Step 1: Precompute the frequency of each character in every column
    freq = [dict() for _ in range(m)]
    for word in words:
        for i, char in enumerate(word):
            freq[i][char] = freq[i].get(char, 0) + 1

    # Step 2: Initialize a DP table
    dp = [0] * (n + 1)
    dp[0] = 1  # There's 1 way to form an empty target string

    # Step 3: Fill DP table column by column
    for i in range(m):  # Iterate over each column in words
        for j in range(n, 0, -1):  # Iterate backward to prevent overwriting dp[j-1]
            if target[j - 1] in freq[i]:
                dp[j] += dp[j - 1] * freq[i][target[j - 1]]
                dp[j] %= MOD

    return dp[n]
```

acca
bbbb
caca

→ [{a:1, b:1, c:1},
{c:1, b:1, a:1},
{c:2, b:1},
{a:2, b:1}]

dp [1|1|0|0|0]

acca
bbbb
caca

acba → m = 4, n = 3

```
for i in range(4):
    for j in range(3, 0, -1):
        if target[j-1] in freq[i]:
            dp[j] += dp[j-1] * freq[i][target[j-1]]
            dp[j] %= mod
```

(i, j) = (0, 3) target[2] = 'a' in freq[0]

[1|1|0|0|0] dp[3] += dp[2] (0) × freq[0]['a'] (1)

(i, j) = (0, 2) target[1] = 'b' in freq[0]

[1|1|0|1|0] dp[2] += dp[1] (0) × freq[0]['b'] (1)

(i, j) = (0, 1) target[0] = 'a' in freq[0]

$dp[1] += \underbrace{dp[0]}_{1} \times \underbrace{freq[0]['a']}_{1}$

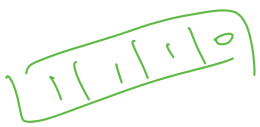
$(i,j) = (1,3)$ target[2] in freq[1]

'a'

$dp[3] += \underbrace{dp[2]}_{0} \times \underbrace{freq[1]['a']}_{1}$

$(i,j) = (1,2)$ target[1] in freq[1]

'b'



$dp[2] += \underbrace{dp[1]}_{1} \times \underbrace{freq[1]['b']}_{1}$

$(i,j) = (1,1)$ target[0] in freq[1]

'a'

$dp[1] += \underbrace{dp[0]}_{1} \times \underbrace{freq[1]['a']}_{1}$

$(2,3)$ target[2] NOT in freq[2]

'a'

$(2,2)$ 'b' in

$dp[2] += \underbrace{dp[1]}_{2} \times \underbrace{freq[2]['b']}_{1}$

$(2,1)$ 'a' NOT in freq[2]

(3, 3) 'a' in freq[3]

1 | 2 | 3 | 6

$dp[3] += \frac{dp[2]}{3} \times \frac{freq[3]['a']}{2}$

(3, 2) 'b' in freq[3]

1 | 2 | 5 | 6

$dp[2] += \frac{dp[1]}{2} \times \frac{freq[3]['b']}{1}$

(3, 1) 'a' in freq[3]

1 | 4 | 5 | 6

$dp[1] += \frac{dp[0]}{1} \times \frac{freq[3]['a']}{2}$

return $\frac{dp[n=3]}{6}$