

411. Minimum Unique Word Abbreviation

[Leetcode Link](#)

Problem Explanation

Given a target string and a set of strings in a dictionary, you are to find an abbreviation of this target string with the smallest possible length such that it doesn't conflict with abbreviations of the strings in the dictionary.

It is important to note that each number or letter in the abbreviation is considered length = 1.

For example, given `target = "apple"` and `dictionary = ["blade"]`, the result would be "a4" because "5" or "4e" might conflict with "blade".

Approach

The approach is to generate all possible abbreviations of a given target string and then check these against the dictionary to find the abbreviation that does not conflict with any of the words in the dictionary. If there are multiple possible abbreviations with the same shortest length, any of them can be returned.

The way to generate all possible abbreviations is by iterating through all the bitmasks of the length of the string. Each bit in the bitmask represents whether the corresponding character in the string is replaced by a number (1) or remained as is (0). When we find a candidate abbreviation, it means that this abbreviation does not conflict with any of the words in the dictionary. We then store it in a list of possible abbreviations.

After generating all possible abbreviations, we go through this list, calculate their length and return the one with the smallest possible length.

Let's see through examples how it works.

Consider `target = "apple"` and `dictionary = ["blade"]`. The target word "apple" can be abbreviated as ["5", "4e", "a4"....]. And the dictionary word "blade" can be abbreviated as ["5", "4e", "b4"....]. It can be seen that "5" or "4e" is conflict with "blade" because they're both valid abbreviations for "apple" and "blade". We then need to find a valid abbreviation for "apple" that does not conflict with any of the abbreviations for "blade", return it with the smallest possible length which is "a4".

Solution

C++

```
1
2  cpp
3  class Solution {
4  public:
5      string minAbbreviation(string target, vector<string>& dictionary) {
6          const int m = target.length();
7          vector<int> masks;
8          for (const string& word : dictionary) {
9              if (word.length() != m)
10                 continue;
11                 // Compute each valid word's mask
12                 masks.push_back(getMask(target, word));
13             }
14             // If there's no word with the same length, simply return the length
15             if (masks.empty())
16                 return to_string(m);
17             // Compute all the abbreviations
18             vector<string> abbrs;
19             const int maxCand = pow(2, m);
20             for (int cand = 0; cand < maxCand; ++cand)
21                 if (all_of(begin(masks), end(masks), [cand](int mask) { return cand & mask; })))
22                     abbrs.push_back(getAbbr(target, cand));
23             string ans = target;
24             // Among all the abbreviations find the smallest one
25             for (const string& abbr : abbrs)
26                 if (getAbbrLen(abbr) < getAbbrLen(ans))
27                     ans = abbr;
28             return ans;
29         }
30     private:
31         int getMask(const string& target, const string& word) {
32             const int m = target.length();
33             // If two characters at the same position are the same, the mask bit is 0
34             // Otherwise, the mask bit is 1
35             int mask = 0;
36             for (int i = 0; i < m; ++i)
37                 if (word[i] != target[i])
38                     mask |= 1 << m - 1 - i;
39             return mask;
40         }
41     // Convert the candidate to the abbreviation
42     string getAbbr(const string& target, int cand) {
43         const int m = target.length();
44         string abbr;
45         int replacedCount = 0;
46         for (int i = 0; i < m; ++i)
47             if (cand >> m - 1 - i & 1) {
48                 if (replacedCount > 0)
49                     abbr += to_string(replacedCount);
50                     abbr += target[i];
51                     replacedCount = 0;
52             } else {
53                 ++replacedCount;
54             }
55             if (replacedCount > 0)
56                 abbr += to_string(replacedCount);
57             return abbr;
58         }
59     int getAbbrLen(const string& abbr) {
60         int abbrLen = 0;
61         int i = 0, j = 0;
62         while (i < abbr.length()) {
63             if (isalpha(abbr[j]))
64                 ++j;
65             else
66                 while (j < abbr.length() && isdigit(abbr[j]))
67                     ++j;
68             ++abbrLen;
69             i = j;
70         }
71         return abbrLen;
72     }
73 };
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