Element Blocks

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Definitions

An element block is a solid colored cube with $[1-2]$ characters and a number on each face.

Figure 1: Uncle Goose Element Block

A list of blocks is represented by the construction:

$$l = [Block, Block, Block, \cdots]$$

where

$$Block = [(Face), (Face), (Face), (Face), (Face), (Face)]$$

$$Face = [(text, number, color)]$$

$$text = \text{a string of English characters with length } [1-2]$$

$$number \in \mathbb{Z}^+$$

$$color \in \{red, blue, orange, pink, purple, green\}$$

For example, a list of three element blocks:

$$\begin{aligned} l = [&[(Cr, 24, red), (Bh, 107, blue), (Nd, 60, orange), (N, 7, green), (In, 49, purple), (Al, 13, pink)],\\ &[(Sg, 106, orange), (C, 6, green), (Pr, 59, red), (V, 23, blue), (Ge, 32, purple), (Es, 99, pink)],\\ &[(B, 5, green), (Ce, 58, red), (Ti, 22, blue), (Co, 27, orange), (Md, 101, purple), (Cf, 98, pink)]] \end{aligned}$$

A word dictionary d is defined as a set of distinct non-zero length strings containing English characters.

For example:

$$d = \{approach, zkasfwq, hikikomori, singularity, cardinality, timemachine, stroopwaffle\}$$

Element Word Composition

0.1 Finding Words

Given a list of element blocks l and a word dictionary d, find all words in d that can be created by placing blocks in l adjacent to each other. Include the block indices in l used to create each word; the indices must be listed in the order they are used in the word. Assume that word matching is case insensitive.

0.2 Maximizing Utilization

Given a list of element blocks l and a word dictionary d, find all words in d that can be created by placing blocks in l adjacent to each other, utilizing the **greatest number of blocks**. Include the indices the block indices in l used to create each word; the indices must be listed in the order they are used in the word. Assume that word matching is case insensitive.

Colorful Word Composition

0.3 Separating Peas and Carrots

Given a list of element blocks l and a word dictionary d, find all words in d that can be created by placing blocks in l adjacent to each other such that **no two adjacent blocks are the same color**. Include the block indices in l used to create each word; the indices must be listed in the order they are used in the word. Assume that word matching is case insensitive.

0.4 A Rainbow Of Sorts

Given a list of element blocks l and a word dictionary d, find all words in d that can be created by placing blocks in l adjacent to each other such that **no two blocks are the same color**. Include the block indices in l used to create each word; the indices must be listed in the order they are used in the word. Assume that word matching is case insensitive.

0.5 Jack is A Dull Boy

Given a list of element blocks l and a word dictionary d, find all words in d that can be created by placing blocks in l adjacent to each other such that **all blocks are the same color**. Include the indices of the blocks in l used to create each word; the indices must be listed in the order they are used in the word. Assume that word matching is case insensitive.

Word Number Fun

0.6 Optimus Prime

Given a list of element blocks l and a word dictionary d, find all words in d that can be created by placing blocks in l adjacent to each other such that the **sum of block numbers is the greatest possible prime**. Include the block indices in l used to create each word; the indices must be listed in the order they are used in the word. Assume that word matching is case insensitive.

0.7 Increasingly Mad

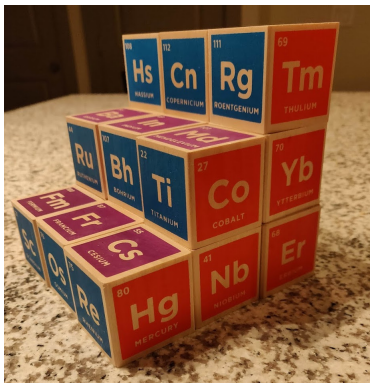
Given a list of element blocks l and a word dictionary d, find all words in d that can be created by placing blocks in l adjacent to each other such that **each block number is increasing**. Each block must either be the leftmost block or have a number greater than or equal to the block to its left. Include the block indices in l used to create each word; the indices must be listed in the order they are used in the word. Assume that word matching is case insensitive.

Stairway to Block Heaven

An $n-$staircase is formed by taking n, nth length rows of increasingly stacked $[1-n]$th height columns as pictured below.

Figure 2: n-staircases

(a) 2-staircase



(b) 3-staircase

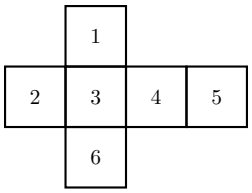
Given a list of element blocks l, a non-negative integer n, and a word dictionary d, find all placements of blocks such that when viewed from each perspective (front, top, left, right, back):

1. Each row forms a word in d when read horizontally from left to right.
2. Each column forms a word in d when read vertically from top to bottom.

Each perspective is defined as follows:

- top - $(n \times n)$ view looking down on the staircase with the nth height columns on top
- front - $(n \times n)$ view towards the front of the staircase with the the nth length rows on bottom
- left - view with a single nth height column as the leftmost and nth length row on bottom
- right - view with a single nth height column as the rightmost and nth length row on bottom
- back - $(n \times n)$ view with n total nth height columns and n total nth length rows

Assume that blocks are provided such that every face is positively oriented with an index given by the unfolded cube:



Provide your answer by constructing the staircase from the bottom to top level. Each level begins with the row starting in the back left corner. Rows are constructed from left to right. Each block is oriented by the index of its left face when placed. Blocks must be positively oriented.

$$Row = [(block\_index_1, left\_face\_index_1), (block\_index_2, left\_face\_index_2) \cdots (block\_index_n, left\_face\_index_n)]$$

$$Level = [Row_1, Row_2, \cdots Row_\rho], \quad \rho \in [1, n]$$

$$Staircase = [Level_1, Level_2, \cdots, Level_n]$$

$$A = [Staircase_1, Staircase_2, \cdots Staircase_k]$$