Problem 5: Crossword (20 points) [File Upload]

By Daniel Yang

After spending too long playing Ultimate with (a suspiciously large number of) friends, you realize that forgot to finish your English essay! Fortunately, your eccentric English professor has agreed to give you a one-day extension if you can solve his word riddles (although he doesn't seem to realize that you may be able to code your way to a solution).

Problem Background

An $n \times m$ *word rectangle* is a grid of letters with n rows and m columns such that every row and every column, when read left to right and top to bottom respectively, form a valid word. For example, the following is a 5×5 word rectangle:

```
SHOES
HELLO
ELDER
ELECT
PORTS
```

In this case, the row words are SHOES, HELLO, ELDER, ELECT, and PORTS, and the column words are SHEEP, HELLO, OLDER, ELECT, and SORTS. Note that repeating words is perfectly fine.

Submission Instructions

The reference word list you should use has been provided on the website. Only words from this list will be accepted as valid. Submissions should be made to the Google Form linked on the website.

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Part 1 (7 points)

In this part, we only consider *symmetric word squares*. That is, the word rectangle must be square (i.e., $n \times n$), and if we reflect the elements of the square across the main diagonal (i.e., take the transpose), the square remains unchanged. For example, the following is a symmetric 3×3 word square:

```
TEA
EAT
ATE
```

(a) Construct a 4×4 symmetric word square. **[2pts]**

(b) Construct a 6×6 symmetric word square that contains `COSCON` as (at least) one of the words. (Note that for this subpart **only**, we count `COSCON` as a valid word, despite it not being in the list.) **[5pts]**

Part 2 (13 points)

(a) Construct a 3×15 word rectangle. **[3pts]**

(b) Construct a word rectangle (any size) with as many distinct letters as possible. Your score will be determined as a function of the number of distinct letters in your answer. In particular, if the number of distinct letters in your word rectangle is X, then you will be awarded $10 - (21 - X)$ points. **[10pts]**

Note: You may repeat letters in your submitted word rectangle, but your score will be based off of the number of distinct letters in your rectangle.

Now that you've gotten your extension, go finish that essay!

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