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[link to github](https://github.com/synthia2080/CS421Project.git)

Initially, for both parts 1 and parts 2 of the project, we had to write down some examples to find common patterns in the verb agreement. This worked well. Here are some examples of what we did:

Conjugation for the verb have to find common patterns in auxiliary verbs

| Form | Verb |
| --- | --- |
| I | have |
| You | have |
| He/She/It | has |
| We | have |
| They | have |

Conjugation for the verb run to find common patterns in -ing verbs

| Form | Verb |
| --- | --- |
| I | run |
| You | run |
| He/She/It | runs |
| We | run |
| They | run |

This worked well in order to come up with the subject-verb agreement. For each sentence, we considered two major verb groups: is the verb auxiliary or not. For each category, we utilized the above patterns in our code. A similar pattern was used for the verbMistakes, syntacticWellFormedness, semanticsPragmatics, and cosine\_similarity functions.

What didn’t work is trying to find patterns for all the auxiliary verbs like has, do, and go all have a certain pattern for each form. However, auxiliary verbs like should and could break the rules that auxiliary verbs has, do, and go have. We did not consider these variations in auxiliary verbs, so this might have resulted in less accurate mistakes count. So, to improve our results we can make more lists for the verbs and identify different subgroups of verbs within major groups of verbs and then follow a similar process like we did for the major groups. A similar process applies to the verbMistakes and syntacticWellFormedness functions. We can also dive deeper into which antonym and synonym pairs have high cosine similarities. For example, there are some antonym pairs that have a higher cosine similarity than synonym pairs, and this might impact our cosine\_similarity function scoring patterns especially for essays with fewer number of words and sentences as the cosine\_similarity function might result in a lower score if the patterns are not correctly identified with respect to the prompt. Therefore, considering the impact of antonym and synonym pairs on cosine similarity measurements is essential for accurately assessing semantic relationships between words or phrases.

I learned that I don't have to find if every sentence is correct in terms of verbs and adverbs and sentence formation. It is almost impossible to do this because language is ever changing and verbs are part of the open class. Same applies to sentence structures and formations. For instance, *Teacher is nice* would likely be incorrect, while *Technology is correct* is perfectly fine. It is hard to find generalized patterns that account for each specific sentence. However, we can find a generalized pattern for common sentence structures. That is exactly how these autograders work. They need to be generally fair in terms of grading these essays, but they are not perfect either. In terms of perfection, even the pos taggers are not always perfect, but rather fair enough to work with as we saw in homework 3 of this course. The goal of writing these essay autograders is that they can be improved over time with new additions in the word dictionaries, so that things like new slang languages or texting languages can also be incorporated as language changes. Ultimately, no matter how much we try to generalize these rules, there are going to be errors in the autograders when we consider a specific sentence just like how there is inductive bias when humans are grading essays where a grader might give the person slightly more points while another person might give them slightly less points for the same essay.