Problem 1c: Extra Credit

The difference results from ['the', 'of'] being seen as an iterable tuple, whereas simply ['the'] is seen as a string. The __getitem__ method is expecting a tuple parameter, as evidenced by "words: Iterable[str]".

Problem 4a: Syntactic vs. Semantic Relation Types

k = 1

Embedding Space	Semantic	Syntactic	Overall
GloVe 50	0.400	0.276	0.332
GloVe 100	0.445	0.278	0.354
GloVe 200	0.317	0.217	0.262

Our GloVe results generally perform worse than the two word2vec models reported in the paper, except for CBOW on semantic word relations, which has an accuracy of 15.5%. The dimensionality of the embedding space does seem to have an effect on the analogy question accuracy, as the increase from 50 to 100 dimensions slightly improves accuracy across the board, and the increase from 100 to 200 dimensions decreases accuracy across the board.

Problem 4b: Effect of Lenience

k = 2

Embedding Space	Semantic	Syntactic	Overall
GloVe 50	0.566	0.536	0.550
GloVe 100	0.665	0.659	0.662
GloVe 200	0.705	0.672	0.687

The results quite significantly improve across all embedding space dimensionalities. This makes sense, as k = 2 allows for greater leniency in the target word's closeness in ranking to the target vector. Therefore, a greater proportion of analogy questions are considered to be answered correctly.

Problem 4c: Qualitative Evaluation

Analogy Question	Gold Answer	GloVe 50	GloVe 100	GloVe 200
france : paris :: italy : x	rome	rome	rome	rome
france : paris :: japan : x	tokyo	tokyo	tokyo	tokyo
france : paris :: florida : x	tallahassee	miami	florida	florida
big : bigger :: small : x	smaller	larger	larger	smaller
big : bigger :: cold : x	colder	cold	cold	cold
big : bigger :: quick : x	quicker	quick	quick	quick

The largest embedding space GloVe 200 performs best for 'big : bigger :: small : x' with

answering 'smaller'. All three embedding spaces answer incorrectly for 'france : paris :: florida : x', with 100 and 200 even returning the value for w3, when it was supposed to return a different value for w4. For all other analogy questions, the different embedding spaces answer the same. In comparison to the results reported by Mikolov et al., besides the discrepancies noted previously, all three GloVe embedding spaces are returning the value for w3 for the last two analogy questions, instead of returning 'colder' and 'quicker'. Perhaps GloVe has difficulties with the comparative forms of adjectives.