Part 2
- Try different values of s and find one that works best. What is this value? Use this value for the rest of the assignment.
  0.6
- What's the best correlation you get?
  0.6530676735943957
- Uncomment line 108 to print out the similarities and ratings for each wug (comment it out again once you're done with this part). What are two words where the predictions of the model and the human ratings are particularly divergent? Why do you think the model may have trouble with these cases? (both of these scales are arbitrary, so the main thing that matters is the relative ordering. You may want to save your output to a file and open it in a spreadsheet program so you can sort by either value and look for mismatches).
  Two words:
  1. **gleed 0.7809867595912039 5.286**
  2. **pank 0.9258755480553503 5.619**
  I think the model may have trouble with these cases because the Training data does not have many words that are similar to the wug, resulting in a lower similarity score. However, the Training data does not encompass the entire English lexicon, so there may be other words that the participants are associating the wugs with that have gone unaccounted for in the model's similarity calculation.

Part 3
- What's the accuracy of the model on the forced choice task?
  0.7073170731707317
- Which words does the model get wrong (list them all)? For each one, indicate what the model predicts and what it should have predicted instead.
  1. **wug: drice, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['dress', 'price', 'ice', 'dice', 'die', 'dry', 'dye', 'drive']**
  2. **wug: rife, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['write', *'knife'*, *'rough'*, *'roof'*, 'right', 'try', 'cry', 'dry', 'fry', 'writhe', 'eye', 'pry', 'rive', 'rifle', 'rhyme', 'rile', 'rise', 'ride']**
  3. **wug: drit, preferred past tense: NULL, prediction: NULL->ld, match: False, close neighbors: ['drip', 'drift', 'edit', 'dart', 'audit', 'drat', 'drill', 'grit']**
  4. **wug: fleep, preferred past tense: iX->EXt, prediction: NULL->t, match: False, close neighbors: ['leap', 'flap', 'flip', 'flop', 'sleep', 'flee']**
  5. **wug: gleed, preferred past tense: i->E, prediction: NULL->ld, match: False, close neighbors: ['plead', 'glide', 'gild', 'gleam', 'glean', 'lead', 'bleed']**
  6. **wug: glit, preferred past tense: NULL, prediction: NULL->ld, match: False, close neighbors: ['lift', 'list', 'glint', 'flit', 'gloat', 'glut', 'lilt', 'glitter', 'litter', 'slit', 'grit']**
  7. **wug: queed, preferred past tense: i->E, prediction: NULL->ld, match: False, close neighbors: ['wield', 'weed', 'key']**
     a. **Model predicts: queeded [kwidld]**

8. **wug: skride, preferred past tense: 2->5, prediction: NULL->d, match: False, close neighbors: ['side', 'cry', 'sky', 'scribe', 'ride', 'stride']**
9. **wug: gude, preferred past tense: NULL, prediction: NULL->d, match: False, close neighbors: ['goof', 'guide', 'goad', 'gird', 'glue']**
10. **wug: blafe, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['bluff', 'lay', 'blame', 'blaze', 'blare', 'bay', 'belay']**
11. **wug: tesh, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['mesh', 'tell']**
12. **wug: nold, preferred past tense: NULL, prediction: NULL->ld, match: False, close neighbors: ['know', 'fold', 'mould', 'unfold', 'enfold', 'hold']**

- Examining the close neighbors of five of the wugs it gets wrong, which words seem to lead it astray? In other words, are there particular words the model 'thinks' are close neighbors, but it really shouldn't count them as close for purposes of applying the past tense transformation?
    1. **wug: drice, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['dress', 'price', 'ice', 'dice', 'die', 'dry', 'dye', 'drive']**
        a. **'price', 'ice', 'dice' all rhyme with 'drice,' which may explain why humans chose NULL->t. Yet the model chooses to use the rule NULL->d, used by close neighbors 'die', 'dry', 'dye', which do not rhyme and therefore may have less closeness to 'drice' in people's minds.**
    2. **wug: fleep, preferred past tense: iX->EXt, prediction: NULL->t, match: False, close neighbors: ['leap', 'flap', 'flip', 'flop', 'sleep', 'flee']**
        a. **'leap' and 'sleep' rhyme with 'fleep,' which may be why humans preferred iX->EXt. They may have also associated 'fleep' with 'weep', 'creep', 'sweep', etc. Yet the model chooses to use the rule NULL->t, used by ['flap', 'flip', 'flop'], which do not rhyme and likely are less associated with 'fleep' in people's minds.**
    3. **wug: tesh, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['mesh', 'tell']**
        a. **In my opinion, 'tell' should not be counted as a close neighbor since I do not count them as similar other than having the same onset. I think this is because their rime are different– compare to 'mesh,' where they have the same ending sound.**
    4. **wug: blafe, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['bluff', 'lay', 'blame', 'blaze', 'blare', 'bay', 'belay']**
        a. **Words like 'blame' and 'blaze' follow the NULL->d rule as they end with voiced sounds. However, 'blafe' ends with an unvoiced sound, so it would be unlikely that it follows that rule instead of NULL->t.**
    5. **wug: gleed, preferred past tense: i->E, prediction: NULL->ld, match: False, close neighbors: ['plead', 'glide', 'gild', 'gleam', 'glean', 'lead', 'bleed']**
        a. **Although most close neighbors use the NULL->ld rule, I feel that 'lead' and 'bleed' are what caused people to prefer the i->E rule over**

the more common rule here. There are also 'read' and 'feed' that may have influenced people as a result of all of these words and their past tense forms rhyming with one another.

- Do you notice any general problems with the model? That is, is it failing to capture something general about how you think humans actually seem to perform this task? **After examining the close neighbors, I feel that humans tend to associate words that rhyme (have the same ending sound) with one another, which I don't think this model does. On the other hand, it compares an entire word to another, calculating the distance between them. Where humans tend to value the rime of a word when forming associations between words, this model looks at the entirety of the word– which I feel causes some of the incorrect predictions we see here.**

  Part 4
  - Were you able to improve the model's accuracy? What accuracy were you able to achieve?
    I was able to improve the model's accuracy to 0.8048780487804879.
  - What did you try? Why did you think it might help?
    I tried editing the min edit function and the edit costs to improve the accuracy. Specifically, I made a function that detected the first vowel of a word, which would mark the beginning of the rime. Edits that occurred in the rime of a word would have the typical edit cost doubled. I thought this would help because after analyzing the close neighbors of the incorrect predictions, I noticed that it seems the model values edits in all parts of the word equally. This differs from how I feel humans perform this task, which is by grouping words that rhyme with each other more closely than those that do not. Through these edits, I thought I could address this issue and make the model's performance closer to that of a human.
  - Why do you think it did (or didn't, as appropriate) work?
    I think it worked because in examining the close neighbors for each of the wugs, I found that many rhymed with the wug– whereas the results were more varied before the modification. Comparing the five words chosen earlier, three now produce the correct prediction and have eliminated the less relevant close neighbors (original in red, modified in blue):

    wug: drice, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['dress', 'price', 'ice', 'dice', 'die', 'dry', 'dye', 'drive']
    wug: drice, preferred past tense: NULL->t, prediction: NULL->t, match: True, close neighbors: ['price', 'ice', 'dice', 'dry']

    wug: gleed, preferred past tense: i->E, prediction: NULL->Id, match: False, close neighbors: ['plead', 'glide', 'gild', 'gleam', 'glean', 'lead', 'bleed']
    wug: gleed, preferred past tense: i->E, prediction: i->E, match: True, close neighbors: ['plead', 'lead', 'bleed']

wug: tesh, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: ['mesh', 'tell']
wug: tesh, preferred past tense: NULL->t, prediction: NULL->t, match: True, close neighbors: ['mesh']

For 'blafe,' no close neighbors were produced, likely indicating that the wug has no rhymes within the Training data.
wug: blafe, preferred past tense: NULL->t, prediction: NULL->d, match: False, close neighbors: []

I was more surprised to see that 'fleep' did not produce the correct prediction, as 'leap' and 'sleep' both follow the iX->EXt rule. It may be that the data still had more similar words in the NULL->t category.
wug: fleep, preferred past tense: iX->EXt, prediction: NULL->t, match: False, close neighbors: ['leap', 'sleep', 'flee']

Overall, by penalizing edits that occur in the rime, we prioritize similarity in this part of the word more than in the onset– matching how humans determine their preference for the past tense of a wug.