TCSS 435 Programming Assignment 3

NOTE: Be sure to adhere to the University's **Policy on Academic Integrity** as discussed in class. Programming assignments are to be written individually and submitted programs must be the result of your own efforts. Any suspicion of academic integrity violation will be dealt with accordingly

Assignment Details:

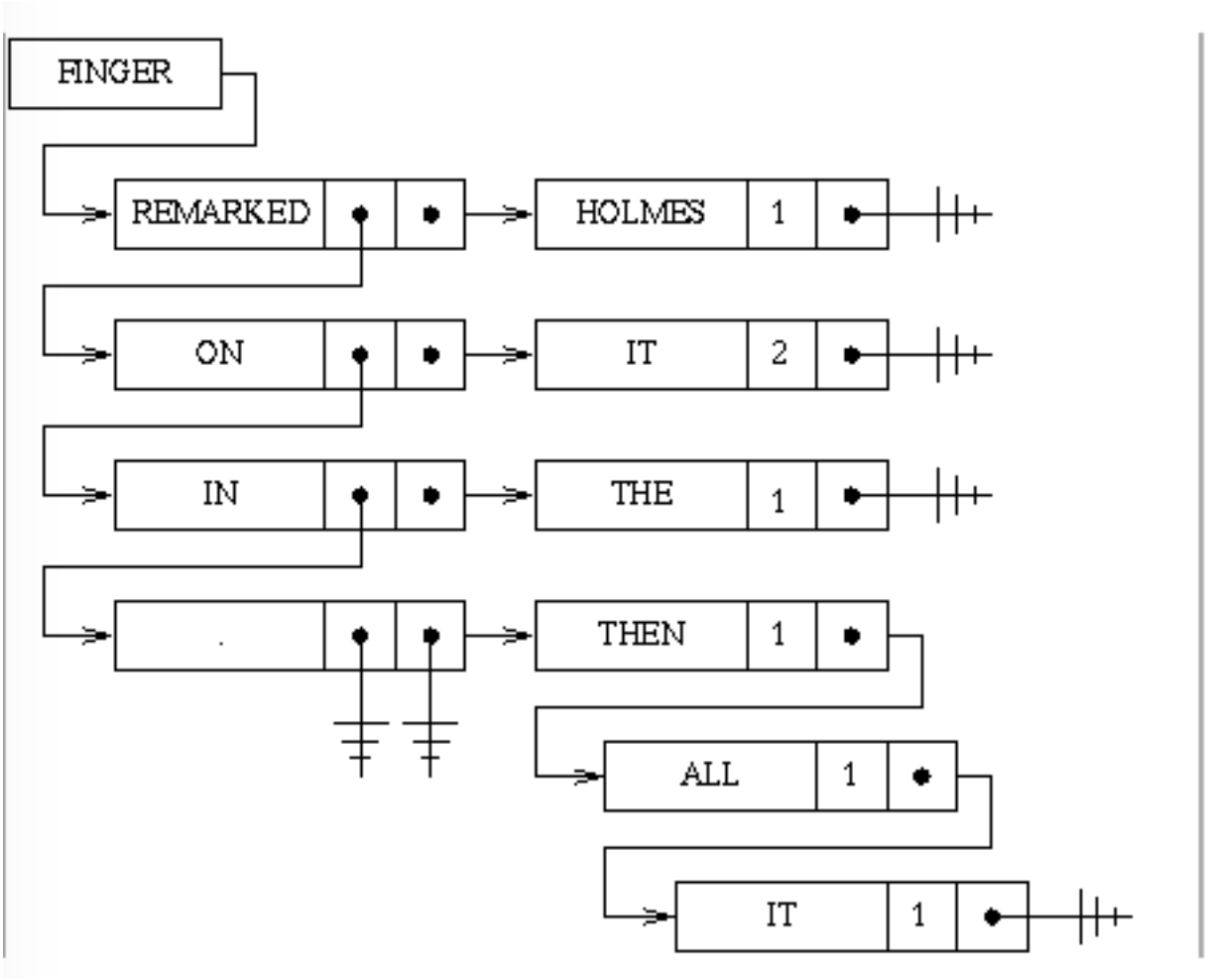
In this assignment, you will fit a tri-gram language model to English and then use it to generate new English text.

A ***unigram model*** of English consists of a single probability distribution ***P(W)*** over the set of all words.

A ***bigram model*** of English consists of two probability distributions: $\boldsymbol{P(W_0)}$ and $\boldsymbol{P(W_i \mid W_{i-1})}$. The first distribution is just the probability of the first word in a document. The second distribution is the probability of seeing word W_i given that the previous word was W_{i-1}.

A **trigram model** of English consists of three probability distributions: $\boldsymbol{P(W_0)}$, $\boldsymbol{P(W_1|W_0)}$, and $\boldsymbol{P(W_i|W_{i-1},W_{i-2})}$. The first distribution is, as above, the probability of the first word in the document. The next distribution is the probability of the second word given the first one. And the third distribution is the probability of the i^{th} word given the two preceding words.

Given a set of documents (in this case, various novels and short stories), your job in this assignment is to fit a trigram model of English. It is recommended that you do this by using a hash table in which you hash on word W_{i-2}. The contents of the hash table cells consist of linked lists as shown below. Each item in the main list links the words that appeared at position W_{i-1}. It also contains a pointer to a second level of linked lists that link the words that appeared at position W_i.



In particular, this structure encodes the fact that in our training data, we observed the following three word sequences:

```
finger remarked holmes
finger on it
finger on it
finger in the
finger . then
finger . all
finger . it
```

Notice that "finger on it" was observed twice. Also notice that the period is treated as a separate word.

Given the information in this data structure, we can compute the probability *P(it|finger,on)* as 2/2 = 1. Similarly, we can compute the probability *P(it|finger, .)* as 1/3.

Data Files:

The following data files have already been processed:

- Alice in Wonderland
- The Adventures of Sherlock Holmes
- The Casebook of Sherlock Holmes
- Call of the Wild
- Billy Budd
- Adventures of Tom Sawyer

Each file contains the lower and uppercase letters, blanks, and periods. All other punctuation has been removed. Question marks and exclamation marks were converted to periods. When you read in the files, please convert all upper case to lower case.

Assignment

Using the two Sherlock Holmes books, train a tri-gram language model by constructing the hash/linked list data structure described above. Then use this data structure to generate a new "story" 1000 words long. You can do this very simply by first choosing a word at random from the hash table. Then using it to choose a subsequent word, and then extending the text by looking up the two words and choosing at random from among the following words in proportion to their frequency of appearance.

Repeat this process, but now train on all six books and then generate a new "story" of 1000 words.

Submission Guidelines:

Submit your files on Canvas using the Programming Assignment 3 submission Link. **You will submit a zip file containing:**

- Turn in your two generated output texts.

- Your source code.