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\* Name: Julian Ceja

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\* Partner Name: Dakota Jackson

\* Partner NetID:

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\* Hours to complete assignment (optional):

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Execution instructions:

If you test from WordNet, we included a test driver for the methods sca() and distance().

If you test from Outcast, we include a test driver for the method outcast().

If you test from ShortestCommonAncestor, we include a test driver for the overloaded length() and ancestor() methods.

No special instructions needed.

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\* Describe concisely the data structure(s) you used to store the

\* information in synsets.txt. Why did you make this choice?

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We used a hashtable to store the synsets as a String with given a given id integer as the key. We made this choice to simplify the translation between the synsets’ ids and the vertices of the digraph. We also stored each individual noun in a separate String array, alongside their corresponding synset id concatenated at the end separated by a space. We made this choice to facilitate the ability to efficiently search for a given noun. Additionally, having the synset id concatenated to it allows us to quickly find which synset a specific noun came from and prevents us from using a 2D array to store that extra information.

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\* Describe concisely the data structure(s) you used to store the

\* information in hypernyms.txt. Why did you make this choice?

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We used a temporary String array to extract the information one line at the time. From there, the information was transferred to a directed graph. We made this choice because it allows us to find paths between different sets of synsets.

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\* Describe concisely the algorithm you use in the constructor of

\* ShortestCommonAncestor to check if the digraph is a rooted DAG.

\* What is the order of growth of the worst-case running times of

\* your algorithms as a function of the number of vertices V and the

\* number of edges E in the digraph?

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Description:

The ProgrammingAssignment3WordNet.word file, underneath the WordNet API, it is stated “You may assume that the input files are in the specified format (and that the underlying digraph is a rooted DAG)”.

Order of growth of running time: N/A

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\* Describe concisely your algorithm to compute the shortest common

\* ancestor in ShortestCommonAncestor. What is the order of growth of

\* the running time of your methods as a function of the number of

\* vertices V and the number of edges E in the digraph? What is the

\* order of growth of the best-case running time?

\*

\* If you use hashing, you should assume the uniform hashing assumption

\* so that put() and get() take constant time.

\*

\* Be careful! If you use a BreadthFirstDirectedPaths object, don't

\* forget to count the time needed to initialize the marked[],

\* edgeTo[], and distTo[] arrays.

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Description:

I used a modified version of the BFS that stores the distTo and visited vertices in a hashtable to prevent using space costly date structures (two arrays of size V). On length( int, int ) and ancestor( int, int ) it runs BFS from a source vertex and only checking the vertices that are on its path to the root, giving a time complexity of O(E + V) where E and V are the edges and vertices on its path to the root (not all the edges and vertices on the graph). On length( Iterable<Integer>, Iterable<Integer> ) and ancestor( Iterable<Integer>, Iterable<Integer> ) it runs BFS from multiple source vertices and only checking the vertices that are on its path to the root, ensuring that we get a time complexity of O(E + V) where E and V are the edges and vertices on its path to the root (not all the edges and vertices on the graph).

running time

method best case worst case

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length(int v, int w) O(E + V) O(E + V)

ancestor(int v, int w) O(E + V) O(E + V)

length(Iterable<Integer> v, O(E + V) O(E + V)

Iterable<Integer> w)

ancestor(Iterable<Integer> v, O(E + V) O(E + V)

Iterable<Integer> w)

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\* Known bugs / limitations.

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N/A

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\* Describe whatever help (if any) that you received.

\* Don't include readings, lectures, and precepts, but do

\* include any help from people (including course staff, lab TAs,

\* classmates, and friends) and attribute them by name.

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N/A

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\* Describe any serious problems you encountered.

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We had trouble implementing the sca() method in the WordNet class due to us overlooking a simple bug.

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\* If you worked with a partner, assert below that you followed

\* the protocol as described on the assignment page. Give one

\* sentence explaining what each of you contributed.

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We worked as partners for Project 2, and applied the same approach to this project. We communicated through voice/video calls, sharing our screens and information as we discussed problems and implemented the program. We both contributed ideas equally as we problem solved implementing the individual methods, API, and comments.

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\* List any other comments here. Feel free to provide any feedback

\* on how much you learned from doing the assignment, and whether

\* you enjoyed doing it.

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This project allowed us to become familiar with the idea of implementing efficient algorithms and data structures to solve a given problem.