PRIFYSGOL
ABERYSTWYTH
UNIVERSITY

Department of Computer Science

CS21120: Data Structures and Algorithm Analysis
Assignment 1 - **Word Play** - Making word ladders

1 Background

You are required for this assigment to implement a program which generates "word ladders" for a given start word.

A "word ladder" is a list of words in which you change one word into another by changing one letter at a time.

eg. clash, flash, flask, flack, flock, clock

A word ladder should not contain any repeated words.

2 Useful information

You might find this example useful to extract all 5 letter words from the system dictionary and put them into a data file on *dante* and *stonkin*:

grep "ˆ[a-z]\{5\}$" /usr/dict/words > dict5.dat

In order to change the number of letters in the words, simply change the integer in the command line.

You may want to prepare a set of data files for use with your program each with the same length of words in them.

3 Two ways of running the program

The program should be able to be run in two different ways.

1. Generation

   The program should take a start word, and a number of steps to generate, and should attempt to generate a word ladder with the given number of steps.

   For example, if the input is "he" and "3" then the word ladder could generate output: he, ho, ha.

2. Discovery

   The program should take 2 words of equal length, and be able to find one of the shortest word ladders between the 2 words. There may be several word ladders with the same shortest length, any one of them will be sufficient.

   Test data for this part should include trying to link "head" to "foot".

   An example potential word ladder for "head" and "foot" as input could be: head, held, hold, fold, food, foot.

4   Suggestions

This assignment should be attempted in a number of stages.

- First of all you should concentrate on getting a sensible data structure to store all the dictionary words. This will probably involve 2 data structures - I would suggest looking at both Hashtables and Graphs.

- You should then attempt the Generation part, this just involves starting from the given word and traversing the graph.

- The Discovery part will involve a 2 stage process of pre-labelling the graph, and then traversing the graph, going in the direction of the target word.

5   Other Requirements

Your program should be written in Java, and may have either a textual or graphical user interface. Your designs for classes should be submitted as class diagrams, and algorithms may be submitted as pseudo-code.

6   The Submission

- You must submit a design for your data structures using UML diagrams where necessary. This should also include the justification for design decisions that you have made.

- You must submit a neatly hand written or typed description of your algorithm, this could be expressed as a flowchart, pseudo-code or another well recognized documentation method.

- You must submit a printed copy of all your Java source code for all new and modified classes, which should be well structured and commented.

- You must submit evidence of testing showing both modes of operation for at least 3 word ladders for each mode.

- You must also submit an electronic copy of your assignment including all documents as PDFs and code (source and class files) as a zip file to blackboard.

7   The Marking Scheme

This assignment is worth 25% of the marks for the course CS21120, therefore you are expected to spend somewhere around 40 hours working on it. Note also that the majority of the marks will be for getting the word ladder generator working - if you only have a nice GUI you will not get very many marks.

Algorithm design 25%

Data structure design 25%

Java code and testing 50%

This assignment should be posted into the Assignment post box located in reception between 10am and 4pm on Friday 26th October 2012. You must include a coursework front sheet signed to declare that you understand and declare originality of your work. This coursework is not anonymous, as you have to hand in code, which is expected to be documented properly with author tags. The electronic submission deadline is at the same time.

Richard Shipman   October 5, 2012