COSCI 21a, Assignment 5

Directions: To receive full credit:

• Place your name at the top of each page.

• Start each problem on a new page.

1. Describe in English and give pseudo-code for a recursive algorithm that returns the last vertex in a singly linked list \( L \) that contains data \( d \) (or nil if \( d \) is not in \( L \)); that is, if there is more than one copy of \( d \) in \( L \), then it returns the last one encountered when traversing the list from the first to the last item. For this problem, assume that a singly linked list does not have a header and is represented by a pointer to its first element.

2. We have seen that both the recursive and iterative versions of the Towers of Hanoi Problem use \( O(n) \) space. Compare the constants that would be expected in practice, charging one unit of space to store an integer (assume that a return address can be stored as an integer). Clearly state any other assumptions you are making.

3. Starting with an empty 2-3 tree, using the algorithm presented in the course notes, draw the 2-3 tree that results from inserting the following strings in this order (using the usual English alphabetical ordering):

   horse, cow, pig, seal, rat, dog

   The draw the 2-3 tree that results from continuing and additionally inserting these strings:

   goat, elephant, fish, rooster, zebra, roach, cat

   And finally, draw the 2-3 tree that results from continuing and additionally inserting these strings:

   hen, llama, aardvark, hog, donkey, rhino, hippo, tiger

4. Draw a red-black tree equivalent to the 2-3 tree you constructed for Problem 3.