Problem 1

Write a partition algorithm for linked lists that takes a list $L$ and a value $x$ and returns three linked lists $L_1, L_2, L_3$ such that all the elements of $L_1$ are $< x$ and all the elements of $L_2$ are $= x$, and all the elements of $L_3$ are $\geq x$.

Use this algorithm to write a $O(n \log n)$ quicksort algorithm for linked lists and a linear-time $kth(L, k)$ algorithm that returns the $k$th-smallest element of $L$.

Problem 2

- Write an algorithm to remove the smallest element from a binary search tree. You should fix up the tree so that it is still a binary search tree and no elements get lost.

- Write an algorithm to remove the root of a binary search tree. Hint: you need to replace the root with a new root – use your algorithm from above to get the new root.

Problem 3

Modify the reachable-set algorithm from class to determine whether an undirected graph contains a cycle.