

1) (10 pts) ANL (Algorithm Analysis)

Write down the **worst case run-times** for each of the requested operations. **You may assume that each operation is done with an efficient algorithm.** Please leave your answer in **simplified Big-Oh** form, in terms of the variables given in the problem. Thus, please do NOT include any leading constants or unnecessary terms. Answers such as  $O(2n^2)$  or  $O(n^2 + \lg n)$  **will receive no credit**, even if they are technically correct. Each part is worth 1 point.

- a) Inserting **k** items, each into the front of a linked list which starts with **n** items.  $O(k)$
- b) Running a floodfill on a grid with **r** rows and **c** columns.  $O(rc)$
- c) Sorting **n** elements via the Quick Sort algorithm.  $O(n^2)$
- d) Efficiently forming a heap out of **n** unsorted items.  $O(n)$
- e) Removing all of **n** items, one by one, from a Priority Queue that originally has **n** items.  $O(n \lg n)$
- f) Inserting **n** items, one by one, into a Binary Search Tree.  $O(n^2)$
- g) Inserting **n** items, one by one, into a AVL Tree.  $O(n \lg n)$
- h) Printing out the set of moves to solve the Towers of Hanoi with a tower of **n** disks.  $O(2^n)$
- i) Merging two **sorted lists**, one with **r** elements, the other with **s** elements, into a single sorted list.  $O(r+s)$
- j) Writing out the first 10 Fibonacci numbers.  $O(1)$

**Grading: 1 pt per answer. Answer has to match exactly to get credit. Only exception is that (i) can be listed as  $O(\max(r,s))$ .**