

1) (10 pts) ANL (Algorithm Analysis)

Give the Big-O run-times for each of the following operations in terms of the variables given in the description. When a particular implementation is not explicitly stated, assume an efficient implementation is used. In order to earn full credit, you must provide a simplified, asymptotically tight bound. (For example, if $O(n)$ was the correct answer, $O(5n)$ and $O(n^2)$ would not receive full credit, even though both are technically correct.)

- a) Merging a sorted array of size m with a sorted array of size n into one sorted array. _____
- b) Creating a heap out of n unsorted integers. _____
- c) **Worst case** run-time of running a Quick Sort on n integers. _____
- d) Inserting an element to the front of a linked list with n elements. _____
- e) Deleting m items, one by one, from an **AVL** tree which originally contains n items ($n \geq m$) _____
- f) A sequence of p push operations onto a stack that originally had n elements on it. (Assume the stack has enough space to handle the sequence of push operations.) _____
- g) **Average case** run time of an insertion sort on n unsorted integers. _____
- h) Calculating $a^b \bmod c$, using fast modular exponentiation, assuming that each multiply and each mod operation take $O(1)$ time. _____
- i) Pre-order traversal of a binary tree with height h and n nodes. _____
- j) **Worst case** run-time for searching for an element in a binary search tree with n nodes. _____