

## Homework 3

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2.1. In the case that there are zero or one item in the unprocessed list we would return two empty lists if there are zero and we would put the one item in the first half of the partition and return the first half with one element in the list and return the second half as an empty list.

2.2. We need to recursively apply mergesort to both halves, this continues until each sublist has one or zero elements. These are inherently sorted and once both halves are sorted, we merge them back together. This ensures that at each recursion level, smaller lists are fully sorted before merging.

2.3. The end condition for this step is when one list is empty. Once a list is empty, we will return the other nonempty list.

2.4. The base case for mergesort is, if the list is empty or has only one element, return it. Recursive steps for the mergesort are, partition the list into two halves, recursively sort both halves, and merge the two sorted halves with the merge function. So, the steps of mergesort would be partition, sort, and merge.

4a. Initially we will have a sorted list that is empty, and the unsorted list will contain all the elements that need to be sorted. At the end of the process the unsorted list is now empty, and the sorted list contains all the elements in ascending order. We can use this to determine when to terminate the process by looking for an empty unsorted list. This means that all elements have been moved to the sorted list.

4b. After each pass, we take the first element from the unsorted list and insert it into the correct position of the sorted list. This continues until the unsorted list becomes empty. Trivially, when the unsorted list has only one element, inserting that element into the sorted list will immediately result in a fully sorted list. The recursive function calls itself with the updated sorted list, after inserting the first unsorted element, and the remaining unsorted list.

4c. Two ways that the insertion sorting can terminate is through the base case for sorting which is when the unsorted list is empty, meaning that all elements have been inserted. The second way is the base case for insertion, which is when the element finds its correct position in the sorted list, this means that it is smaller than the next element or it has reached the end of the list.