SCI 199 (Beautiful Algorithms)

Assignment #2 Due: Oct. 25, 2001 (in tutorial)

Note: In all questions, the better the algorithm, the better the mark.

1. The *ternary search* algorithm locates an element in a list of non-decreasing integers by successively splitting the list into three sublists of equal (or as close to equal as possible) size, and restricting the search to the appropriate sublist.

   (a) Describe the steps of this algorithm, using the methodology developed in class.

   (b) What is the time complexity of your algorithm? Briefly justify.

2. Given a list of n non-decreasing integers, describe an efficient algorithm to find the *last* location of a given iteger **key**. If **key** is not in the list, then an appropriate message should be made.

   (a) What is the time complexity of your algorithm?

   (b) How would you utilize your algorithm to find the **range** of occurrences of **key** in the list? The output of your algorithm should either be a pair of integers, **low** and **high** (to indicate that **key** occurs in all entries indexed between **low** and **high** inclusive) or an appropriate message indicating that **key** is not in the list. What is the time complexity of your algorithm?

3. A **mode** of a list of n integers is an element that occurs at least as often as each of the other elements. For each of the following two instances, describe an algorithm to find a mode in the list. What are the time complexities of your algorithms?

   (a) Assume that the list is sorted in non-decreasing order.

   (b) Assume that the list is not sorted.

   (c) **EXTRA:** For each of the two cases described above, is it possible to have an algorithm that is faster than your algorithm? Briefly defend your answer.