CSC236 tutorial exercises #5

(Best before 11 am, Monday October 29th)

Danny Heap

Here are your tutorial sections:

Surname	Section	Room	TA
A–F	Day 1 (11:00 am)	LM162	Yuval
G–Li	Day 2 (11:00 am)	BA2139	Lila
Lo–Si	Day 3 (11:00 am)	BA2145	Oles
So–Z	Day 4 (11:00 am)	BA2155	Lalla
A–H	Evening 1 (8:00 pm)	BA1190	Colin
I–M	Evening 2 (8:00 pm)	BA2135	Norman
N–Z	Evening 3 (8:00 pm)	BA2139	Feyyaz

These exercises are meant to give you practice applying the Master Theorem to divide-and-conquer algorithms.

1. A non-empty array A with integer entries has the property that no odd number occurs at a lower index than an even number. Devise a divide-and-conquer algorithm for finding the highest index of an even number element, or -1 if A has no elements that are even numbers. Use the Master Theorem to bound the asymptotic time complexity of your algorithm.

2. Consider this informal algorithm for QuickSort of a non-empty array A of distinct integers

   (a) Choose a pivot, p from A in constant time

   (b) Partition A into A_{p^-} consisting of elements less than p, $[p]$ itself, and A_{p^+} consisting of elements greater than p. Recursively QuickSort A_{p^-} and A_{p^+}

   (c) Concatenate the sorted version of A_{p^-}, $[p]$, and the sorted version of A_{p^+}

   Write a recurrence T, for the time complexity of QuickSorting A. Assume the worst (that the constant-time choice of a pivot is consistently unlucky), and use repeated substitution to find a closed form for T. Assume the best (that the constant-time choice of a pivot is consistently lucky) and use the Master Theorem to bound T.