CS 5720 Design and Analysis of Algorithms
Homework #5

Submission requirements:

- Submit your work in PDF format to the appropriate assignment on Canvas.
- **5% extra credit** if your writeup is *typed*.

Assignment:

1. Consider MergeSort and QuickSort as implemented in class. That is, QuickSort uses the Hoare Partition and lazy pivot selection ($p = A[l]$). For each part (a)-(d):

   i. Give a completely-specified **recurrence relation** which describes the *number of element comparisons* which the algorithm requires under the given conditions. For these, try to be as specific as possible (i.e., pay careful attention to indexing).

   ii. If the recurrence relation can be solved using the Master Theorem, do so to determine its order of growth.

   Here are the parts:

   (a) How does MergeSort operate on **sorted arrays?**

   (b) How does MergeSort operate on **reverse-sorted arrays?**

   (c) How does QuickSort operate on **sorted arrays?**

   (d) How does QuickSort operate on **arrays made of all equal elements?** Be careful to use the specific inequalities I gave in class.

2. In QuickSort, give a pivot selection rule which would result in the fastest possible runtimes on **sorted arrays**. What is the resulting recurrence relation?