CSE 100: Algorithm Design and Analysis. Midterm Exam 2 Key Topics.
Spring 2024

Disclaimer: I do not guarantee that the following list is complete.

1. Ch06. Node indexing. Binary-heap height. Illustration of a heap operation on a given input. The run time of heap operations. Implementation of Max-Heapify, Build-Max-Heap, Heapsort, Extract-Max, Insert, Increase-Key. In particular, the run time of Build-Max-Heap. You should know the analysis. In-place sorting.

2. Ch07. Running time of deterministic/randomized quick sort. Run time analysis. Implementation of Partition and Quicksort.

3. Ch08. Understanding the decision tree of a sorting algorithm; why and how it gives a $\Omega(n \log n)$ lower bound for any comparison based sorting algorithm. Constructing the decision tree for Insertion sort. Stable sorting. The assumptions that help break this lower bound barrier in counting, radix, bucket sort. Illustration of bucket sort. RT for sorting n binary numbers of $O(\log n)$ bits. Radix sort implementation. Counting sort implementation.

4. Ch09. Randomized Selection: how you make recursive calls based on the partition result and the order of the element to be found. What is the RT of the randomized algorithm? Understanding the run time analysis. What if we don't use randomization? $O(n)$-time Deterministic Selection. Understanding the run time analysis. In particular, how good the pivot is.

5. Ch11. Hashing. Direct addressing vs. Hashing. Universal Hash Family. Given a hash family, can you tell if it is compact and/or a universal hash family? RT analysis assuming the universal hash family. Resolving collisions using chains (illustration) Hash applications (e.g. discussion sessions problems).

6. Ch12.13 Can you tell what is successor, min, max element, etc from the picture? Output the tree nodes in pre/in/post order. What is the height of a red black tree?