# Sorting Models

Reset Progress Reveal Solutions

## 1 3-Wise Comparisons

Assume you have a function called 3-sort that takes as input an array of size 3 of comparable objects and returns them in sorted order. You want to sort an array of size $n \geq 3$ objects only using calls to 3-sort. How many function calls of 3-sort are required to sort an array of size n? Choose the asymptotically largest applicable lower bound.

- ○ $\Omega(\log n)$
- ○ $\Omega(\sqrt{n})$
- ○ $\Omega(n)$
- ● $\Omega(n \log n)$

Correct

## 2 Possible or Impossible

Is it possible to implement the following algorithms or data structures?

A data structure that stores comparable objects and supports the following operations:

- Insert new objects in $O(1)$ time per insertion.
- Remove objects in $O(1)$ time per removal.
- Return the smallest object currently in the collection in $O(1)$ time.

Is it possible to implement such a data structure?

- ○ Possible
- ● Impossible

Correct

An algorithm that runs in $O(n)$ time and takes an array $A$ of size $n$ of comparable objects, $i$, and $j$ $(1 \leq i < j \leq n)$ as inputs and returns all the elements that are greater than the $i$th smallest element in $A$ and less than the $j$th smallest element in $A$?

- ● Possible
- ○ Impossible

Correct

Which algorithm would be a good choice to use for the last part?

- ● $k$-Select
- ○ Radix Sort
- ○ Quick Sort
- ○ Merge Sort

Correct

An algorithm that runs in $O(n)$ time and takes an array $A$ of size $n$ of comparable objects and partitions $A$ into $\frac{n}{\log n}$ groups of size $\log n$ each, where for every $i < j$, members of group $i$ are smaller than or equal to members of group $j$.

- ○ Possible
- ● Impossible

Correct

## 3 Radix Sort and Counting Sort

Assume you have an array $A$ of size $n$ with positive integer element with all elements in the range $[1, n^3)$.

What is the runtime of Counting Sort run on $A$?

- ○ $\Theta(n)$
- ○ $\Theta(n \log n)$
- ○ $\Theta(n^2)$
- ● $\Theta(n^3)$

Correct

What is the runtime of Radix Sort, using base 10, run on $A$?

- ○ $\Theta(n)$
- ● $\Theta(n \log n)$
- ○ $\Theta(n^2)$
- ○ $\Theta(n^3)$

Correct

Which base for Radix Sort will result in the fastest Radix Sort algorithm to sort $A$ with?

- ○ 2
- ○ 10
- ● $n$
- ○ $n^2$

Correct