Homework #4
COMP 582
GRADUATE DESIGN AND ANALYSIS OF ALGORITHMS
Fall 2023

Due on: Saturday, September 23th, 8pm
Late submissions: will NOT be accepted
Format: Please start each problem on a new page.
Where to submit: Gradescope.

Please type your answers; handwritten assignments will not be accepted.
To get full credit, your answers must be explained clearly,
with enough details and rigorous proofs.

September 17, 2023

Problem 1

Given an unsorted array $A = \{a_i\}_{i=1}^n$ of size n, provide an algorithm that finds

$$r = \max_{i,j \leq n} |a_i - a_j|$$

using at most $O(n)$ comparisons on the worst case input. Bonus: design an algorithm which uses at most $\frac{3}{2}n$ comparisons on the worst case input. Prove that your algorithm is correct.

Problem 2

You are given two unsorted arrays of size n, A and B, where A has no repeated elements and B has no repeated elements. Provide an algorithm that finds the k-th smallest entry of their intersection $A \cap B$ and prove that your algorithm is correct. For full credit, your algorithm must run in $O(n \log n)$ time.