

# CS 4040/5040

## Milestone 1

**Author:** Viraj Parmar

**Date:** October 22, 2025

### 1. Build / Run Instructions

- a) **Python version:** Python 3.12.6
- b) **Run program:**
  - o Open terminal / command prompt
  - o Navigate to project folder
  - o Run: python main.py

### 2. The program will:

- Test correctness of Insertion Sort and Randomized Quick Sort on small sample arrays.
- Measure **median runtime** for each input size n.
- Skip Insertion Sort for very large inputs ( $n = 10000, 20000$ ) because it is too slow.
- Print runtimes in milliseconds (ms).

### 3. Algorithms Implemented:

Algorithm	Type	Time complexity
Insertion Sort	Comparison-based	In-place, $O(n^2)$ worst-case
Randomized Quick Sort	Comparison-based	Recursive, pivot chosen randomly, $O(n \log n)$ expected