21BCS052
10/17/23

RUN-TIME POLYMORPHISM: POINTERS, ABSTRACT CLASSES, VIRTUAL FUNCTIONS

Objectives: The primary objective of this lab assignment was to implement and understand abstract classes and pure virtual functions, emphasizing their role in defining interfaces and polymorphism. Additionally, it involved implementing insertion sort and optimizing its performance for a collection of objects.

Learnings:

- **Abstract Class and Pure Virtual Functions:**
  - Modified the **Element** class to include pure virtual functions **norm** and **print**, defining an interface for derived classes to implement.
  - Implemented a derived class **PointN** representing an n-dimensional point and overrode the pure virtual functions **norm** and **print** as per the requirements.
- **Insertion Sort and Performance Optimization:**
  - Generated objects (**Point**, **Vector**, and **PointN**) based on specified rules and implemented an insertion sort algorithm (**slowSort**) to sort them by the magnitude of their norms.
  - Investigated performance optimization by enhancing the sorting algorithm in **fastSort** by introducing memo array to store the norms to reduce execution time compared to **slowSort**.

Challenges:

- Understanding and implementing the norms for different types of elements (Points, Vectors, and n-dimensional Points) to comply with the pure virtual function **norm** posed challenges initially.
- Enhancing the sorting algorithm (**fastSort**) to demonstrate a noticeable speedup while ensuring correctness and maintaining code readability was challenging.

Key Notes:

- Abstract classes with pure virtual functions serve as interfaces, defining a contract that derived classes must fulfill.
- Performance optimization involves analyzing and modifying algorithms to reduce execution time while maintaining correctness.

Conclusion: This lab assignment provided insights into the implementation of abstract classes, pure virtual functions, and their significance in enabling polymorphism. Additionally, it offered hands-on experience in implementing sorting algorithms and optimizing their performance, showcasing the impact of algorithmic improvements on execution time.