**Department of Computer Science**

**University of Ghana**

**DCIT 204 – Data Structures and Algorithms 1**

**Group Project**

**UG Navigate: Optimal Routing Solution for University of Ghana Campus**

**Project Overview:** In this project, students will develop an algorithm and a Java application to help users find the best route from one location to another on the University of Ghana (UG) campus. This includes considering factors such as shortest distance and optimal arrival time, taking into account traffic conditions. The project will utilize various algorithms and techniques, such as Vogel Approximation Method, Northwest Corner Method, Critical Path Method, as well as searching and sorting algorithms, to determine efficient routes and arrival times.

**Project Objectives:**

1. Develop an algorithm and a Java application to find the best route from location A to location B on the UG campus.
2. Utilize multiple methods to calculate distance and arrival time, ensuring efficiency and accuracy.
3. Implement sorting algorithms to organize routes based on distance and arrival time.
4. Incorporate a searching algorithm to provide multiple route options for users based on selected landmarks.
5. Enhance algorithm performance using techniques like Divide and Conquer, Greedy, and Dynamic Programming.

**Activities:**

1. **Algorithm Implementation:** Students will implement various techniques taught in class, including Vogel Approximation Method, Northwest Corner Method, and Critical Path Method, to determine efficient routes and arrival times.
2. **Distance Calculation:** Demonstrate how distances are obtained from source to destination through all possible routes, using methods like Google Maps or other mapping applications. Students can also explore additional distance calculation algorithms such as:
   * **Dijkstra's Algorithm:** Find the shortest path between nodes in a graph, considering edge weights (distances) between nodes.
   * **Floyd-Warshall Algorithm:** Calculate shortest paths between all pairs of nodes in a graph, considering edge weights.
   * *A (A Star) Search Algorithm:*\* Find the shortest path from a start node to a goal node, considering both actual cost and heuristic estimates.
3. **Sorting and Printing Routes:** Sort distances and arrival times to provide users with sorted route options. Utilize sorting algorithms such as Quick Sort or Merge Sort for efficient organization.
4. **Searching Algorithm:** Implement a searching algorithm to allow users to select routes based on landmarks. Provide at least three route options for each selection, with significant landmarks highlighted.
5. **Landmark-based Route Generation:** Enable users to input landmarks and generate routes accordingly. For example, if a user enters "Bank," the system should provide all routes passing through or near a bank to the destination.
6. **Creativity:** Encourage students to apply Divide and Conquer, Greedy, and Dynamic Programming approaches to optimize the algorithm's performance and enhance user experience.

**Deliverables:**

1. Presentation of Algorithms: Students will present their algorithms, explaining the techniques used and how they contribute to efficiency.
2. Java Application: Develop a user-friendly Java application that incorporates the implemented algorithms, allowing users to easily input locations and landmarks to find optimal routes.

**Additional Context:** Ensure that the project is contextualized to the University of Ghana campus, with specific landmarks and routes relevant to the campus environment. Students are to consider real-world factors such as traffic patterns and campus layout when designing their algorithms and applications.

**Deadline**

**End of the semester. Date will be communicated.**