Luke Williams

Preety Kahatri

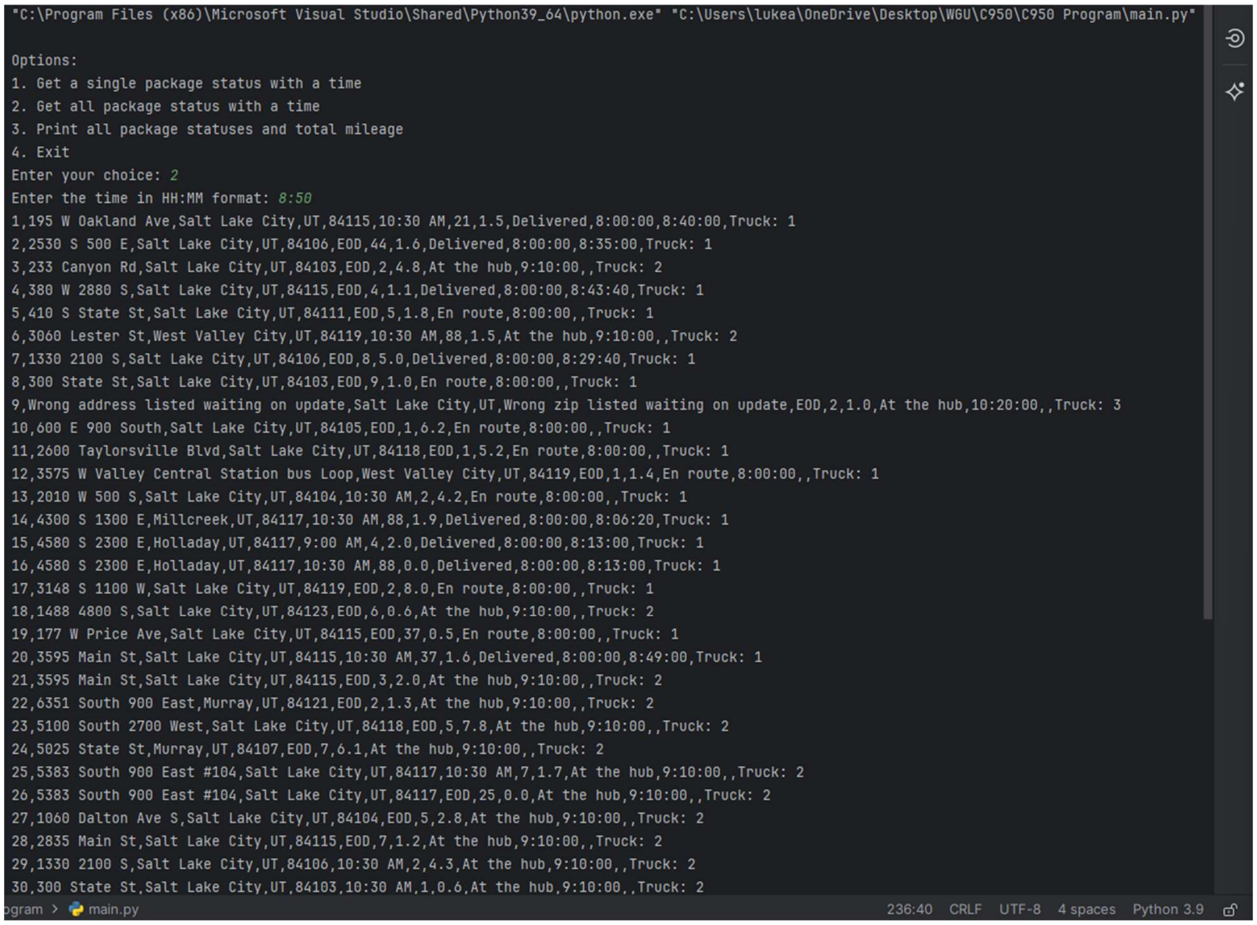
C950

10/30/2023

C950 Task Two

D.

Time check 1, 8:50



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2. Get all package status with a time
3. Print all package statuses and total mileage
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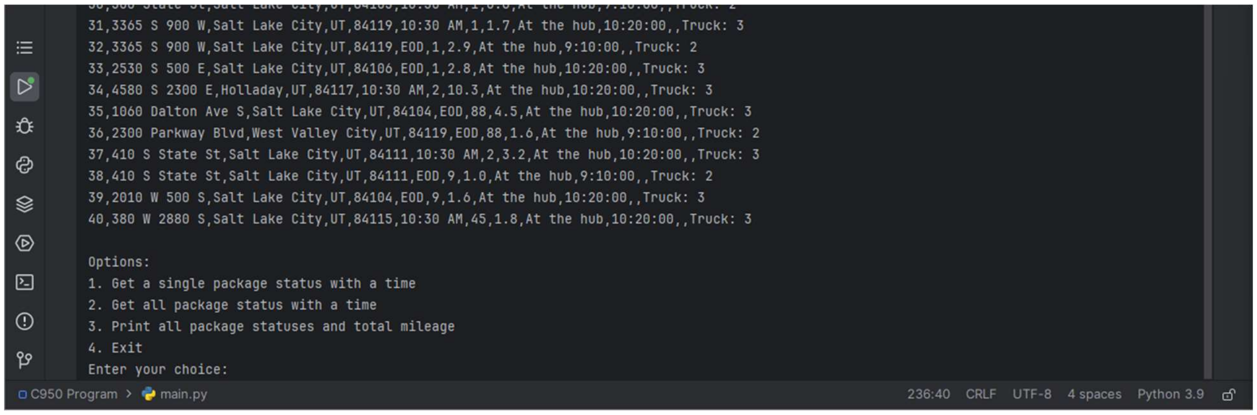

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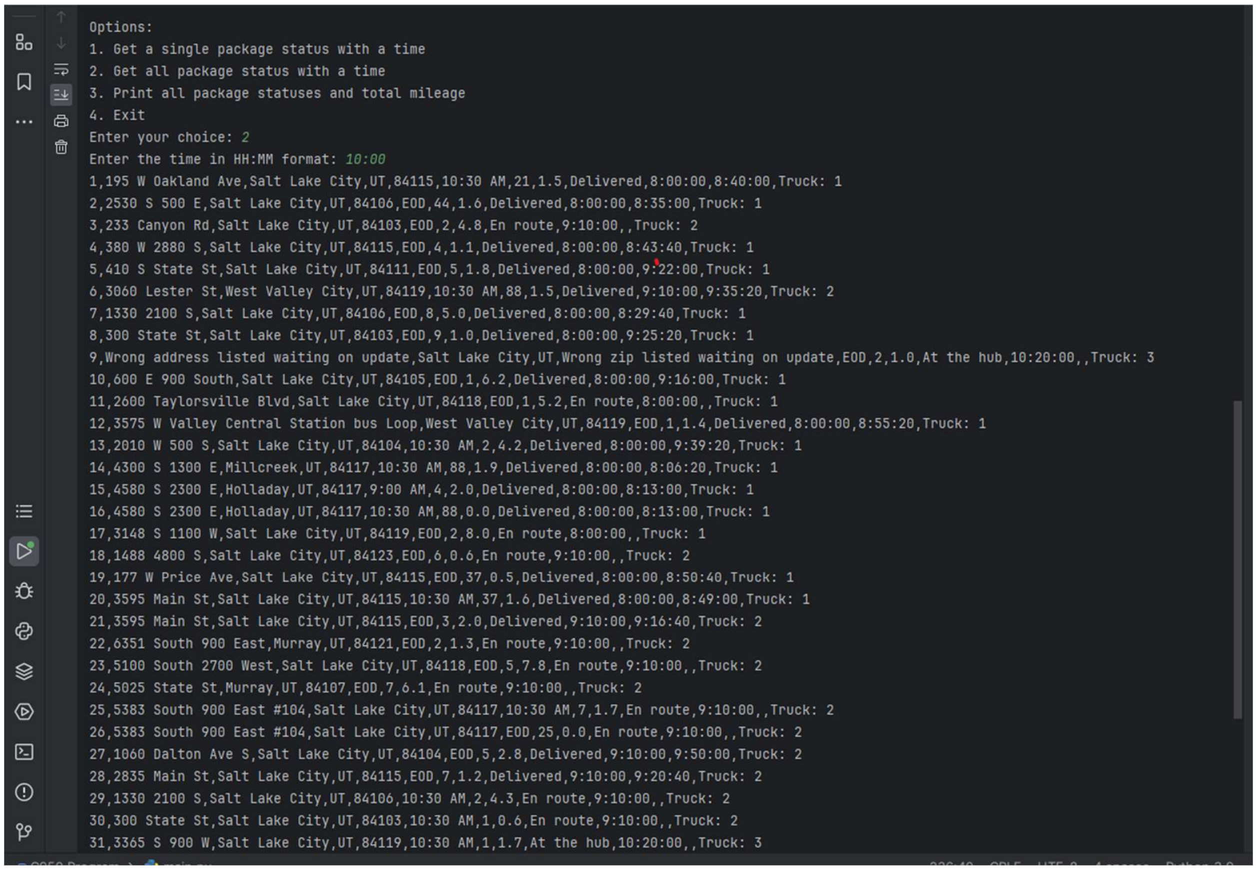

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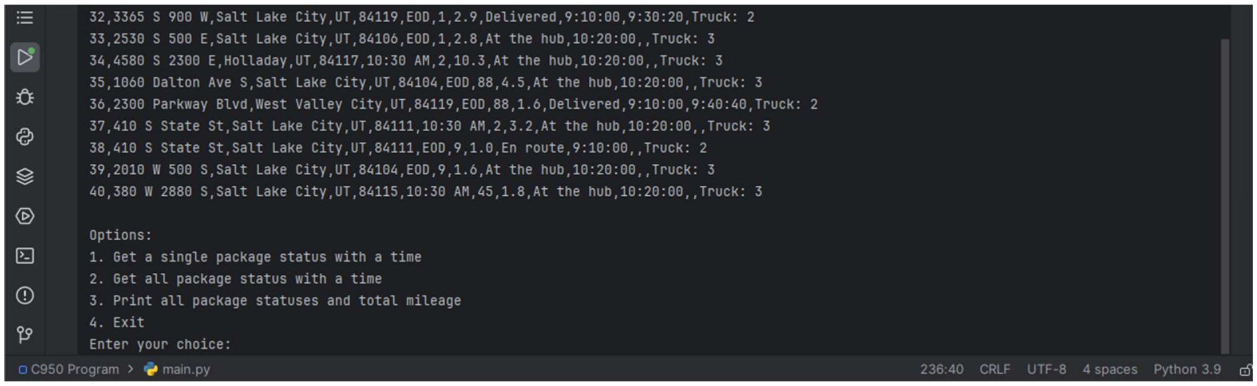

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Enter your choice:
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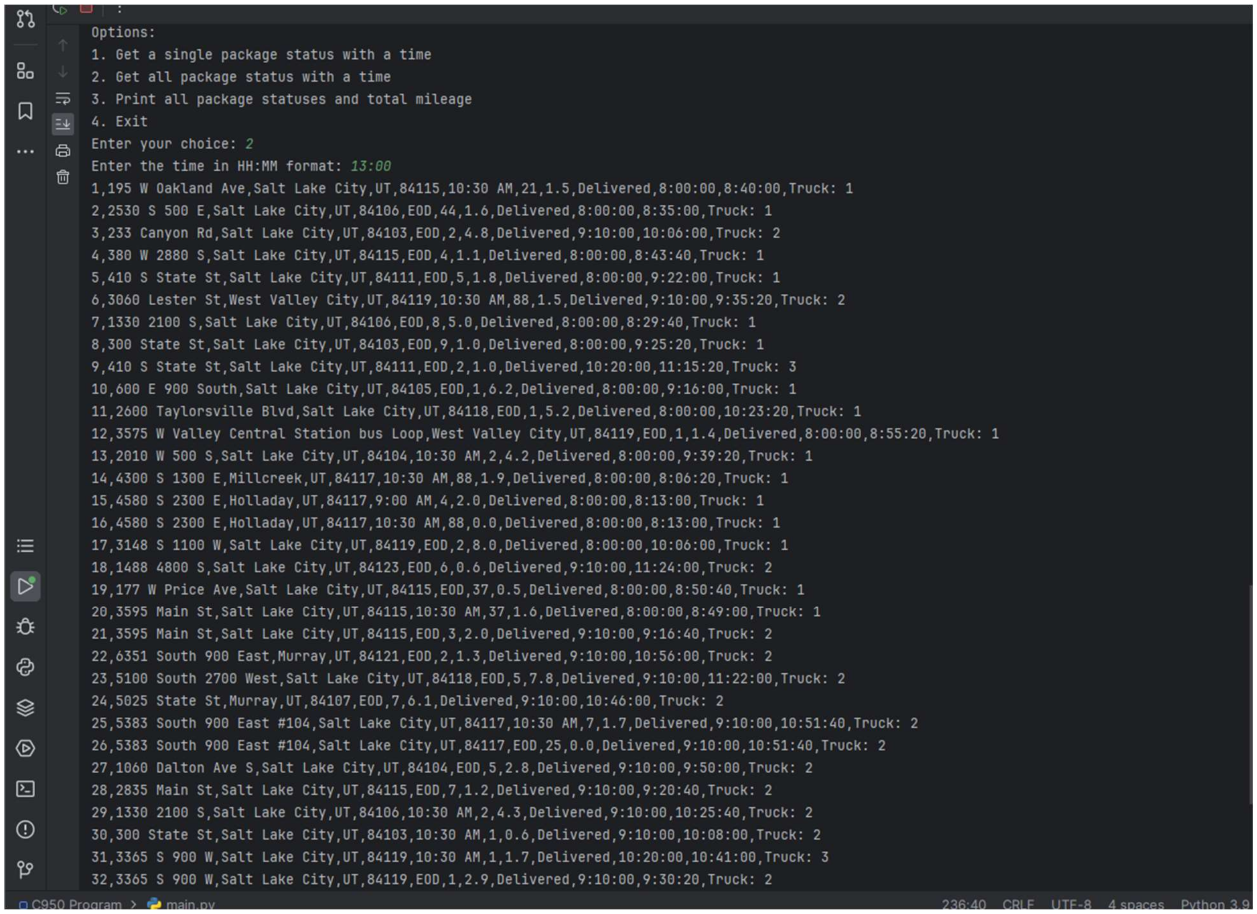

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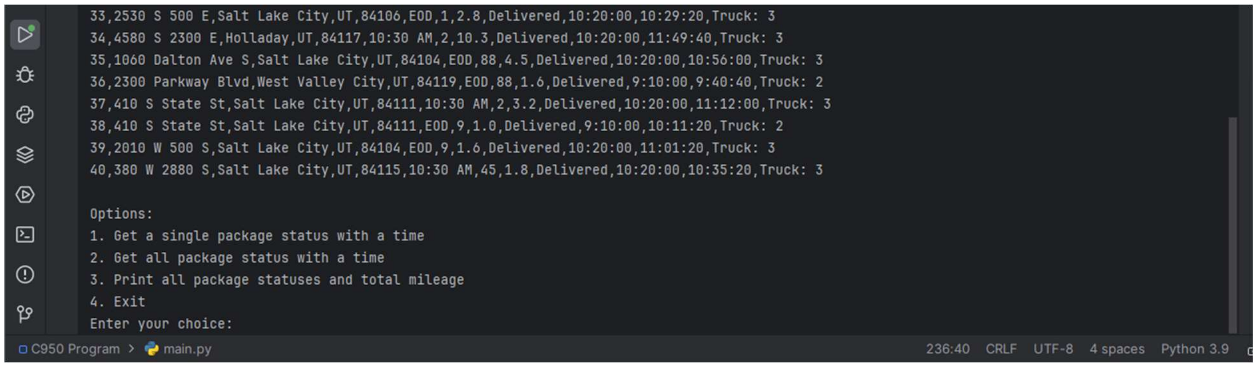

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Options:
1. Get a single package status with a time
2. Get all package status with a time
3. Print all package statuses and total mileage
4. Exit
Enter your choice:
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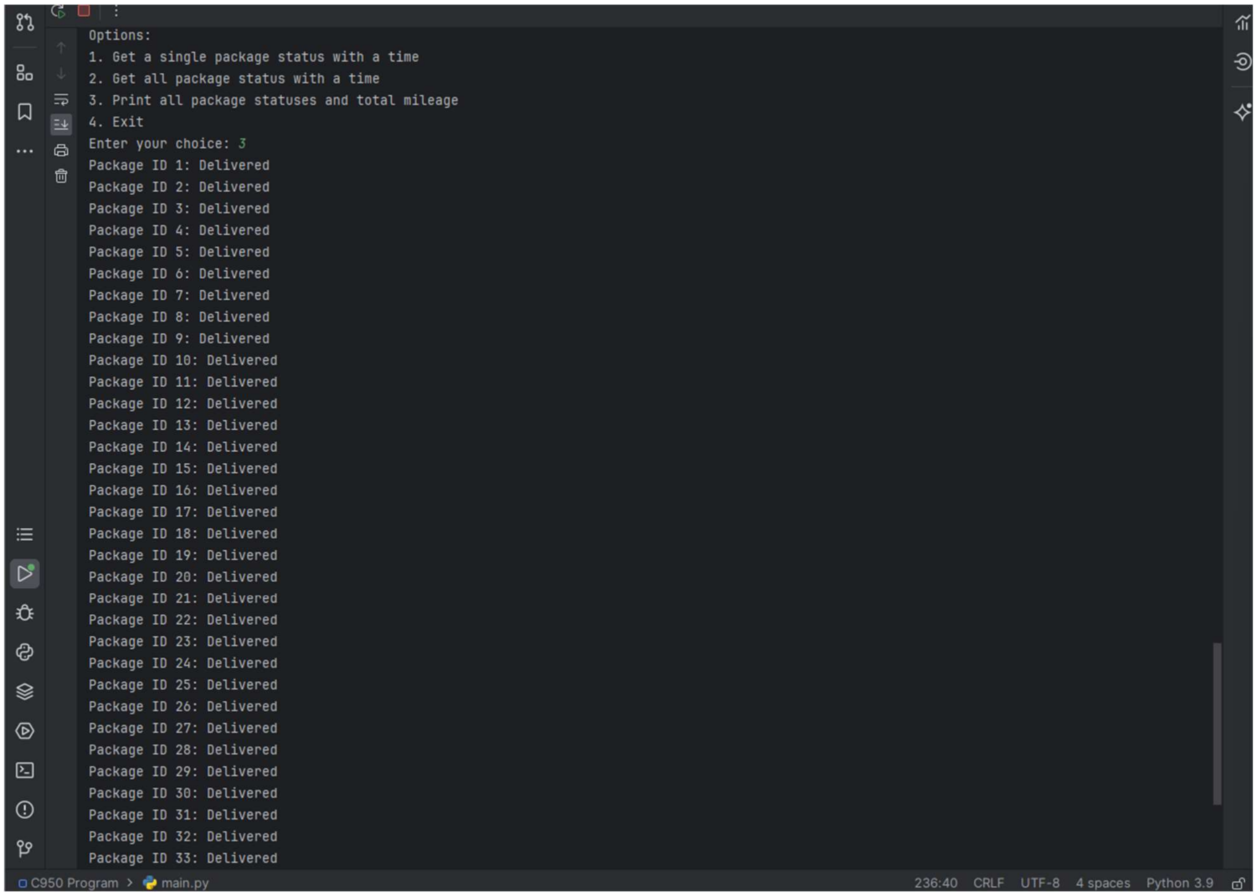
E.

Shows successful completion of code and total mileage of all trucks.



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3. Print all package statuses and total mileage
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Package ID 9: Delivered
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Package ID 32: Delivered
Package ID 33: Delivered
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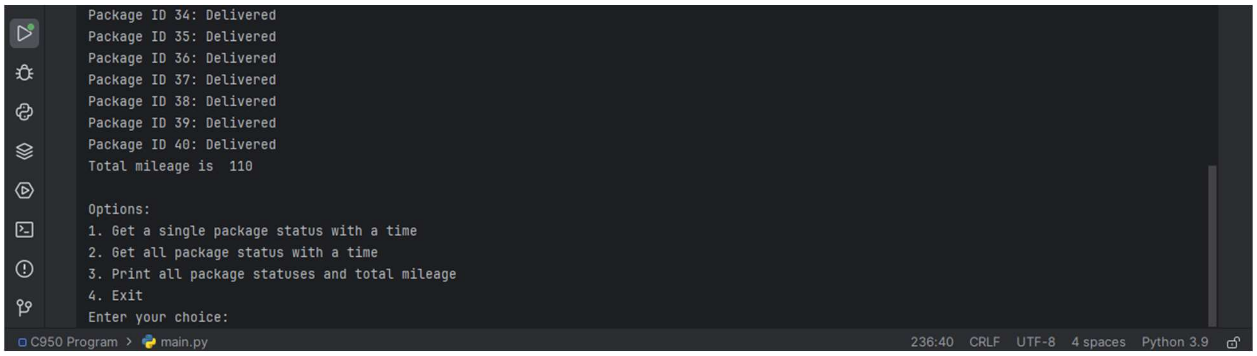

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Package ID 35: Delivered
Package ID 36: Delivered
Package ID 37: Delivered
Package ID 38: Delivered
Package ID 39: Delivered
Package ID 40: Delivered
Total mileage is  110

Options:
1. Get a single package status with a time
2. Get all package status with a time
3. Print all package statuses and total mileage
4. Exit
Enter your choice:
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C950 Program > main.py 236:40 CRLF UTF-8 4 spaces Python 3.9

F. Justify the package delivery algorithm used in the solution as written in the original program by doing the following:

1. Describe **two or more** strengths of the algorithm used in the solution.

   The algorithm is efficient due to its greedy approach, which selects the nearest package for delivery, potentially minimizing travel time and distance. Additionally, it prioritizes packages with the most urgent deadlines, ensuring time-sensitive deliveries are completed first, a crucial aspect of effective delivery service.

2. Verify that the algorithm used in the solution meets *all* requirements in the scenario.

   The algorithm meets the scenario's requirements by:

   Handling Special Instructions: It includes logic to handle special instructions for packages, which may affect delivery order or require specific actions.

   Optimizing Delivery Routes: By using the greedy method to select the nearest package for delivery, the algorithm works towards optimizing routes, which is likely to reduce overall delivery times and distances.

   Dynamic Time Tracking: The algorithm tracks current time dynamically and calculates expected delivery times, which helps in meeting delivery deadlines and provides the ability to check package status at different times of the day.

   Limiting Package Loads: It respects a maximum limit of packages per delivery turn, which could correspond to physical limitations of the trucks or operational rules of the delivery service.

3. Identify **two** other named algorithms that are different from the algorithm implemented in the solution and would meet *all* requirements in the scenario.

   Dijkstra's Algorithm and Genetic Algorithm

   a. Describe how *both* algorithms identified in part F3 are different from the algorithm used in the solution.

Dijkstra’s Algorithm

1. Optimization Focus: Dijkstra's algorithm focuses on finding the shortest path from a single source to all other nodes in a graph. Unlike a greedy algorithm that makes the locally optimal choice at each step, Dijkstra's continually updates the shortest path to each node as it processes the graph.

2. Approach: It uses a systematic approach to explore all possible paths to each node, updating its calculations as it discovers shorter paths. This is in contrast to a greedy algorithm, which may not reconsider choices once made.

3. Use Case: Ideal for problems where you need to find the shortest path in a weighted graph, such as in routing and map navigation. A greedy algorithm might be used for simpler, less computationally intensive tasks where a near-optimal solution is sufficient.

4. Complexity: Dijkstra's algorithm can be more computationally intensive, especially for large graphs, as it needs to maintain and update the distance to all nodes until the shortest path to each node is found.

Genetic Algorithm

1. Methodology: A genetic algorithm is an iterative approach that simulates the process of natural selection. It generates multiple solutions, 'evolves' them through processes analogous to biological crossover and mutation, and selects the best ones for further iteration.

2. Global Optimization: Unlike a greedy algorithm, a genetic algorithm does not make immediate, locally-optimal decisions. Instead, it explores a wide range of potential solutions, even those that may initially seem suboptimal, to find the best overall solution over time.

3. Flexibility and Adaptability: Genetic algorithms are highly adaptable and can be used for a wide range of optimization problems, including those where the solution space is vast or poorly defined, which might be challenging for a greedy approach.

4. Computational Intensity: They tend to require more computational resources than greedy algorithms, as they iterate over many generations of solutions and involve random elements, making them less predictable and potentially slower to arrive at an optimal solution.

In summary, while a greedy algorithm quickly makes decisions based on immediate benefits, Dijkstra's algorithm and genetic algorithms take a more comprehensive approach. Dijkstra’s focuses on updating and optimizing paths in a systematic way, and genetic algorithms iterate over multiple solutions, evolving them over time to find the best outcome. Both can potentially provide more globally optimal solutions than a greedy algorithm, but at the cost of higher computational complexity.

G. Describe what you would do differently, other than the two algorithms identified in part F3, if you did this project again, including details of the modifications that would be made.

I would implement a route optimization algorithm and make it dynamic so it could adapt throughout the day and allow the schedule to be updated real time.

H. Verify that the data structure used in the solution meets *all* requirements in the scenario.

   The chaining hash table is suitable for the package delivery system due to its efficient lookup, insertion, and deletion operations, which are typically O(1) on average. It allows quick access to package information using package IDs, which is essential for real-time package tracking and updating delivery statuses.

   1. Identify **two** other data structures that could meet the same requirements in the scenario.
      a. Balanced binary search tree or dynamic array
      a. Describe how *each* data structure identified in H1 is different from the data structure used in the solution.
         a. Balanced Binary Search Trees (BSTs) maintain sorted data and offer more predictable O(log n) performance for various operations, unlike hash tables which might perform poorly with many collisions. BSTs excel in range queries without needing hashing. On the other hand, dynamic arrays allow for constant-time indexing access, but their search, insert, and delete operations are less efficient than those of a hash table, particularly when unsorted. They may also use extra memory due to resizing, while hash tables use memory more efficiently, allocating only for actual elements and pointers.