Task 1: Business Case Analysis

Keniyah Chestnut

Optimization — D605

SID: 012601305

A: IDENTIFICATION OF BUSINESS NEED

In Scenario 1, ABC Logistics needs to improve profit margins while continuing to meet customer expectations. The company currently struggles with delivery efficiency, truck utilization, and rising operational costs. Because they are trying to reduce costs and increase profit while balancing several constraints, this qualifies as an optimization problem. I will outline an approach to optimize truck routing, reduce emissions, and lower costs while still meeting customer needs.

A1: EXPLANATION OF OPTIMIZATION APPROACH

The key business need is optimizing delivery operations to reduce overall cost. This includes optimizing which trucks are assigned to which routes and when deliveries are made. Addressing this through optimization will reduce fuel use, lower driver costs, and limit the number of vehicles on the road. This will also help the company reach their goal of reducing their carbon footprint while keeping customers satisfied.

A2: LINEARITY

The relationships between cost, distance, and truck capacity can be expressed using linear equations. Because the cost of fuel, truck usage, and travel time scale in a predictable way, the problem is mostly linear. The constraints related to delivery times and truck capacity also follow a linear structure.

A3: TYPE OF OPTIMIZATION PROBLEM

This is a Mixed-Integer Linear Programming (MILP) problem. It includes both continuous variables, such as cost and distance, and integer variables, such as whether a specific truck is assigned to a specific route. This problem also qualifies as a type of network optimization because it involves route planning similar to a logistics network.

B: IDENTIFY COMPONENTS OF OPTIMIZATION APPROACH

The main objective is to minimize total delivery costs. This includes fuel, driver wages, and truck maintenance. By minimizing cost, profit is increased without sacrificing customer delivery windows. An added benefit is a reduction in emissions by using fewer trucks and shorter routes.

Decision Variables

- Truck assignment to delivery points
- Delivery sequence for each truck
- Truck type used per route

Constraints

1. Truck capacity must not be exceeded

2. Deliveries must occur within the required time windows

B1: EXPLANATION OF ENDPOINT CONSIDERATIONS

In this optimization problem, endpoint considerations refer to the conditions that must be met by the time each delivery route is completed. These considerations ensure that the outcomes of the routing solution align with ABC Logistics' operational goals.

1. **Improve truck utilization across the fleet**

   At the conclusion of each optimized route, the solution should ensure that truck capacity is efficiently used. Trucks should not end routes underloaded if the same deliveries could have been consolidated. Maximizing utilization at the end of each delivery run contributes to cost savings and operational efficiency.

2. **Maintain or improve customer delivery satisfaction**

   Each route must be completed in a way that deliveries are made within customer time windows. This means that, by the end of each delivery cycle, all packages on the route must have been delivered on time, directly supporting customer satisfaction.

3. **Reduce carbon emissions through more efficient routing**

   The routes chosen must minimize unnecessary travel and fuel consumption. This means

that once each truck completes its route, it should have traveled the shortest or most fuel-efficient path possible, thereby reducing emissions as an outcome of the completed delivery path.

C: OPTIMIZATION METHOD RECOMMENDATION

Network optimization using Mixed-Integer Linear Programming (MILP) is recommended. It is well suited for logistics problems involving cost minimization and vehicle routing. This method can incorporate all constraints and decision variables while producing an efficient delivery schedule.

References

No sources were used besides WGU official course materials.