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C950 Data Structures & Algorithms II

PA Task 1: WGUPS Routing Program Planning

A - Algorithm Identification

I will be using the nearest neighbor algorithm as the core algorithm in my routing program. The nearest neighbor algorithm is an algorithm in which for each node left to visit, the nearest node is always the next to be visited. More information on my choice of using the nearest neighbor algorithm can be found in part C.

In this program, the nearest neighbor algorithm will be used to determine the most efficient route each truck should take to maximize the efficiency of their deliveries. It will plot a route from one package’s address to another, always choosing the nearest address to the previous delivery address when choosing the next location.

Being a greedy algorithm, the nearest neighbor algorithm may not always select the most optimal path for each delivery truck; however, the paths chosen will be sufficient for the purposes of this project.

B - Data Structure Identification

I will be using a hash table to store packages with their related data. A hash table is a self-adjusting data structure which stores key-value pairs. More information on my choice of using a hash table can be found in part C.

All package-related data will be held in the hash table. Each key in the table will be a package ID, and each value will be a “Package” object with all package-related data, including fields such as delivery address, delivery deadline, package weight, and delivery status.

C1 - Algorithm Overview

The core algorithm will plot the route for a single truck. Its logic can be described in the following pseudocode:

function PlotDeliveryRoute(truck)

    Initialize an empty list "route"

    Initialize a set "unvisited\_addresses" with each package address on the truck

    current\_location = HUB

    while length(unvisited\_addresses) != 0

        next\_address = null

        min\_distance = infinity

        for each address in unvisited\_addresses:

            distance = distance between current\_location and address

            if distance < min\_distance

                min\_distance = distance

                next\_address = address

            end if

        end for

        append next\_address to route

        remove next\_address from unvisited\_addresses

        current\_location = next\_address

    end while

    append HUB to route

end function

This function will be called once for each delivery truck before the packages are delivered. Once a route has been plotted, the truck will deliver its packages by visiting each address in the “route” list.

C2 – Programming Environment

IDE: VSCode v1.89.1

Language: Python v3.10.11

OS: Windows 11

Hardware: LG Gram; 12th Gen Intel® Core™ i7-1260P 2.10GHz; 32.0 GB RAM

C3 – Space-Time Complexity Analysis