C950 Task-2 WGUPS Write-Up

(Task-2: The implementation phase of the WGUPS Routing Program).

(Zip your source code and upload it with this file)

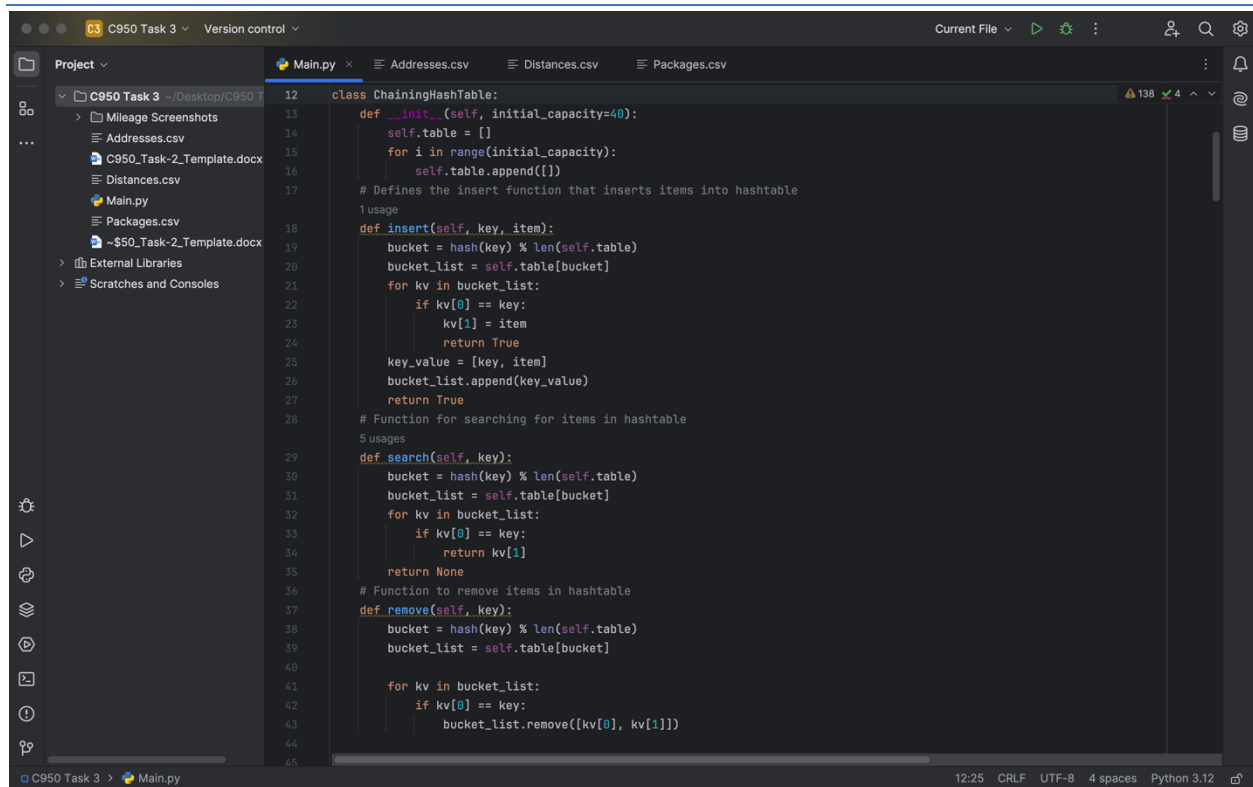Cade Fisher

ID #011020270

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08/13/2024

C950 Data Structures and Algorithms II

A. Hash Table

B. Look-Up Functions

```python
# Function for searching for items in hashtable
5 usages
def search(self, key):
    bucket = hash(key) % len(self.table)
    bucket_list = self.table[bucket]
    for kv in bucket_list:
        if kv[0] == key:
            return kv[1]
    return None
```

C. Original Code

C1. Identification Information

```
# Cade Fisher
#Student ID: 011020270
# C950 Task 2
# 08/13/2024
```

C2. Process and Flow Comments
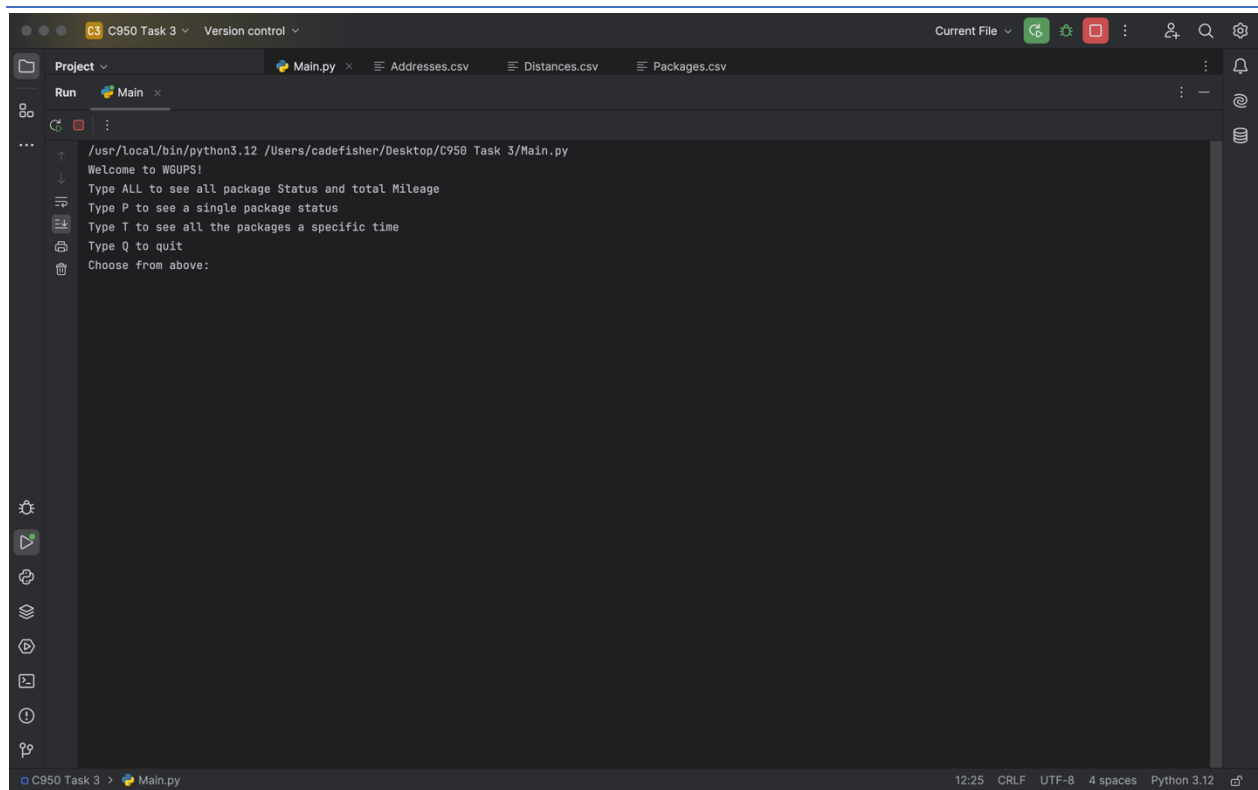
```python
# Executes the package delivery algorithm by using the nearest neighbor
3 usages
def package_delivery_algo(truck):
    # Initialize the list of packages that have not yet been delivered and clears the truck package list
    notDelivered = [myHash.search(packageId) for packageId in truck.packages]
    for packageId in truck.packages:
        package = myHash.search(packageId)
        notDelivered.append(package)
        truck.packages.clear()
    # While there are still packages to deliver and tracks the shortest distance of the remaining packages
    while len(notDelivered) > 0:
        nextAddress = float(inf)
        nextPackage = None
        for package in notDelivered:
            if distanceBewteenAddresses(addressFinder(truck.currentLocation),
                                        addressFinder(package.address)) <= nextAddress:
                nextAddress = distanceBewteenAddresses(addressFinder(truck.currentLocation), addressFinder(package.address))
                nextPackage = package
        # Adds the next package's ID to the truck's package list
        truck.packages.append(nextPackage.Id)
        # Removes the delivered package from the list of not delivered packages
        notDelivered.remove(nextPackage)
        # Updates the truck's mileage by adding the distance traveled
        truck.mileage += nextAddress
        # Updates the truck's current location to the address of the delivered package
        truck.currentLocation = nextPackage.address
        # Calculates the travel time based on the distance and the truck's average speed
        travelTime = (nextAddress / 18) * 60
        travelTimeDelta = datetime.timedelta(minutes=travelTime)
        # Updates the truck's departure time to account for the travel time
        truck.departureTime += travelTimeDelta
        # Sets the delivery time of the delivered package to the truck's updated departure time
        nextPackage.deliveryTime = truck.departureTime

# Creates the instances of the truck class for each truck
```
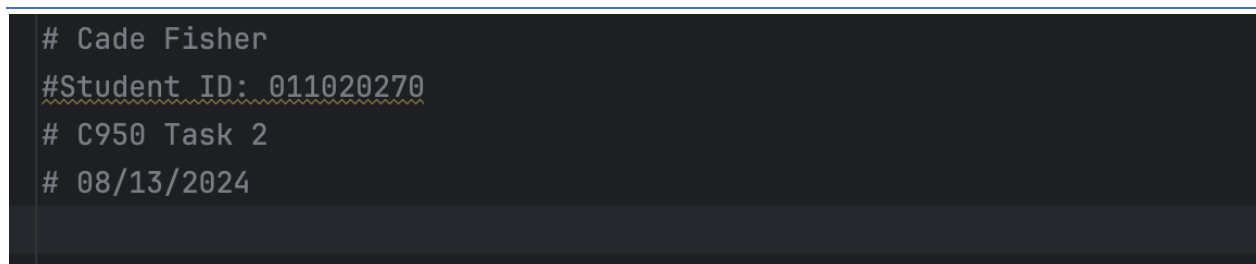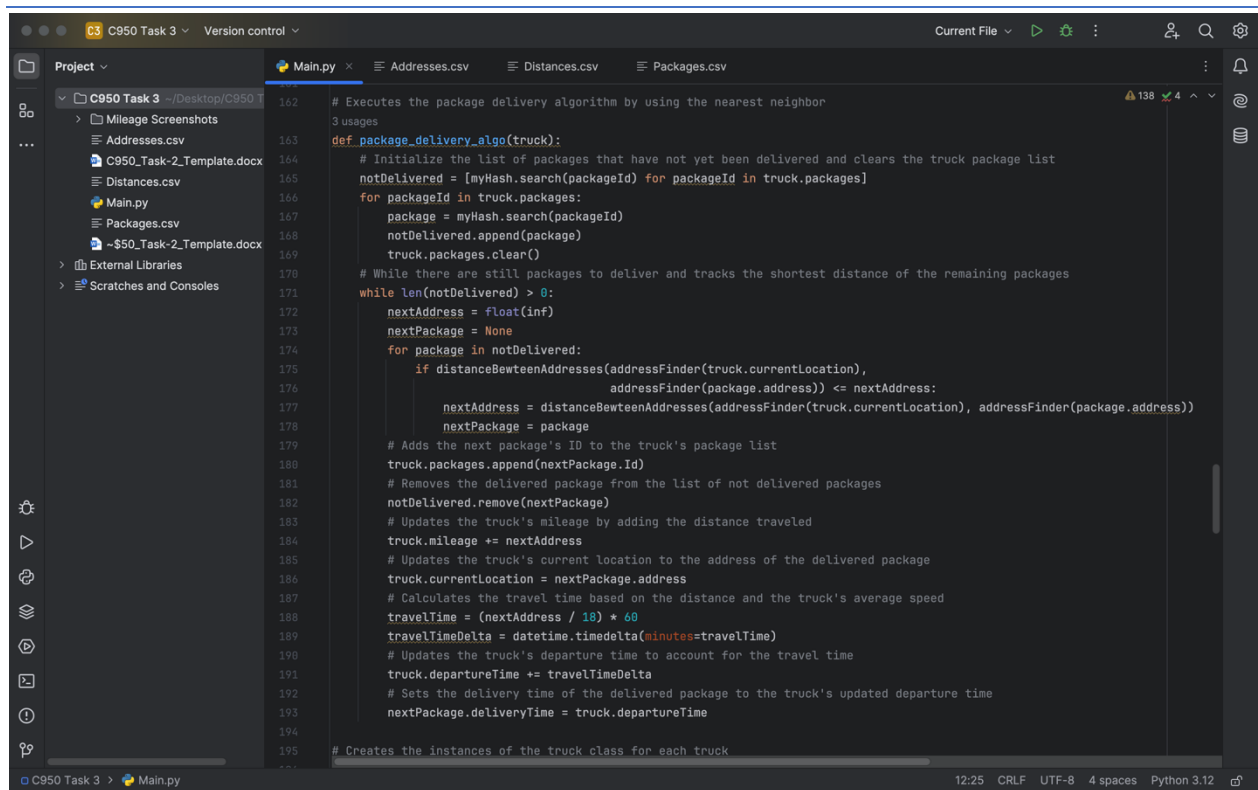
D. Interface

D1. First Status Check

```
/usr/local/bin/python3.12 /Users/cadefisher/Desktop/C950 Task 3/Main.py
Welcome to WGUPS!
Type ALL to see all package Status and total Mileage
Type P to see a single package status
Type T to see all the packages a specific time
Type Q to quit
Choose from above: T
Enter a time in the format HH:MM:SS: 09:00:00
Package 1: 195 W Oakland Ave Salt Lake City UT 84115 10:30 AM 21 Delivered: 8:39:00 by truck1
Package 2: 2530 S 500 E Salt Lake City UT 84106 EOD 44 AT HUB
Package 3: 233 Canyon Rd Salt Lake City UT 84103 EOD 2 AT HUB
Package 4: 380 W 2880 S Salt Lake City UT 84115 EOD 4 AT HUB
Package 5: 410 S State St Salt Lake City UT 84111 EOD 5 AT HUB
Package 6: 3060 Lester St West Valley City UT 84119 10:30 AM 88 AT HUB
Package 7: 1330 2100 S Salt Lake City UT 84106 EOD 8 AT HUB
Package 8: 300 State St Salt Lake City UT 84103 EOD 9 AT HUB
Package 9: 300 State St Salt Lake City UT 84103 EOD 2 AT HUB
Package 10: 600 E 900 South Salt Lake City UT 84105 EOD 1 AT HUB
Package 11: 2600 Taylorsville Blvd Salt Lake City UT 84118 EOD 1 AT HUB
Package 12: 3575 W Valley Central Station bus Loop West Valley City UT 84119 EOD 1 AT HUB
Package 13: 2010 W 500 S Salt Lake City UT 84104 10:30 AM 2 En route on truck1
Package 14: 4300 S 1300 E Millcreek UT 84117 10:30 AM 88 Delivered: 8:06:20 by truck1
Package 15: 4580 S 2300 E Holladay UT 84117 9:00 AM 4 Delivered: 8:13:00 by truck1
Package 16: 4580 S 2300 E Holladay UT 84117 10:30 AM 88 Delivered: 8:13:00 by truck1
Package 17: 3148 S 1100 W Salt Lake City UT 84119 EOD 2 En route on truck1
Package 18: 1488 4800 S Salt Lake City UT 84123 EOD 6 AT HUB
Package 19: 177 W Price Ave Salt Lake City UT 84115 EOD 37 Delivered: 8:49:40 by truck1
Package 20: 3595 Main St Salt Lake City UT 84115 10:30 AM 37 Delivered: 8:48:00 by truck1
Package 21: 3595 Main St Salt Lake City UT 84115 EOD 3 AT HUB
Package 22: 6351 South 900 East Murray UT 84121 EOD 2 AT HUB
Package 23: 5100 South 2700 West Salt Lake City UT 84118 EOD 5 AT HUB
Package 24: 5025 State St Murray UT 84107 EOD 7 AT HUB
Package 25: 5383 S 900 East Salt Lake City UT 84117 10:30 AM 7 AT HUB
```

```
Package 9: 300 State St Salt Lake City UT 84103 EOD 2 AT HUB
Package 10: 600 E 900 South Salt Lake City UT 84105 EOD 1 AT HUB
Package 11: 2600 Taylorsville Blvd Salt Lake City UT 84118 EOD 1 AT HUB
Package 12: 3575 W Valley Central Station bus Loop West Valley City UT 84119 EOD 1 AT HUB
Package 13: 2010 W 500 S Salt Lake City UT 84104 10:30 AM 2 En route on truck1
Package 14: 4300 S 1300 E Millcreek UT 84117 10:30 AM 88 Delivered: 8:06:20 by truck1
Package 15: 4580 S 2300 E Holladay UT 84117 9:00 AM 4 Delivered: 8:13:00 by truck1
Package 16: 4580 S 2300 E Holladay UT 84117 10:30 AM 88 Delivered: 8:13:00 by truck1
Package 17: 3148 S 1100 W Salt Lake City UT 84119 EOD 2 En route on truck1
Package 18: 1488 4800 S Salt Lake City UT 84123 EOD 6 AT HUB
Package 19: 177 W Price Ave Salt Lake City UT 84115 EOD 37 Delivered: 8:49:40 by truck1
Package 20: 3595 Main St Salt Lake City UT 84115 10:30 AM 37 Delivered: 8:48:00 by truck1
Package 21: 3595 Main St Salt Lake City UT 84115 EOD 3 AT HUB
Package 22: 6351 South 900 East Murray UT 84121 EOD 2 AT HUB
Package 23: 5100 South 2700 West Salt Lake City UT 84118 EOD 5 AT HUB
Package 24: 5025 State St Murray UT 84107 EOD 7 AT HUB
Package 25: 5383 S 900 East Salt Lake City UT 84117 10:30 AM 7 AT HUB
Package 26: 5383 S 900 East Salt Lake City UT 84117 EOD 25 AT HUB
Package 27: 1060 Dalton Ave S Salt Lake City UT 84104 EOD 5 AT HUB
Package 28: 2835 Main St Salt Lake City UT 84115 EOD 7 AT HUB
Package 29: 1330 2100 S Salt Lake City UT 84106 10:30 AM 2 Delivered: 8:29:40 by truck1
Package 30: 300 State St Salt Lake City UT 84103 10:30 AM 1 En route on truck1
Package 31: 3365 S 900 W Salt Lake City UT 84119 10:30 AM 1 Delivered: 8:58:40 by truck1
Package 32: 3365 S 900 W Salt Lake City UT 84119 EOD 1 AT HUB
Package 33: 2530 S 500 E Salt Lake City UT 84106 EOD 1 AT HUB
Package 34: 4580 S 2300 E Holladay UT 84117 10:30 AM 2 Delivered: 8:13:00 by truck1
Package 35: 1060 Dalton Ave S Salt Lake City UT 84104 EOD 88 AT HUB
Package 36: 2300 Parkway Blvd West Valley City UT 84119 EOD 88 AT HUB
Package 37: 410 S State St Salt Lake City UT 84111 10:30 AM 2 En route on truck1
Package 38: 410 S State St Salt Lake City UT 84111 EOD 9 AT HUB
Package 39: 2010 W 500 S Salt Lake City UT 84104 EOD 9 AT HUB
Package 40: 380 W 2880 S Salt Lake City UT 84115 10:30 AM 45 Delivered: 8:42:40 by truck1
Choose from above:
```

D2. Second Status Check

```
                                                                Main  ×

/usr/local/bin/python3.12 /Users/cadefisher/Desktop/C950 Task 3/Main.py
Welcome to WGUPS!
Type ALL to see all package Status and total Mileage
Type P to see a single package status
Type T to see all the packages a specific time
Type Q to quit
Choose from above: T
Enter a time in the format HH:MM:SS: 10:00:00
Package 1: 195 W Oakland Ave Salt Lake City UT 84115 10:30 AM 21 Delivered: 8:39:00 by truck1
Package 2: 2530 S 500 E Salt Lake City UT 84106 EOD 44 AT HUB
Package 3: 233 Canyon Rd Salt Lake City UT 84103 EOD 2 AT HUB
Package 4: 380 W 2880 S Salt Lake City UT 84115 EOD 4 Delivered: 9:20:00 by truck3
Package 5: 410 S State St Salt Lake City UT 84111 EOD 5 Delivered: 9:56:40 by truck3
Package 6: 3060 Lester St West Valley City UT 84119 10:30 AM 88 Delivered: 9:30:40 by truck3
Package 7: 1330 2100 S Salt Lake City UT 84106 EOD 8 AT HUB
Package 8: 300 State St Salt Lake City UT 84103 EOD 9 AT HUB
Package 9: 300 State St Salt Lake City UT 84103 EOD 2 AT HUB
Package 10: 600 E 900 South Salt Lake City UT 84105 EOD 1 AT HUB
Package 11: 2600 Taylorsville Blvd Salt Lake City UT 84118 EOD 1 AT HUB
Package 12: 3575 W Valley Central Station bus Loop West Valley City UT 84119 EOD 1 AT HUB
Package 13: 2010 W 500 S Salt Lake City UT 84104 10:30 AM 2 Delivered: 9:18:00 by truck1
Package 14: 4300 S 1300 E Millcreek UT 84117 10:30 AM 88 Delivered: 8:06:20 by truck1
Package 15: 4580 S 2300 E Holladay UT 84117 9:00 AM 4 Delivered: 8:13:00 by truck1
Package 16: 4580 S 2300 E Holladay UT 84117 10:30 AM 88 Delivered: 8:13:00 by truck1
Package 17: 3148 S 1100 W Salt Lake City UT 84119 EOD 2 En route on truck1
Package 18: 1488 4800 S Salt Lake City UT 84123 EOD 6 AT HUB
Package 19: 177 W Price Ave Salt Lake City UT 84115 EOD 37 Delivered: 8:49:40 by truck1
Package 20: 3595 Main St Salt Lake City UT 84115 10:30 AM 37 Delivered: 8:48:00 by truck1
Package 21: 3595 Main St Salt Lake City UT 84115 EOD 3 Delivered: 9:12:40 by truck3
Package 22: 6351 South 900 East Murray UT 84121 EOD 2 En route on truck3
Package 23: 5100 South 2700 West Salt Lake City UT 84118 EOD 5 AT HUB
Package 24: 5025 State St Murray UT 84107 EOD 7 En route on truck3
Package 25: 5383 S 900 East Salt Lake City UT 84117 10:30 AM 7 En route on truck3
```

```
                                                                Main  ×

Package 9: 300 State St Salt Lake City UT 84103 EOD 2 AT HUB
Package 10: 600 E 900 South Salt Lake City UT 84105 EOD 1 AT HUB
Package 11: 2600 Taylorsville Blvd Salt Lake City UT 84118 EOD 1 AT HUB
Package 12: 3575 W Valley Central Station bus Loop West Valley City UT 84119 EOD 1 AT HUB
Package 13: 2010 W 500 S Salt Lake City UT 84104 10:30 AM 2 Delivered: 9:18:00 by truck1
Package 14: 4300 S 1300 E Millcreek UT 84117 10:30 AM 88 Delivered: 8:06:20 by truck1
Package 15: 4580 S 2300 E Holladay UT 84117 9:00 AM 4 Delivered: 8:13:00 by truck1
Package 16: 4580 S 2300 E Holladay UT 84117 10:30 AM 88 Delivered: 8:13:00 by truck1
Package 17: 3148 S 1100 W Salt Lake City UT 84119 EOD 2 En route on truck1
Package 18: 1488 4800 S Salt Lake City UT 84123 EOD 6 AT HUB
Package 19: 177 W Price Ave Salt Lake City UT 84115 EOD 37 Delivered: 8:49:40 by truck1
Package 20: 3595 Main St Salt Lake City UT 84115 10:30 AM 37 Delivered: 8:48:00 by truck1
Package 21: 3595 Main St Salt Lake City UT 84115 EOD 3 Delivered: 9:12:40 by truck3
Package 22: 6351 South 900 East Murray UT 84121 EOD 2 En route on truck3
Package 23: 5100 South 2700 West Salt Lake City UT 84118 EOD 5 AT HUB
Package 24: 5025 State St Murray UT 84107 EOD 7 En route on truck3
Package 25: 5383 S 900 East Salt Lake City UT 84117 10:30 AM 7 En route on truck3
Package 26: 5383 S 900 East Salt Lake City UT 84117 EOD 25 En route on truck3
Package 27: 1060 Dalton Ave S Salt Lake City UT 84104 EOD 5 Delivered: 9:40:40 by truck3
Package 28: 2835 Main St Salt Lake City UT 84115 EOD 7 Delivered: 9:16:40 by truck3
Package 29: 1330 2100 S Salt Lake City UT 84106 10:30 AM 2 Delivered: 8:29:40 by truck1
Package 30: 300 State St Salt Lake City UT 84103 10:30 AM 1 Delivered: 9:32:00 by truck1
Package 31: 3365 S 900 W Salt Lake City UT 84119 10:30 AM 1 Delivered: 8:58:40 by truck1
Package 32: 3365 S 900 W Salt Lake City UT 84119 EOD 1 Delivered: 9:25:40 by truck3
Package 33: 2530 S 500 E Salt Lake City UT 84106 EOD 1 En route on truck3
Package 34: 4580 S 2300 E Holladay UT 84117 10:30 AM 2 Delivered: 8:13:00 by truck1
Package 35: 1060 Dalton Ave S Salt Lake City UT 84104 EOD 88 Delivered: 9:40:40 by truck3
Package 36: 2300 Parkway Blvd West Valley City UT 84119 EOD 88 AT HUB
Package 37: 410 S State St Salt Lake City UT 84111 10:30 AM 2 Delivered: 9:28:40 by truck1
Package 38: 410 S State St Salt Lake City UT 84111 EOD 9 AT HUB
Package 39: 2010 W 500 S Salt Lake City UT 84104 EOD 9 AT HUB
Package 40: 380 W 2880 S Salt Lake City UT 84115 10:30 AM 45 Delivered: 8:42:40 by truck1
Choose from above:
```

D3. Third Status Check

```
/usr/local/bin/python3.12 /Users/cadefisher/Desktop/C950 Task 3/Main.py
Welcome to WGUPS!
Type ALL to see all package Status and total Mileage
Type P to see a single package status
Type T to see all the packages a specific time
Type Q to quit
Choose from above: T
Enter a time in the format HH:MM:SS: 13:00:00
Package 1: 195 W Oakland Ave Salt Lake City UT 84115 10:30 AM 21 Delivered: 8:39:00 by truck1
Package 2: 2530 S 500 E Salt Lake City UT 84106 EOD 44 Delivered: 12:13:00 by truck2
Package 3: 233 Canyon Rd Salt Lake City UT 84103 EOD 2 Delivered: 12:35:00 by truck2
Package 4: 380 W 2880 S Salt Lake City UT 84115 EOD 4 Delivered: 9:20:00 by truck3
Package 5: 410 S State St Salt Lake City UT 84111 EOD 5 Delivered: 9:56:40 by truck3
Package 6: 3060 Lester St West Valley City UT 84119 10:30 AM 88 Delivered: 9:30:40 by truck3
Package 7: 1330 2100 S Salt Lake City UT 84106 EOD 8 Delivered: 12:07:40 by truck2
Package 8: 300 State St Salt Lake City UT 84103 EOD 9 Delivered: 12:33:00 by truck2
Package 9: 410 S State St Salt Lake City UT 84111 EOD 2 Delivered: 12:33:00 by truck2
Package 10: 600 E 900 South Salt Lake City UT 84105 EOD 1 Delivered: 12:23:40 by truck2
Package 11: 2600 Taylorsville Blvd Salt Lake City UT 84118 EOD 1 Delivered: 11:21:40 by truck2
Package 12: 3575 W Valley Central Station bus Loop West Valley City UT 84119 EOD 1 Delivered: 11:48:40 by truck2
Package 13: 2010 W 500 S Salt Lake City UT 84104 10:30 AM 2 Delivered: 9:18:00 by truck1
Package 14: 4300 S 1300 E Millcreek UT 84117 10:30 AM 88 Delivered: 8:06:20 by truck1
Package 15: 4580 S 2300 E Holladay UT 84117 9:00 AM 4 Delivered: 8:13:00 by truck1
Package 16: 4580 S 2300 E Holladay UT 84117 10:30 AM 88 Delivered: 8:13:00 by truck1
Package 17: 3148 S 1100 W Salt Lake City UT 84119 EOD 2 En route on truck1
Package 18: 1488 4800 S Salt Lake City UT 84123 EOD 6 Delivered: 11:25:00 by truck2
Package 19: 177 W Price Ave Salt Lake City UT 84115 EOD 37 Delivered: 8:49:40 by truck1
Package 20: 3595 Main St Salt Lake City UT 84115 10:30 AM 37 Delivered: 8:48:00 by truck1
Package 21: 3595 Main St Salt Lake City UT 84115 EOD 3 Delivered: 9:12:40 by truck3
Package 22: 6351 South 900 East Murray UT 84121 EOD 2 Delivered: 10:30:40 by truck3
Package 23: 5100 South 2700 West Salt Lake City UT 84118 EOD 5 Delivered: 11:23:00 by truck2
Package 24: 5025 State St Murray UT 84107 EOD 7 Delivered: 11:08:00 by truck3
Package 25: 5383 S 900 East Salt Lake City UT 84117 10:30 AM 7 Delivered: 10:26:20 by truck3
```

```
Package 9: 410 S State St Salt Lake City UT 84111 EOD 2 Delivered: 12:33:00 by truck2
Package 10: 600 E 900 South Salt Lake City UT 84105 EOD 1 Delivered: 12:23:40 by truck2
Package 11: 2600 Taylorsville Blvd Salt Lake City UT 84118 EOD 1 Delivered: 11:21:40 by truck2
Package 12: 3575 W Valley Central Station bus Loop West Valley City UT 84119 EOD 1 Delivered: 11:48:40 by truck2
Package 13: 2010 W 500 S Salt Lake City UT 84104 10:30 AM 2 Delivered: 9:18:00 by truck1
Package 14: 4300 S 1300 E Millcreek UT 84117 10:30 AM 88 Delivered: 8:06:20 by truck1
Package 15: 4580 S 2300 E Holladay UT 84117 9:00 AM 4 Delivered: 8:13:00 by truck1
Package 16: 4580 S 2300 E Holladay UT 84117 10:30 AM 88 Delivered: 8:13:00 by truck1
Package 17: 3148 S 1100 W Salt Lake City UT 84119 EOD 2 En route on truck1
Package 18: 1488 4800 S Salt Lake City UT 84123 EOD 6 Delivered: 11:25:00 by truck2
Package 19: 177 W Price Ave Salt Lake City UT 84115 EOD 37 Delivered: 8:49:40 by truck1
Package 20: 3595 Main St Salt Lake City UT 84115 10:30 AM 37 Delivered: 8:48:00 by truck1
Package 21: 3595 Main St Salt Lake City UT 84115 EOD 3 Delivered: 9:12:40 by truck3
Package 22: 6351 South 900 East Murray UT 84121 EOD 2 Delivered: 10:30:40 by truck3
Package 23: 5100 South 2700 West Salt Lake City UT 84118 EOD 5 Delivered: 11:23:00 by truck2
Package 24: 5025 State St Murray UT 84107 EOD 7 Delivered: 11:08:00 by truck3
Package 25: 5383 S 900 East Salt Lake City UT 84117 10:30 AM 7 Delivered: 10:26:20 by truck3
Package 26: 5383 S 900 East Salt Lake City UT 84117 EOD 25 Delivered: 10:26:20 by truck3
Package 27: 1060 Dalton Ave S Salt Lake City UT 84104 EOD 5 Delivered: 9:40:40 by truck3
Package 28: 2835 Main St Salt Lake City UT 84115 EOD 7 Delivered: 9:16:40 by truck3
Package 29: 1330 2100 S Salt Lake City UT 84106 10:30 AM 2 Delivered: 8:29:40 by truck1
Package 30: 300 State St Salt Lake City UT 84103 10:30 AM 1 Delivered: 9:32:00 by truck1
Package 31: 3365 S 900 W Salt Lake City UT 84119 10:30 AM 1 Delivered: 8:58:40 by truck1
Package 32: 3365 S 900 W Salt Lake City UT 84119 EOD 1 Delivered: 9:25:40 by truck3
Package 33: 2530 S 500 E Salt Lake City UT 84106 EOD 1 Delivered: 10:10:20 by truck3
Package 34: 4580 S 2300 E Holladay UT 84117 10:30 AM 2 Delivered: 8:13:00 by truck1
Package 35: 1060 Dalton Ave S Salt Lake City UT 84104 EOD 88 Delivered: 9:40:40 by truck3
Package 36: 2300 Parkway Blvd West Valley City UT 84119 EOD 88 Delivered: 11:38:20 by truck2
Package 37: 410 S State St Salt Lake City UT 84111 10:30 AM 2 Delivered: 9:28:40 by truck1
Package 38: 410 S State St Salt Lake City UT 84111 EOD 9 Delivered: 12:29:40 by truck2
Package 39: 2010 W 500 S Salt Lake City UT 84104 EOD 9 Delivered: 12:49:00 by truck2
Package 40: 380 W 2880 S Salt Lake City UT 84115 10:30 AM 45 Delivered: 8:42:40 by truck1
Choose from above:
```

E. Screenshot of Code Execution

```
Main ×

/usr/local/bin/python3.12 /Users/cadefisher/Desktop/C950 Task 3/Main.py
Welcome to WGUPS!
Type ALL to see all package Status and total Mileage
Type P to see a single package status
Type T to see all the packages a specific time
Type Q to quit
Choose from above: ALL
Total Mileage:  93.69999999999999
Package 1: 195 W Oakland Ave Salt Lake City UT 84115 10:30 AM 21 Delivered at 8:39:00 by Truck 1
Package 2: 2530 S 500 E Salt Lake City UT 84106 EOD 44 Delivered at 12:13:00 by Truck 2
Package 3: 233 Canyon Rd Salt Lake City UT 84103 EOD 2 Delivered at 12:35:00 by Truck 2
Package 4: 380 W 2880 S Salt Lake City UT 84115 EOD 4 Delivered at 9:20:00 by Truck 3
Package 5: 410 S State St Salt Lake City UT 84111 EOD 5 Delivered at 9:56:40 by Truck 3
Package 6: 3060 Lester St West Valley City UT 84119 10:30 AM 88 Delivered at 9:30:40 by Truck 3
Package 7: 1330 2100 S Salt Lake City UT 84106 EOD 8 Delivered at 12:07:40 by Truck 2
Package 8: 300 State St Salt Lake City UT 84103 EOD 9 Delivered at 12:33:00 by Truck 2
Package 9: 300 State St Salt Lake City UT 84103 EOD 2 Delivered at 12:33:00 by Truck 2
Package 10: 600 E 900 South Salt Lake City UT 84105 EOD 1 Delivered at 12:23:40 by Truck 2
Package 11: 2600 Taylorsville Blvd Salt Lake City UT 84118 EOD 1 Delivered at 11:21:40 by Truck 2
Package 12: 3575 W Valley Central Station bus Loop West Valley City UT 84119 EOD 1 Delivered at 11:48:40 by Truck 2
Package 13: 2010 W 500 S Salt Lake City UT 84104 10:30 AM 2 Delivered at 9:18:00 by Truck 1
Package 14: 4300 S 1300 E Millcreek UT 84117 10:30 AM 88 Delivered at 8:06:20 by Truck 1
Package 15: 4580 S 2300 E Holladay UT 84117 9:00 AM 4 Delivered at 8:13:00 by Truck 1
Package 16: 4580 S 2300 E Holladay UT 84117 10:30 AM 88 Delivered at 8:13:00 by Truck 1
Package 17: 3148 S 1100 W Salt Lake City UT 84119 EOD 2 Delivered at 13:15:40 by Truck 1
Package 18: 1488 4800 S Salt Lake City UT 84123 EOD 6 Delivered at 11:25:00 by Truck 2
Package 19: 177 W Price Ave Salt Lake City UT 84115 EOD 37 Delivered at 8:49:40 by Truck 1
Package 20: 3595 Main St Salt Lake City UT 84115 10:30 AM 37 Delivered at 8:48:00 by Truck 1
Package 21: 3595 Main St Salt Lake City UT 84115 EOD 3 Delivered at 9:12:40 by Truck 3
Package 22: 6351 South 900 East Murray UT 84121 EOD 2 Delivered at 10:30:40 by Truck 3
Package 23: 5100 South 2700 West Salt Lake City UT 84118 EOD 5 Delivered at 11:23:00 by Truck 2
Package 24: 5025 State St Murray UT 84107 EOD 7 Delivered at 11:08:00 by Truck 2
Package 25: 5383 S 900 East Salt Lake City UT 84117 10:30 AM 7 Delivered at 10:26:20 by Truck 3
```

F1. Strengths of the Chosen Algorithm

The algorithm used in the solution is the nearest neighbor algorithm. Its strengths are its simplicity, which makes it easy to implement and understand, and its ability to quickly find good routes for short delivery trips, making it efficient for practical use where an exact optimal solution is not necessary.

F3. Other Possible Algorithms

Dijkstra's Algorithm: This algorithm finds the shortest path between a starting point and all other points, ensuring the most efficient route across all delivery points.

2-opt Algorithm: This algorithm optimizes routes by making local improvements through swapping pairs of edges, which helps reduce the overall distance in a delivery route with multiple stops.

F3a. Algorithm Differences

Dijkstra's Algorithm finds the shortest path from a starting point to all other points, while the nearest neighbor algorithm only considers the nearest package at each step. The 2-opt Algorithm refines an existing route by swapping edges to reduce distance, whereas the nearest neighbor algorithm builds the route from scratch without optimization of the entire path.

G. Different Approach

I would use Simulated Annealing to explore a broader range of routes and avoid getting stuck in local optima. Additionally, I would integrate real-time traffic data to dynamically adjust routes for better efficiency.

H1. Other Data Structures

Binary Search Tree (BST): A BST can efficiently store and retrieve packages based on their addresses, allowing for quick lookups and updates.

Priority Queue: A priority queue can manage packages based on delivery priority or distance, enabling efficient retrieval of the next most important package to deliver.

H1a. Data Structure Differences

A Binary Search Tree provides ordered access with logarithmic time complexity, whereas a hashtable offers constant-time average access. A Priority Queue organizes elements based on priority, allowing for efficient retrieval of the highest or lowest priority item, unlike a hashtable, which does not maintain any order.