ComfortRoute – Iteration 1 Written Deliverable

GitHub Repository: https://github.com/Kass-ii/CSE-3311-

Version: 0.1-inception 1

Team#: 3

• Project Overview

Iteration 1 focuses on implementing backtracking on a single rail line using real GTFS transit data. The goal is to maximize time spent inside the train while ensuring the rider returns to the original station before a specified deadline.

• Implemented features – Backtracking on same rail Line

- User provides start station, start-after time, and return-by-time.
- System identifies the rail line serving the station.
- Explores outbound trips and possible turnaround stops.
- Find return trips on the same line.
- Selects plan maximizing total ride time while satisfying return constraint.

To help maximize rider comfort, this feature utilizes backtracking. With backtracking, DART trains can pass by its destination on a rail line while being able to return to it by its expected arrival time. This feature helps maximize rider comfort along DART lines by allowing them to utilize the comfortable environment inside the train without experiencing a loss of time.

• Input and Output

Inputs	Outputs
Start station (string)	Route ID and name
Start-after time (HH:MM:SS)	Departure time
Return-by time (HH:MM:SS)	Turnaround stop
	Arrival back time

	Total ride minutes
	Turnaround wait time

- **Top Risks**
  - GTFS time calculation errors (trips past midnight).
  - Possibility of a valid return trip not being found before return-by deadline (may return null).
  - Incorrect rail identification for stations that serve multiple routes.
  - Suboptimal turnaround trips are selected (where the system chooses one turnaround trip, but a later one could yield a greater ride time).
  - Same station chosen for turnaround.
  - Performance risk from large amounts of GTFS data.
- **Test Cases**

At this moment, the integration of GTFS data with the full system is in progress. The following test cases represent designed validation scenarios with expected outcomes and their purposes.

Test Case	Input	Expectation	Purpose
Backtracking is possible	**Start Station: MockA Start-after: 08:00:00 Return-by: 09:00:00**	**The system selects a turnaround station beyond its origin and returns before 09:00 while maximizing ride time.**	**Validates backtracking logic.**
No backtracking window	**Start Station: MockB Start-after: 08:00:00 Return-by: 08:20:00**	**Minimal ride time or no valid trip is returned.**	**Ensures deadline constraint is met.**
Large window	**Start Station: MockC**	**System selects the furthest feasible**	**Ensures that algorithm explores all**

	Start-after: 08:00:00 Return-by: 11:00:00	**turnaround stop where the return arrival occurs before 11:00. Maximizes total ride**	**feasible options and explores the most optimal option.**
No return trip is available	**Start Station: MockA Start-after: 08:00:00 Return-by: 08:40:00**	**System returns “no feasible plan found” without crashing**	**Validates error handling**
Midnight trips	**Start Station: MockC Start-after: 23:30:00 Return-by: 01:30:00**	**System correctly handles 24+ hour values, valid plan is returned if feasible**	**Validates GTFS time parsing**

- ## How to run iteration 1

The iteration uses an algorithm that takes a start station as input, along with a departure time and return by time. From there, the algorithm identifies the rail line that is associated with the train station and searches for departures to take place after the start-after-time. Next, it looks for possible turnaround trips that are on the same transit line. If the actual arrival time precedes the return-by-time, the algorithm will select the plan that maximizes the total ride time. Otherwise, it will trace back to searching for turnaround options. This will output the optimal round-trip journey plan.

- ## Customers and Users

The primary users would be residents of DFW that utilize systems such as DART and TRE as their primary method of transportation. User feedback has included ensuring that time constraints such as arrival times are met while still being able to maximize the overall ride time for rider comfort.