

Team Project: General Transit Feed Specification Tool

General Transit Feed Specification (GTFS) Static is a flat file format for specifying transit (aka bus) schedule information. More details and example files are available here:

<https://developers.google.com/transit/gtfs/>. This format is used by Google Transit and most transit applications around the world. Creating and maintaining GTFS files can be challenging for a transit organization as bus schedules change, stops change, and routes change.

You will be creating an application that can import and export GTFS files and store the content of the files in a functional and efficient class structure within the program. The end users of your application include a transit route manager, route planners, riders, mobile applications (via an API), Google Transit and others to be discussed later.

You can assume that the application will always start by loading GTFS files, but they may not be syntactically valid, so your program will need to identify any formatting errors encountered without the application crashing. Appropriate error messages should be shown to the users. Note that GTFS files are csv files, and their format is clearly specified in here: <https://developers.google.com/transit/gtfs/>, so your program should validate the files against those rules (unless specified differently by the instructor). Not all elements of the GTFS files are required in each file, and the column order is also not fixed. Some elements are optional, and others are required.

For this class we will deviate from the specification slightly to simplify the application. The ONLY GTFS files your program should load and process are: stops.txt, trips.txt, stop_times.txt, routes.txt. You should consider the "route_color" column in routes.txt as required even though the specification says it is optional. Consider the efficiency of storing, searching, updating, and other operations listed below when designing your data structures.

The final application will have many different functionalities. The exact deliverables you will be implementing will be provided each week for lab (note that they will **not** be tackled in sequential order and several features may not be implemented during this term). Additional features may be added to the project during the term, but the features below capture the functionality that your application should be designed to accommodate.

1. Import a set of GTFS files into the program
 - a. stops.txt
 - b. trips.txt
 - c. stop_times.txt
 - d. routes.txt
2. Display the distance of each trip
3. Display the average speed based on the start and end times of a trip.
4. Display the number of trips each stop is found on.
5. Search for a stop by stop_id and display all route_id(s) that contain the stop
6. Search for a route by route_id and display all the stop_id(s) on the route
7. Search for a route by route_id and display the trip_id for any trips happening in the future
8. Search for a stop by stop_id and display the next trip_id(s) (closest to the current time)
9. Plot the GPS coordinates for all the stops on a given route on a Google map (static is OK)
 - a. Different routes should be different colors

- b. A legend should be shown
- 10. Plot the current location of any bus on any route inferred from the timing in the trips
- 11. Update any attributes of a stop_time, stop, route, or trip
- 12. Update any attributes of a group of stop_times simultaneously
 - a. Attributes of a trip should be possible to apply to “all similar trips”
- 13. Click and drag a stop on a route to change the stop location
 - a. Note: This should apply the change to all trips using the stop
- 14. Click on a stop and change the times that the individual trips arrive and depart at the stop.
- 15. Export the GTFS files in the correct format from the data structure
 - a. stops.txt
 - b. trips.txt
 - c. stop_times.txt
 - d. routes.txt

Sets of valid GTFS files will be made available for testing, but you must generate your own test cases. Some of these requirements are intentionally vague and require clarification. If in doubt, ask questions!

Lastly, it is very important that you develop an understanding of what is meant by a stop, route, and trip consistent with the terminology used in GTFS. If you are unclear, please ask for clarification.