Decision-aid methodologies in transportation – Transport modelling module – Lab 3

1 Objective – Trip distribution models

The objective of this lab is to understand the implementation of trip distribution models. There are three main files to go through this lab:

1. 00_Furness.ipynb: A brief example on the implementation of the Furness method
2. 01_Double_constrained_gravity.ipynb: Implementation of the doubly constrained gravity model assuming an exponential deterrence function.
3. 02_Double_constrained_gravity_Hyman.ipynb: Implementation of the doubly constrained gravity model assuming an exponential deterrence function. In this notebook, we also estimate the parameter of the deterrence function with the Hyman method.

2 Tasks

1. Go through the notebooks and understand each of the methodologies
    a. Comment: When using synthetic data, we generate the trip ends from a known OD matrix. Just with a quick look (without any formal test), how well do the techniques approximate the original data?
    b. Mini task: You have different input data for the Furness method and the gravity model. You can try to swap the data and compare the results of a single method on the same data.
2. Implement the gravity model with the Hyman method using the real-life data and the estimations from the trip generation model (results were generated in the previous lab). Check the notebooks for more details.

With respect to task 2, the process is a bit more complicated, compared to the synthetic data example. Here are some things to take into consideration:

2.1 Dealing with the generalised cost

Question: How about the generalised cost to-from, the external zone?
Answer: Simply assume that the generalised cost to-from the external zone, is the average value of the generalised costs between all zones in the study area (else, the average value of the generalised costs matrix).

Important! The results from the trip generation lab are productions and attractions. Instead, we need origin and destinations. You can use the "PA_vectors" data to adjust (different file per trip purpose).

For today we will assume that the generalised cost is the same for each trip purpose but we will relax this assumption in the next week's lab.

Use the Fribourg_generalised_cost.csv as the generalised cost input

2.2 From production-attraction to origin-destination

In the "PA_vectors" files you have the following variables:

- Share_PO: The share of productions per zone that are the origin of the trip
- Share_PD: The share of productions per zone that are the destination of the trip
- Share_AO: The share of attractions per zone that are the origin of the trip
- Share_AD: The share of attractions per zone that are the destination of the trip

Hence, we can say that:
Origins = Productions* Share_PO + Attractions* Share_AO
Destinations = Productions* Share_PD + Attractions* Share_AD

2.3 Consider only the morning peak data

Assumption! Let's say that we only care for the morning peak hours 7 – 9 AM.
Our trip generation data include daily trips.

Before the trip distribution step, we should only keep the trips that took place during the morning peak. Use the following table to convert the daily trips (as estimated with the regression model) to morning peak trips:

Trip type	Morning peak proportion
HBW	25%
HBE	30%
HBO	10%

After the conversions, please make sure that the sum of productions is the same as the sum of attractions!

2.4 Mean trip length

In order to implement the Hyman method using the real-world Fribourg data, we need to have some idea regarding the mean trip length. We can use some existing known OD matrix that we collected at some point.

For the mean trip length you can use the "OD" csv files depending on the trip purpose. E.g. OD_HBW refers to the OD matrix with respect to home based work trips.

3 Expected outputs

After implementing Task 2, you should had three (3) origin-destination matrices, once per trip purpose.