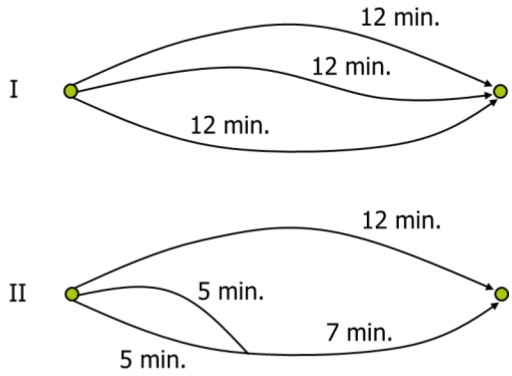
Post lecture questions Basic concepts

What are the components of the 4-stage transport model system? Which travel choice is involved in each component? Often, a fifth sub model is added to the four-step model. What travel choice behaviour does this fifth sub model describe?
For each component of the 4-stage transport model, an aggregate (on a zonal level) or disaggregate (on a household or individual level) approach can be taken. Name the main advantage and the main disadvantage of the disaggregate approach.
If a traveller makes a trip from A to B, and from B to C, then the trip from A to C is called a tour True or false?
Explain the main advantage of using tours as opposed to using trips
What is the trip purpose of a trip from work to a shop? And from work to home?
Explain why different trip purposes are distinguished.

Post lecture questions Choice modelling

Consider the following two networks with three routes. How will the travellers distribute themselves, according to the logit model?

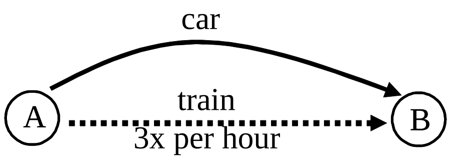


What would change if a nested logit model is applied?

For a certain OD-pair the shares for car and train trips are 80:20. The mode choice can be described by a logit model with exponent 0.03*-Z, where Z is the travel time. How much is the difference in travel time?

City X considers building a metro system. In order to determine parameter values for a choice model, they conduct a survey among users of an existing metro system in city Y. Questions concerning total travel time and waiting time are asked. Using these survey outcomes, parameters for a logit model for computing the future number of travellers for the metro system in city X are determined.
Will this future number of travellers be correct, overestimated, or underestimated?

Consider cities A and B that are connected by a local road. Furthermore, between these cities is a train service available with a frequency of 3 trains per hour (departing every 20 minutes). The travel time by car is 60 minutes, and by train is 40 minutes. The total number of travellers between A and B is 1000.



In order to determine the modal split, a multinomial logit model is used with the following estimated utility functions:

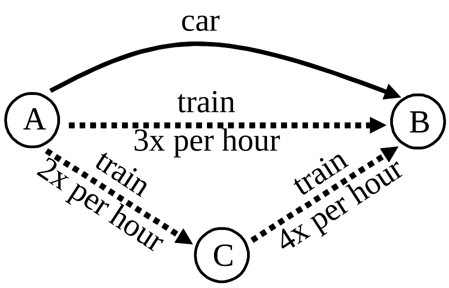
$$V^{car} = 1.0 - 0.09TC$$

$$V^{train} = -0.12A - 0.10TT - 0.16F$$

where
TC is the in-vehicle travel time by car [min.],
TT is the in-vehicle travel time by train [min.],
A is the average access waiting time [min.] (waiting time to board the first train)
F is the average transfer waiting time [min.] (waiting time to transfer to another train)

(d) Determine the number of travellers taking the train.

Suppose that a high-speed rail connection is opened such that travellers from city A to city B can travel by a new train service. This new service is not a direct connection, but a transfer in city C is required, as illustrated in the next figure. The travel times (A,C) and (C,B) are both 10 minutes. The high-speed train service from A to C has a frequency of 2 trains per hour (departing each 30 minutes) and the high-speed train service from C to B has a frequency of 4 trains per hour (departing each 15 minutes).



(e) Using the same utility functions and again applying a logit model, what percentage of *train users* will use the high-speed train service?

Since the train alternatives cannot be seen as independent alternatives, a simple multinomial logit model is not the correct model to apply and may make incorrect forecasts about the modal split between car and train.

(f) How can the model be improved such that the modal split rates between car and train are more accurate?

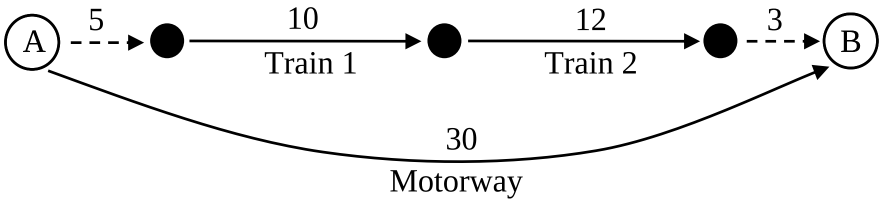
Suppose that from a travel survey, a choice model has been estimated for describing the choice between the alternatives car and train. The following systematic (observable) utility functions have been estimated:

$$V_{car} = 0.6 - 0.12 \cdot TT_{car} - 0.55 \cdot TC_{car}$$
$$V_{train} = -0.10 \cdot TT_{train} - 0.28 \cdot WT_{train} - 0.15 \cdot AET_{train} - 0.55 \cdot TC_{train}$$

where *TT* is the in-vehicle travel time (in minutes), *TC* is the travel cost (in euros), *WT* is the waiting time (in minutes), and *AET* is the access and egress walking time (in minutes).

(a) What does the mode-specific constant 0.6 represent? And what does this specific value mean from a behavioural point of view?

Consider Traveller 1 from city A to city B that has the choice of taking the car or the train. The travel time by car is 30 minutes, with a travel cost of 2.50 euro. There is no direct train connection, so there is a transfer from train service 1 to train service 2. The walking time to the first train station is 5 minutes, while the walking time from the last train station to the final destination is 3 minutes. The first train service has a frequency of 4x per hour, while the second train service has a frequency of 6x per hour. The travel time of the first train is 10 minutes, while the second train takes 12 minutes. The total price for the train ticket is 1.50 euro. We assume that Traveller 1 has no knowledge of the train schedule (time table). The situation is depicted below.



(b) Assuming a multinomial logit model with a scale parameter equal to one, what is the probability that Traveller 1 will take the train? [4]

Consider now Traveller 2 from the same household, who knows the schedule (time table) of both train services, in which the second train service is synchronized with the first train service.

(c) Assuming a multinomial logit model with a scale parameter equal to one, what is the probability that Traveller 2 will take the train? [3]