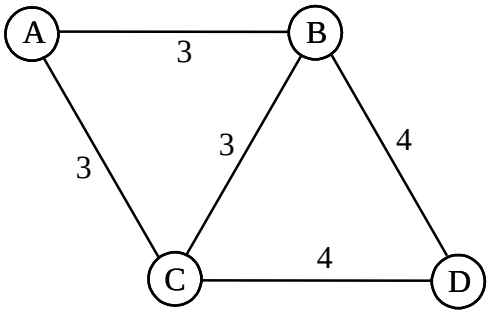
Post lecture questions Land use modelling 2017 plus answers

Accessibility and descriptive models

Consider 4 four cities, A through D, in which residents live and firms offer jobs. The distances [in km] between the cities are indicated in the figure below.



The number of residents living in each city, and the number of jobs being offered by firms in each city are listed in the next table. Assume that all intra-city distances are 2 km.

City	Residents	Jobs
A	4000	2000
B	1000	500
C	2000	1000
D	3000	4000

The accessibility can be computed with the following potential accessibility measure,

$$\Omega_i = \sum_j P_j / c_{ij} \qquad \text{[origin-based definition]}$$

or

$$\Omega_j = \sum_i P_i / c_{ij} \qquad \text{[destination-based definition]}$$

where Ω_i is the accessibility of city *i*, P_i is the potential of city *i*, and c_{ij} is the distance from city *i* to city *j*.

(a) From the perspective of residents (who would like to be close to jobs), which city is most accessible? [5]

From the perspective of residents the potential of a city is given by the number of jobs. Given the number of jobs (table) and the distances between cities (figure) the accessibility of each city can be computed.

$$city \begin{bmatrix} A \\ B \\ C \\ D \end{bmatrix} = \begin{bmatrix} 2000 \\ 500 \\ 1000 \\ 4000 \end{bmatrix}' \cdot \begin{bmatrix} 1/2 & 1/3 & 1/3 & 1/7 \\ 1/3 & 1/2 & 1/3 & 1/4 \\ 1/3 & 1/3 & 1/2 & 1/4 \\ 1/7 & 1/4 & 1/4 & 1/2 \end{bmatrix} = \begin{bmatrix} 2071.4 \\ 2250.0 \\ 2333.3 \\ 2660.7 \end{bmatrix}$$

City D then proves to be the most accessible.

(b) From the perspective of a shop (that likes to be easily reachable by residents), which city is most accessible? [5]

Similar to (a), the accessibility of each city can be computed from the perspective of a shop (thus considering the potential as to the number of residents).

$$city \begin{bmatrix} A \\ B \\ C \\ D \end{bmatrix} = \begin{bmatrix} 4000 \\ 1000 \\ 2000 \\ 3000 \end{bmatrix}' \cdot \begin{bmatrix} 1/2 & 1/3 & 1/3 & 1/7 \\ 1/3 & 1/2 & 1/3 & 1/4 \\ 1/3 & 1/3 & 1/2 & 1/4 \\ 1/7 & 1/4 & 1/4 & 1/2 \end{bmatrix} = \begin{bmatrix} 3428.6 \\ 3250.0 \\ 3416.7 \\ 2821.4 \end{bmatrix}$$

City A then proves to be the most accessible.

Accessibility plays an important role in land use (spatial) modelling. Accessibility can be measured in several different ways. One measure is the potential accessibility.

(a) Formulate a potential accessibility measure and define all the variables.

An example is:
$A_i = \sum_j M_j f(c_{ij})$,
where A_i is the (origin-based) accessibility of zone i, M_j is the potential of zone j (e.g., number of inhabitants, employers, shops, etc.), c_{ij} is the travel time/cost from zone i to zone j, and f is a decreasing function, for example $f(c_{ij}) = \exp(-c_{ij})$.

The models proposed by Hansen (1959) and by Lowry (1964) explicitly take accessibility measures into account.

(b) Describe for both the Hansen model and the Lowry model how accessibility is affecting the location decisions of users.

In the Hansen model, accessibility affects the location where residents will live. The more accessible a location is to jobs, the more likely residents will move to that location.
In the Lowry model, the residential location is affected by the accessibility to total employment, while service employment is affected by the attraction of service employment, which is defined in terms of accessibility.

Land use and transport integrated (LUTI) models

True/False statements

(a) Accessibility plays an important role when a firm selects a new location, but does not play an important role in the decision to move; in other words, accessibility is a 'pull factor', not a 'push factor'.

True

(b) A directed allocation policy of the government with respect to land use means that people can freely choose their location of residence.

False (developers can decide where to build)

(c) TIGRIS XL is an integrated land-use and transportation interaction (LUTI) model that predicts a long term equilibrium in location decisions of households and firms.

False (TIGRIS XL does not reach an equilibrium)

(d) Accessibility or potential value is not the main transport related attribute in in utility functions for location choice of households or firms

True

Integrated land use – transportation models describe the two-way interaction between land-use and transport. The two types of models therefore interact, in which different actors (also called decision makers or agents) are involved.

a. Which actors can be distinguished? And which kind of choices do these actors make?

households: choosing to move and choosing a residential location
firms: employment level and location
developers: real-estate development
government: infrastructure and land use policies

b. Which of the following 10 processes are described within the transport system, which ones in the land use system, and which ones are usually exogenous to the model?

- route choice
- real-estate development
- job changes
- demographic changes
- destination choice
- infrastructure investments
- moving to a new house
- buying a car
- using a car
- tax rates

Transport system	Land use system	Exogenous
- route choice - destination choice - buying a car - using a car	- real-estate development - changing jobs - moving to a new house	- demographic changes - infrastructure investments - tax rates

c. Specify four markets that are modelled in a LUTI-model (e.g. TIGRIS XL). Briefly describe for each market which process it models.

Land use market: the way it is decided which locations to develop for housing or industry/offices/etc.
Real estate market: the way companies decide whether or not to move and if they intend to move where to settle
Housing market: the way households decide whether or not to move and if they intend to move where to settle
Labour market: The interaction between households and employment
Transport market: Interaction between transport demand and transport supply