Assignment: An Agent-based Network Growth Model *

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The agent-based module for this assignment can be accessed at http://street.umn.edu/NetworkGrowth.html. Scroll down for a brief description of the model on the webpage. Details about the model can be found in (Levinson and Huang, 2012; Huang and Levinson, 2011).

The goals of this assignment are:

- understanding how different incentives and disincentives influence the growth of network structure;
- learning about the patterns of road network growth;
- understanding how individual network builders' behavior shape the road/skyway network.

1 Task 1: understand the model

1.1 The Grid-like City Scenario

Run the following scenario:

1. Select the "Single-center grid-like city" scenario.
2. Set δ as 0.68, rounds as 30.
3. Set $Gridsize$ as 7, $scale$ as 4.0, $newedgecost$ as 541, w_{center} as 2900, and w as 700.
4. Click "Go".

Save the output network and the graphs of network topological measures. Click "Setup" and run the scenario at least 5 times. What network patterns have emerged? What features do you have? Do you obtain different network topologies?

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1.2 The Minneapolis Skyways Scenario

Run the following scenario:

1. Select the "Minneapolis Skyways" scenario.
2. Turn on "show-downtown-streets".
3. Turn on "show-actual-skyways".
4. Set δ as 0.68, $unitedgecost$ as 320, and $unitbenefit$ as 1.4.
5. Set $rounds$ as 45.
6. Click "Go".

Save the output network and the graphs of network topological measures. Click "Setup" and run the scenario at least 5 times. What network patterns have emerged? How close they are to the actual skyway network? What kind of evolutionary patterns do you observe?

2 Task 2: understand how different parameters influence network topology

Select the "Single-center grid-like city" scenario. Set δ values and $newedgecost$ as the values in Table 1 while keeping other parameters the same as Task 1. Run each arrangement and save the emerged network and the plots of the topological features.

Discuss the following questions:

- What happens to the network topology when δ is the greatest and $newedgecost$ is the smallest?
- What happens to the network topology when δ is the smallest and $newedgecost$ is the greatest?

Select the "Four-center grid-like city" scenario. Set δ values and $newedgecost$ as the values in Table 1 while keeping other parameters the same as Task 1. Run each arrangement and save the emerged network and the plots of the topological features.

Discuss the following questions:

- What happens to the network topology when δ is the greatest and $newedgecost$ is the smallest?
- What happens to the network topology when δ is the smallest and $newedgecost$ is the greatest?

Table 1: Different parameters in the grid-like city scenario

			δ		
	0.05	0.55	1.0	1.50	2
newedgecost	50				
	100				
	150				
	200				

- Given the same set of parameters, how is the network in the single-center scenario different from the one in the four-center scenario? Use examples to illustrate the differences.

3 Task 3: Submit a memo reporting to findings

The recommended outline is as follows:

- Problem statement
- Methodology: describe the models and your approach in Task 1 and Task 2. Refer to Levinson and Huang (2012); Huang and Levinson (2011) for details about the models.
- Results and analysis: report findings from Task 1 and Task 2.
- Conclusions and limitations.

References

Huang, A. and Levinson, D. (2011). The structure and dynamics of a skyway network. *The European Physical Journal: Special Topics*, in press.

Levinson, D. and Huang, A. (2012). A Positive Theory Network of Network Connectivity. *Environment and Planning B: Planning and Design*, 39(2):308–325.