

Introduction to Fractals and Scaling

Homework for Unit 8:

Urban Scaling

<http://www.complexityexplorer.org>

Beginner

Let's assume that the urban scaling results hold exactly, so that the GDP of a city scales as $N^{7/6}$ (where N is the population), and that the length of roads in a city scales as $N^{5/6}$.

The population of the New York City metropolitan statistical area (MSA) is 20.1 million. The population of the Los Angeles MSA is 18.2 million.

1. Suppose a certain city has a GDP of 500 million euro. What GDP would you expect for a city that has twice the population? What GDP would you expect for a city that has half the population?
2. Suppose a certain city has 1000 km of roads. What length of roads would you expect for a city that had twice the population? What length of roads would you expect for a city that has half the population?
3. The total length of roads in New York City is 6074 miles¹. Based on the urban scaling theory, what would you predict would be the total length of roads in the Los Angeles MSA?
4. The GDP for the Los Angeles MSA is 8.31 billion dollars. Based on the urban scaling theory, what would you predict for the GDP of the New York City MSA?

Intermediate

There are no intermediate problems for this unit.

Advanced

There are no advanced problems for this unit.

¹<http://www.nyslocalgov.org/pdf/HighwayServices.pdf>