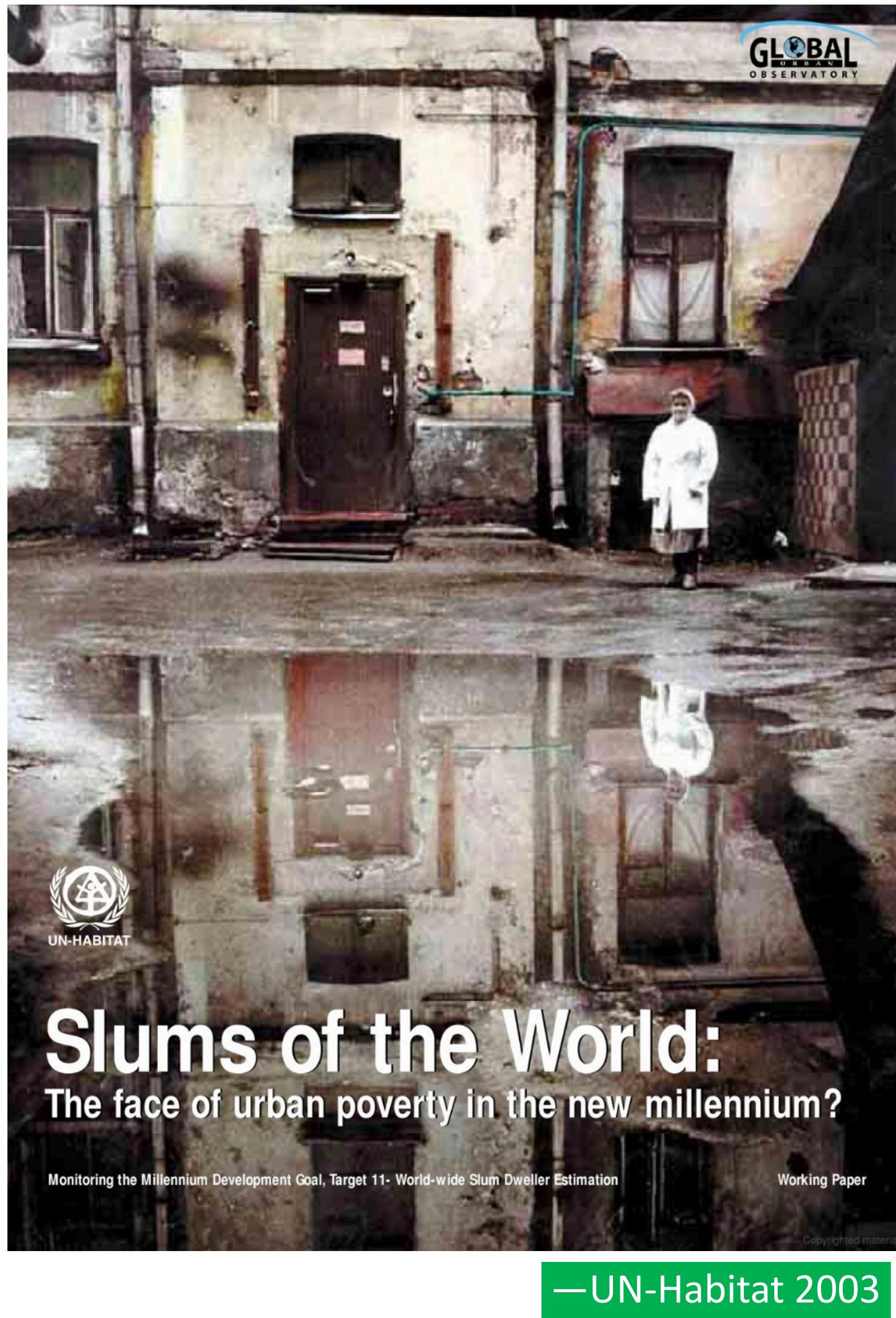


# **Lecture 12**

**Neighborhoods and Human Development: The international situation**

## **12.2 City shape, topology and incremental models of urban planning**



—UN-Habitat 2003

'The absence of data from large areas of the world on **slum indicators** substantiate the view that these precarious settlements are still

**"zones of silence"**

in terms of public knowledge, opinion and discussion about urban poverty'

## Millennium Development Goals

**Target 7.D:**  
**Achieve, by 2020, a significant improvement in the lives of at least 100 million slum dwellers**

- Between 2000 and 2014, more than 320 million people living in slums gained access to improved water sources, improved sanitation facilities, or durable or less crowded housing, thereby exceeding the MDG target.
- More than 880 million people are estimated to be living in slums today, compared to 792 million in 2000 and 689 million in 1990.



Kroo Bay, Freetown, Sierra Leone

credit: Pete Muller, National Geographic

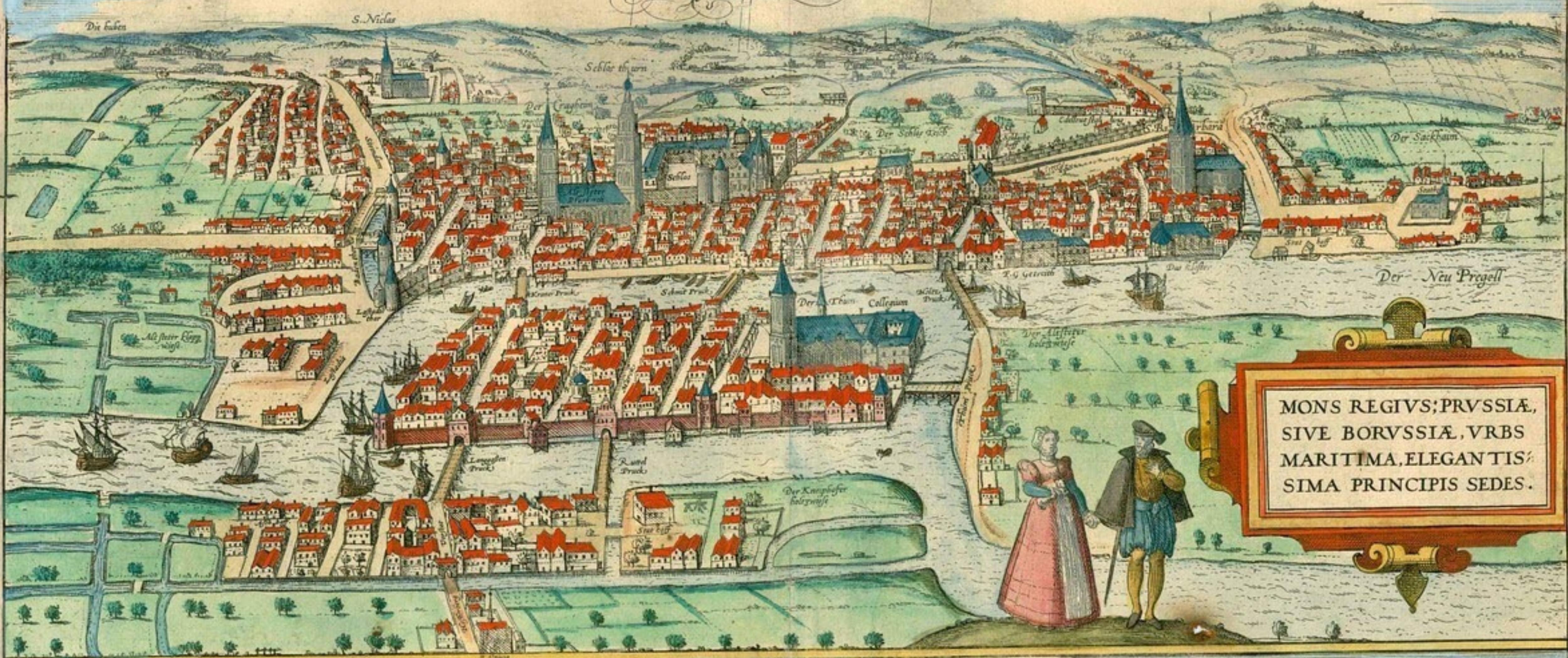
City shape, topology and change

# Is there an ideal city form?



Königsberg, Prussia

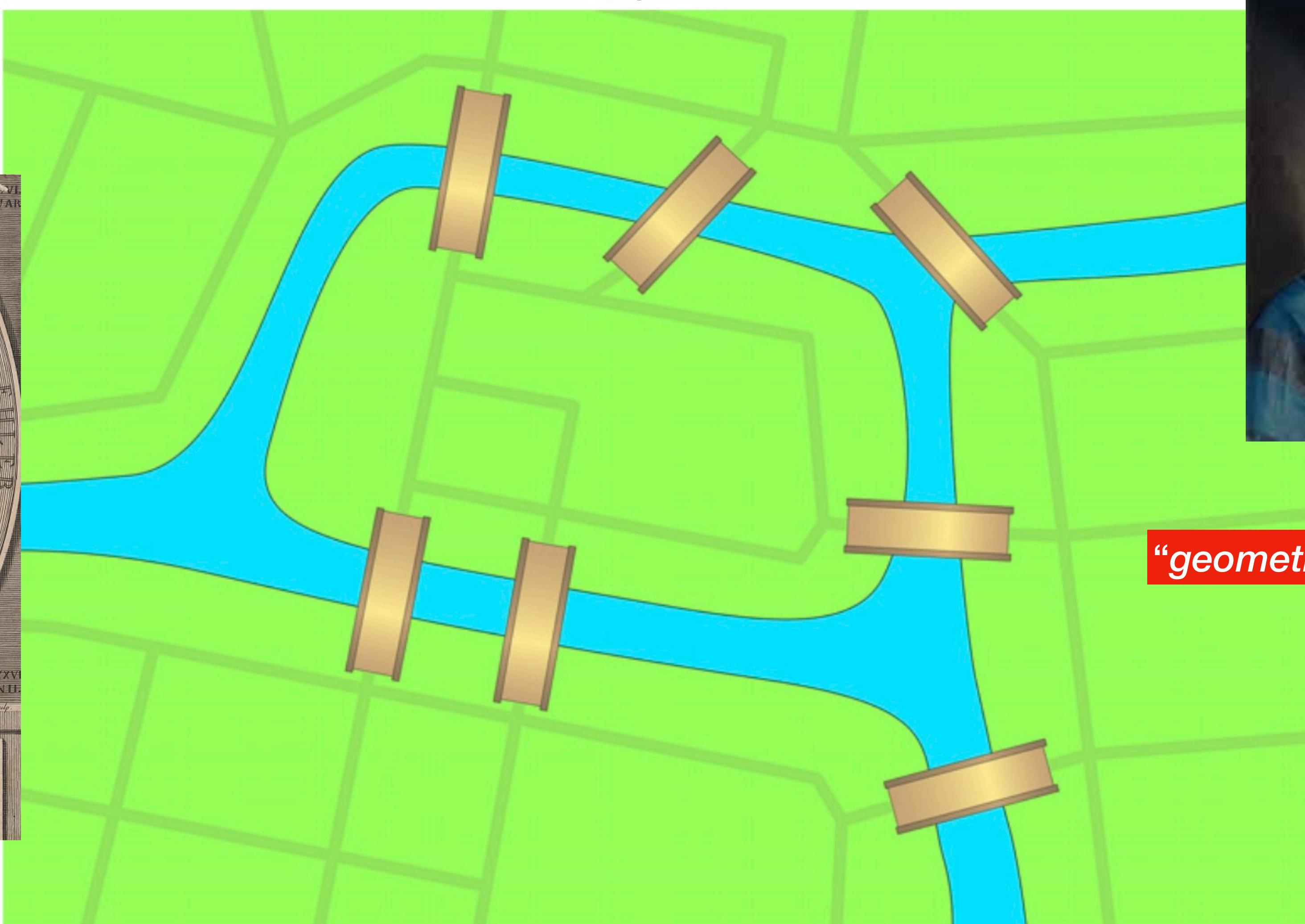
Die Fürstliche Hanvit Statt Königsberg  
in Preussen.



*"This question is so banal, but seemed to me worthy of attention in that [neither] geometry, nor algebra, nor even the art of counting was sufficient to solve it."*



Kart Gottlieb Ehler



The Königsberg Bridge problem asked whether it was possible for a person to walk through the city, crossing each bridge once and only once. Image credit: ScienceSource/SPL.



Leonard Euler

**"geometria situs" → topology**

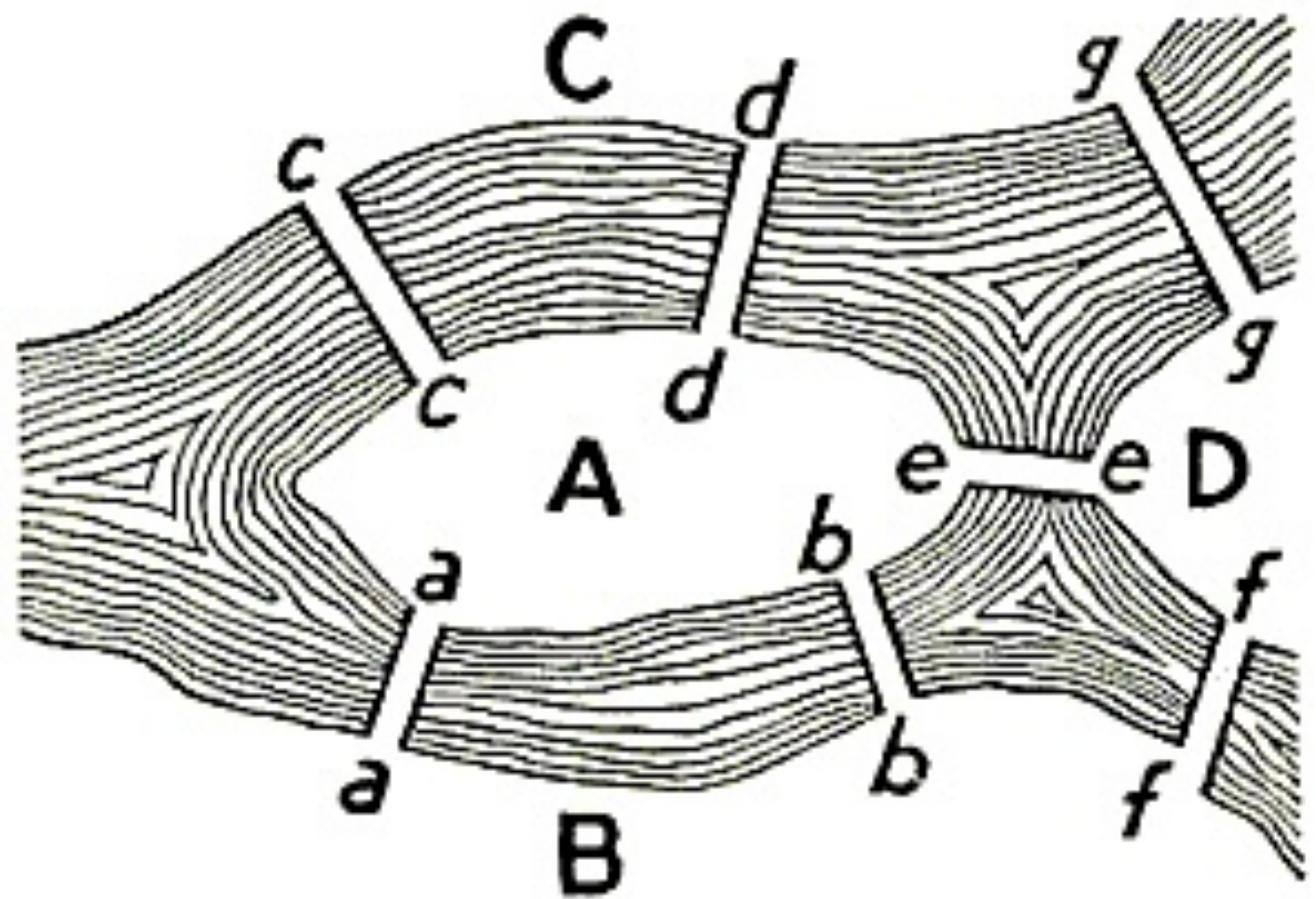
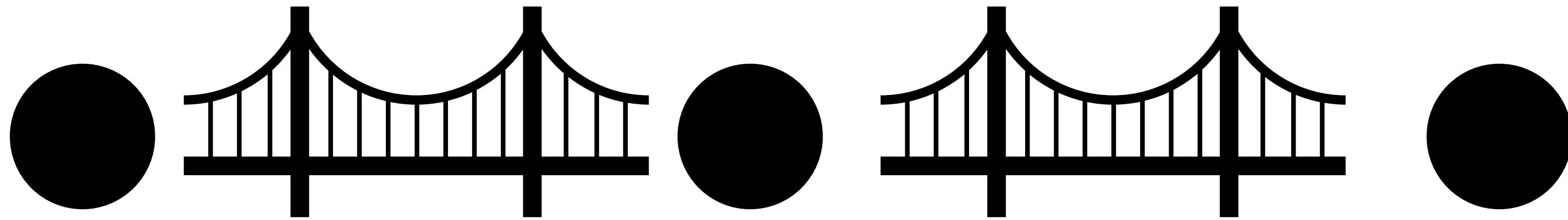


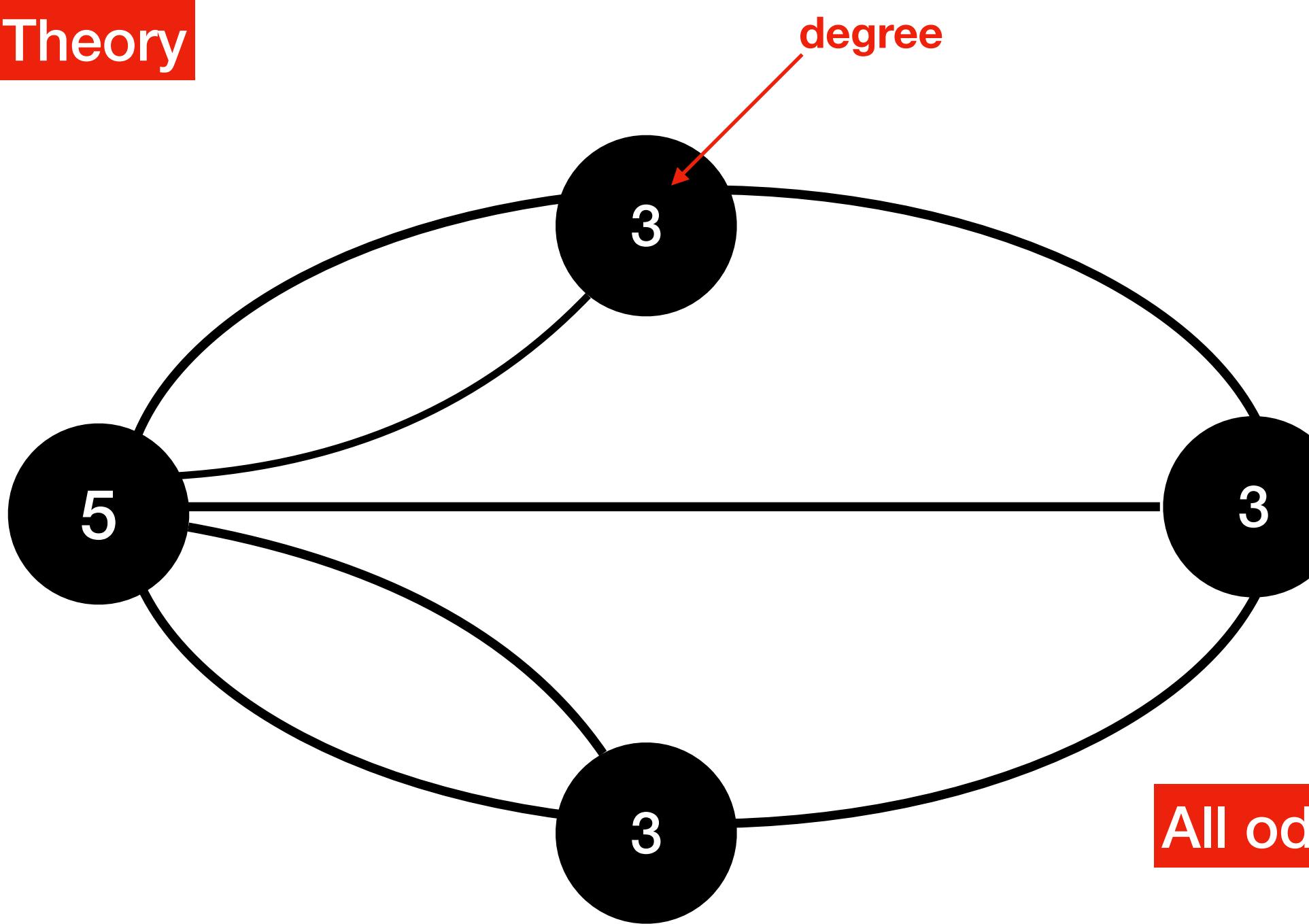
FIGURE 98. *Geographic Map:  
The Königsberg Bridges.*



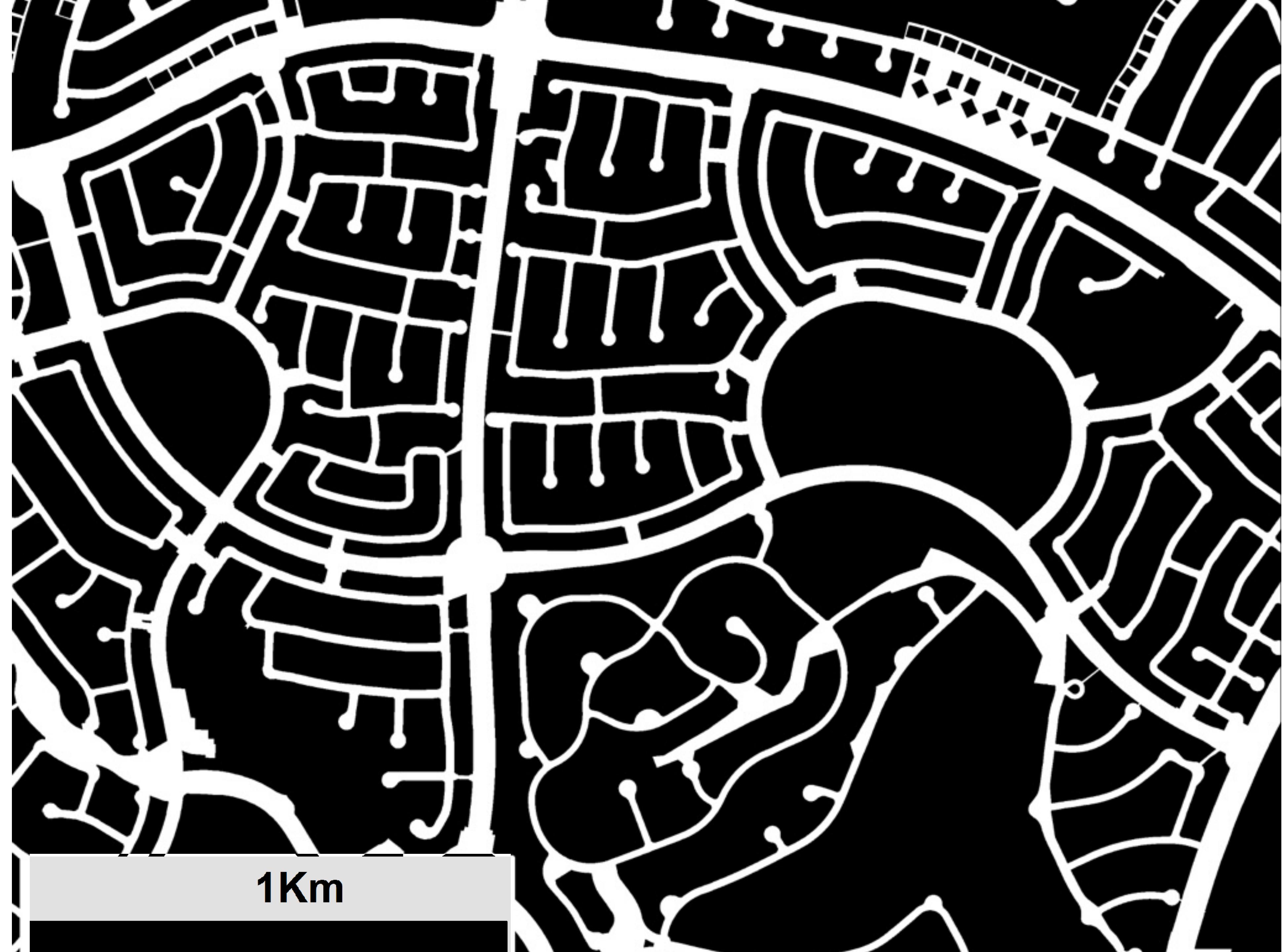
number of bridges must be even, except at starting and finishing points

<https://mathworld.wolfram.com/KoenigsbergBridgeProblem.html>

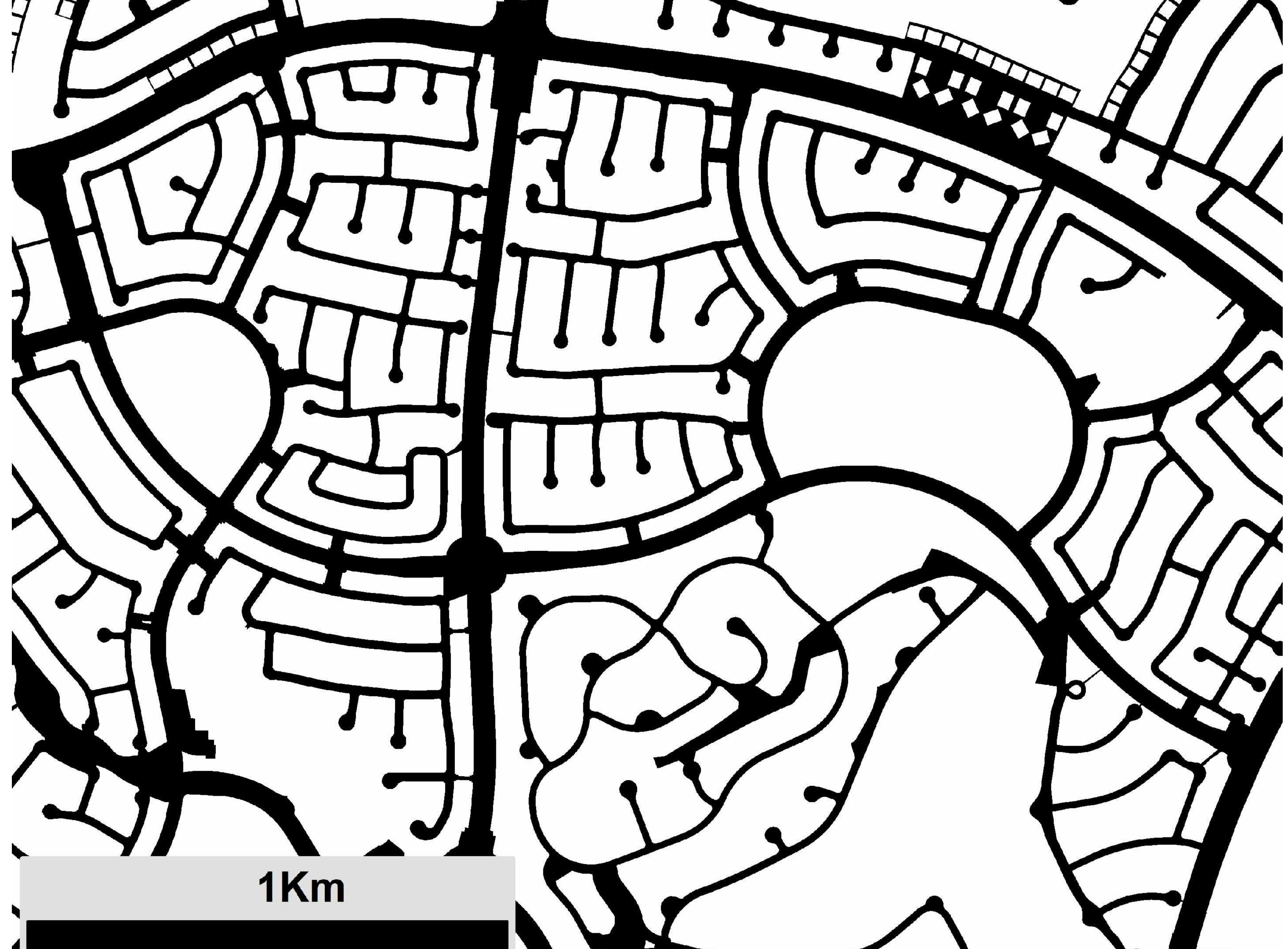
Geometry → Topology → Graph Theory



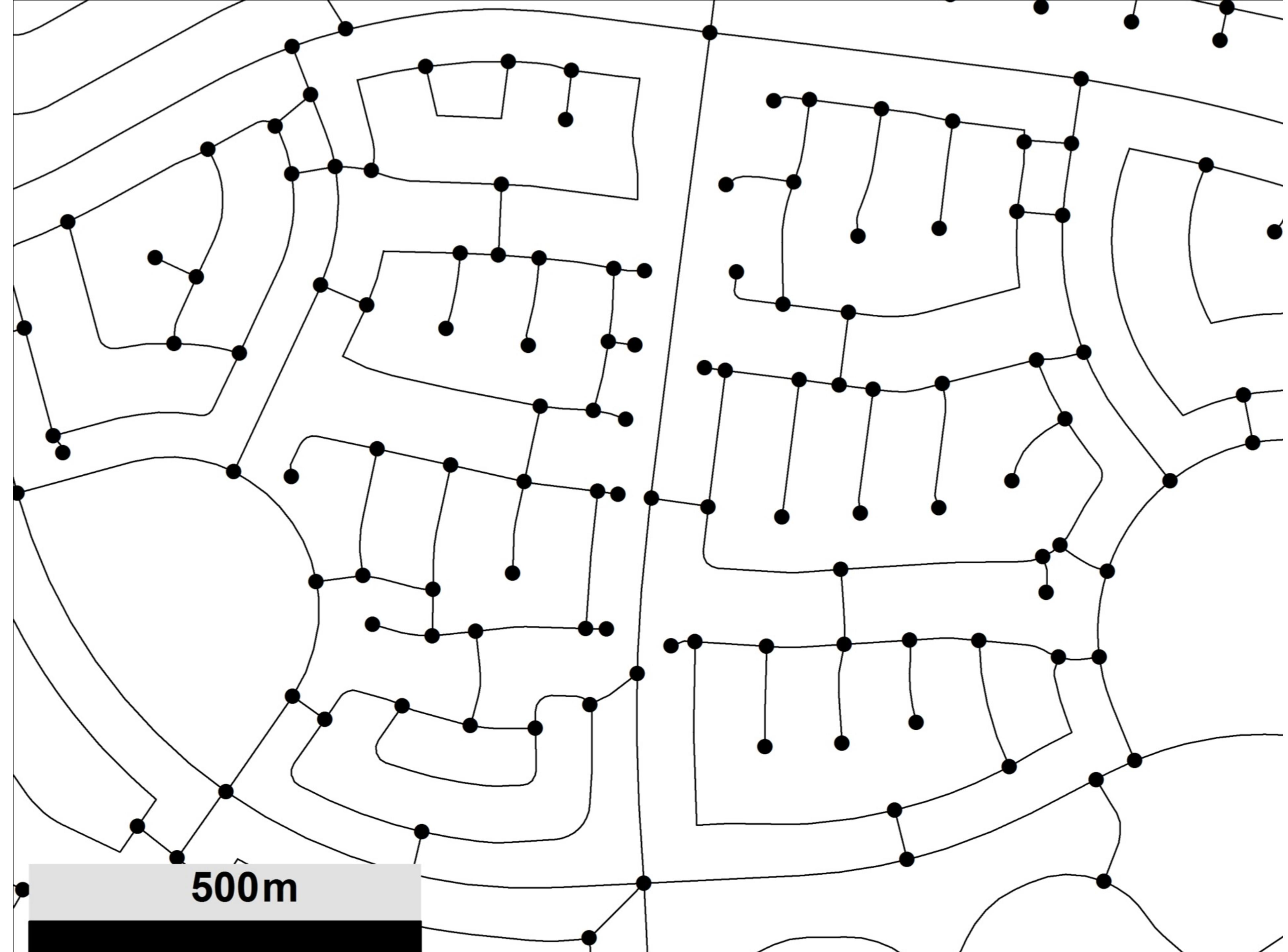
All odd degre: Eulerian circuit is not possible !

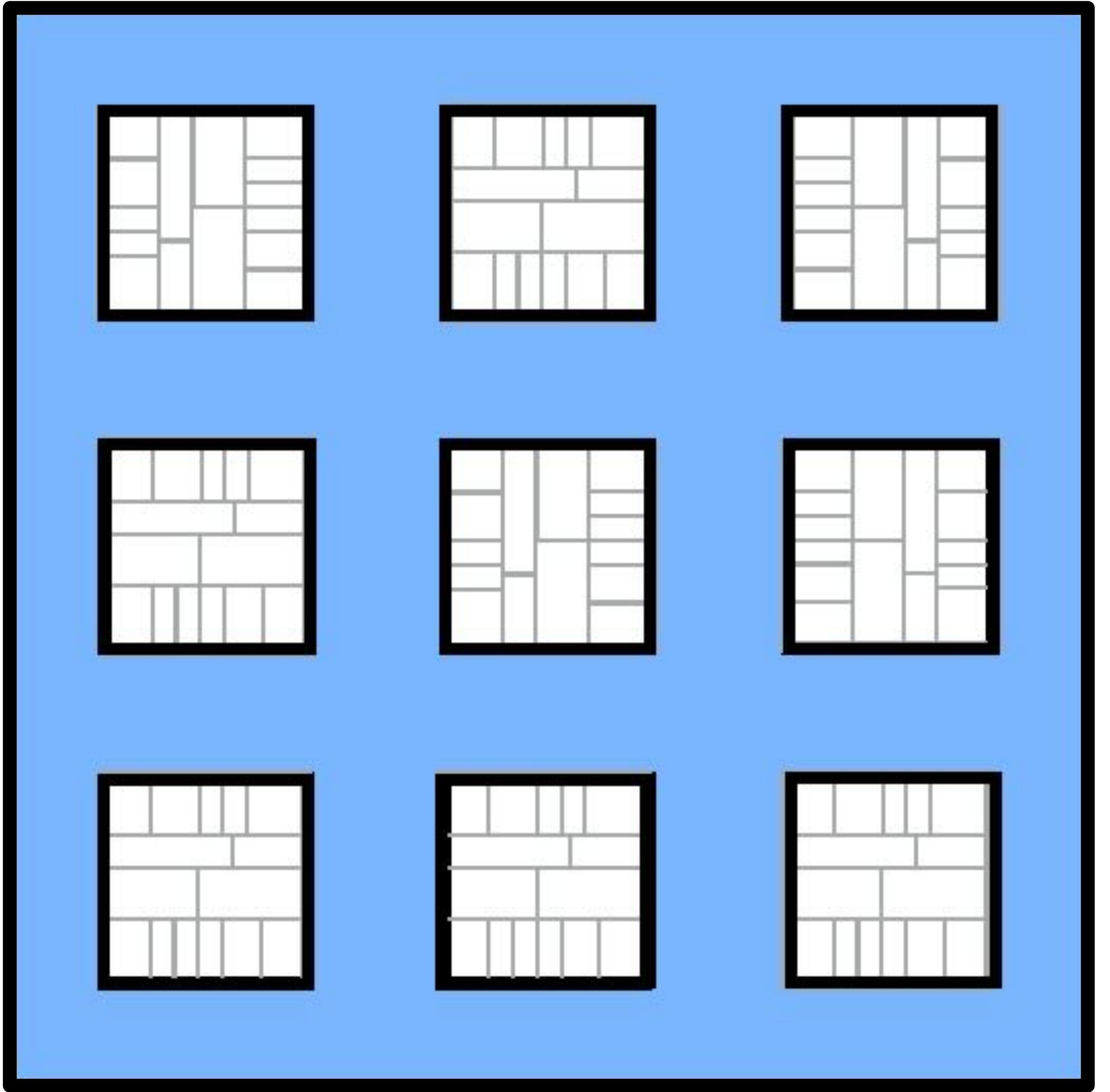


1Km

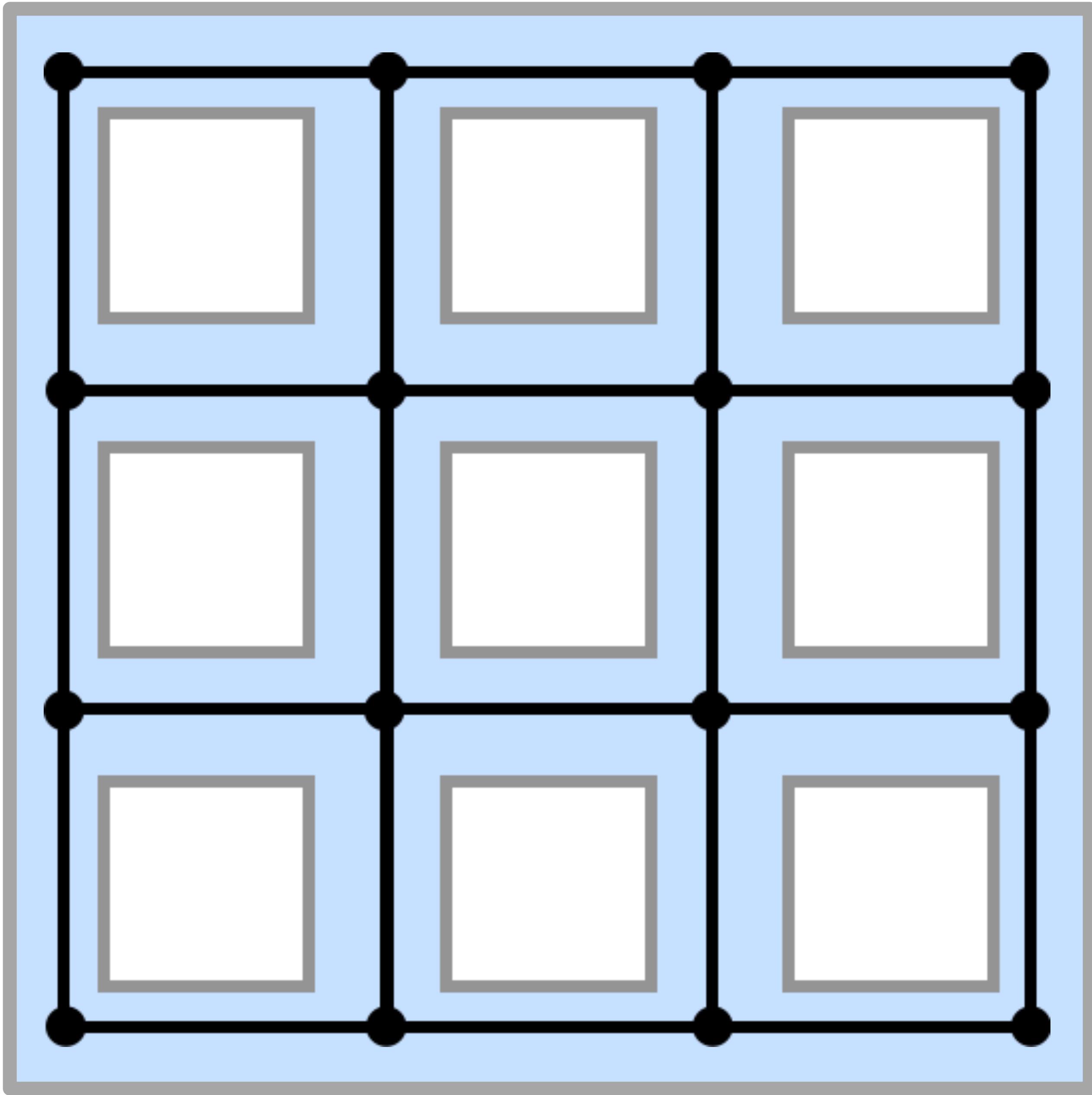


1Km

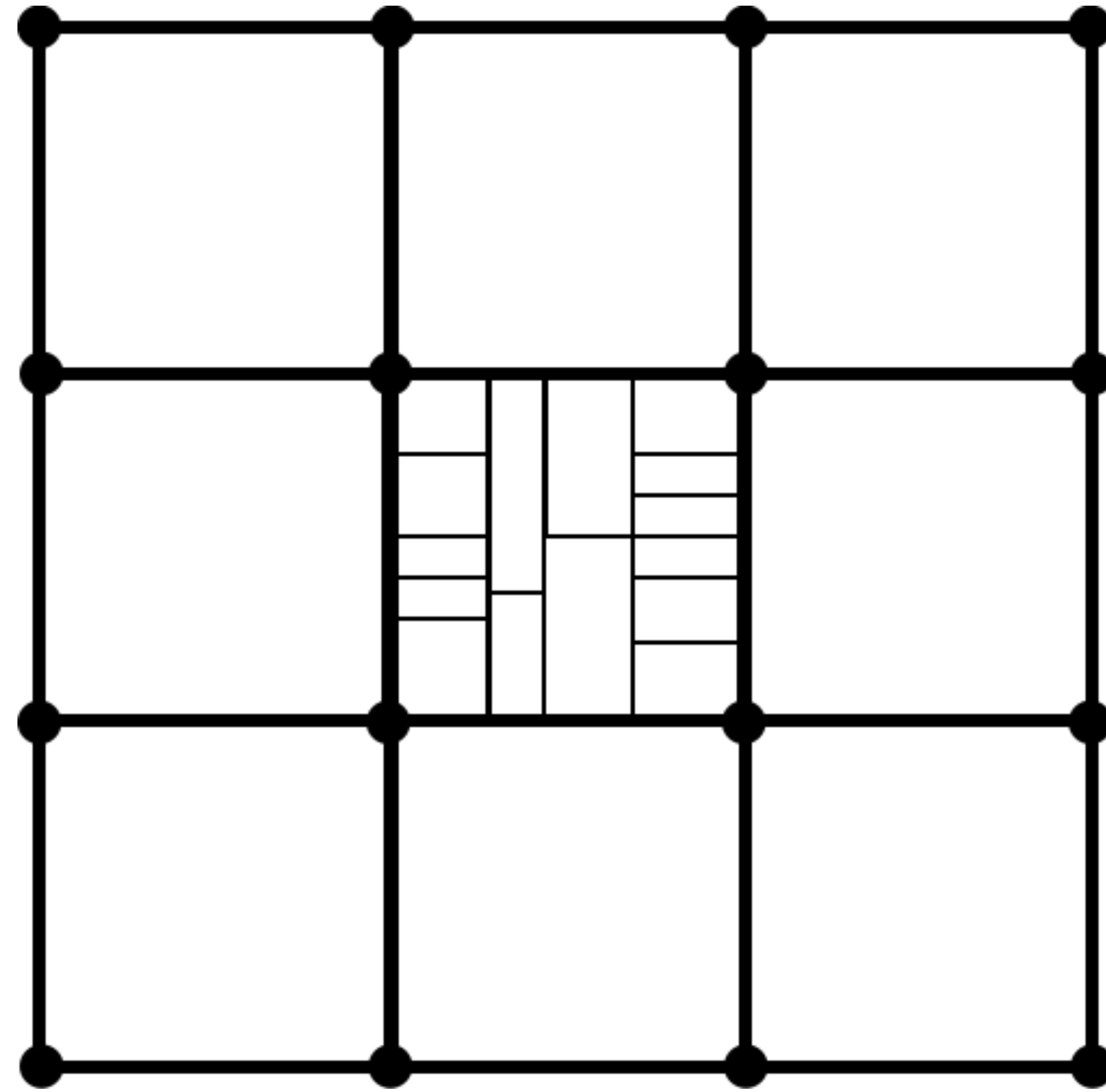


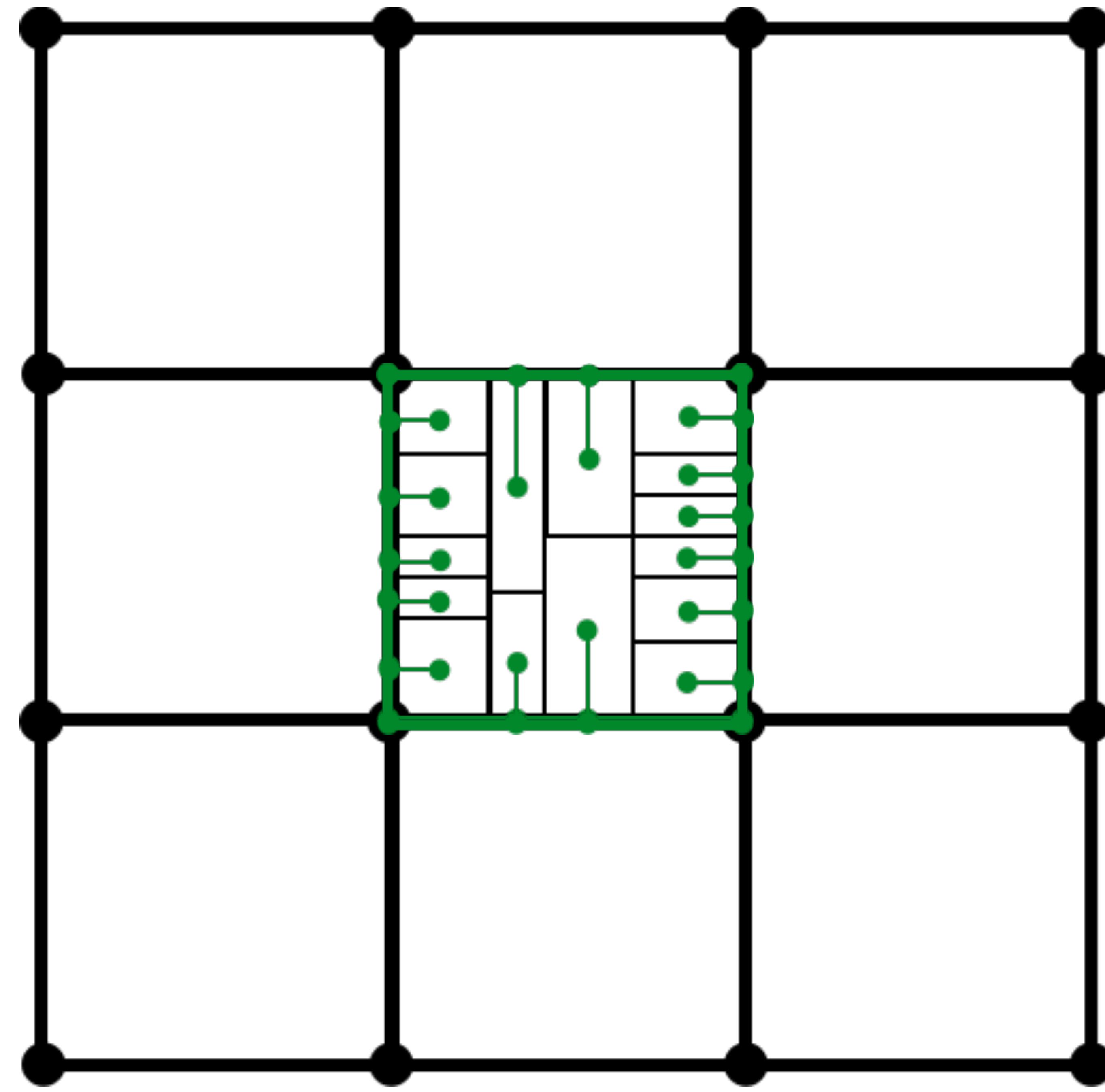


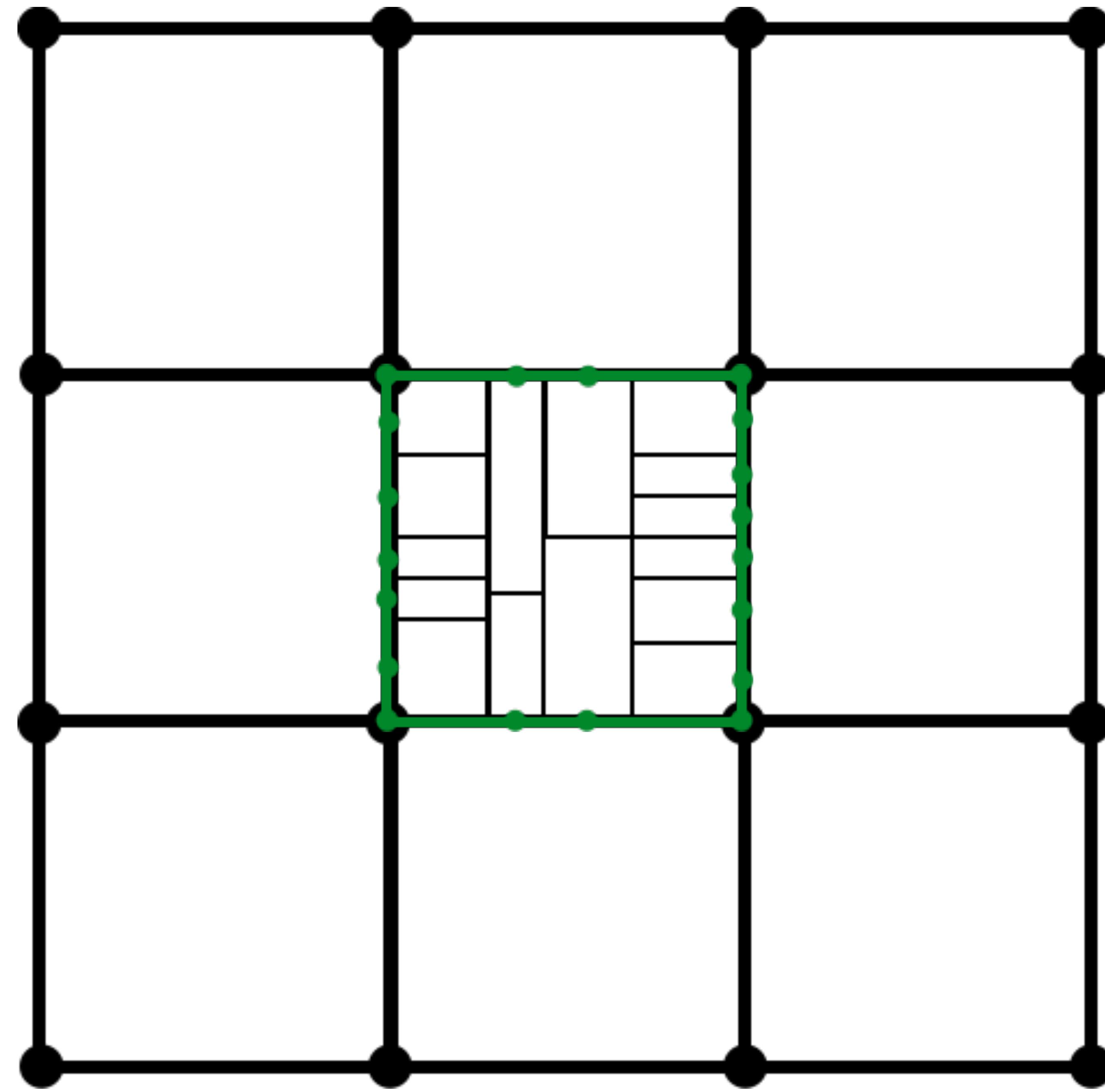
$$\chi = 1 - b$$

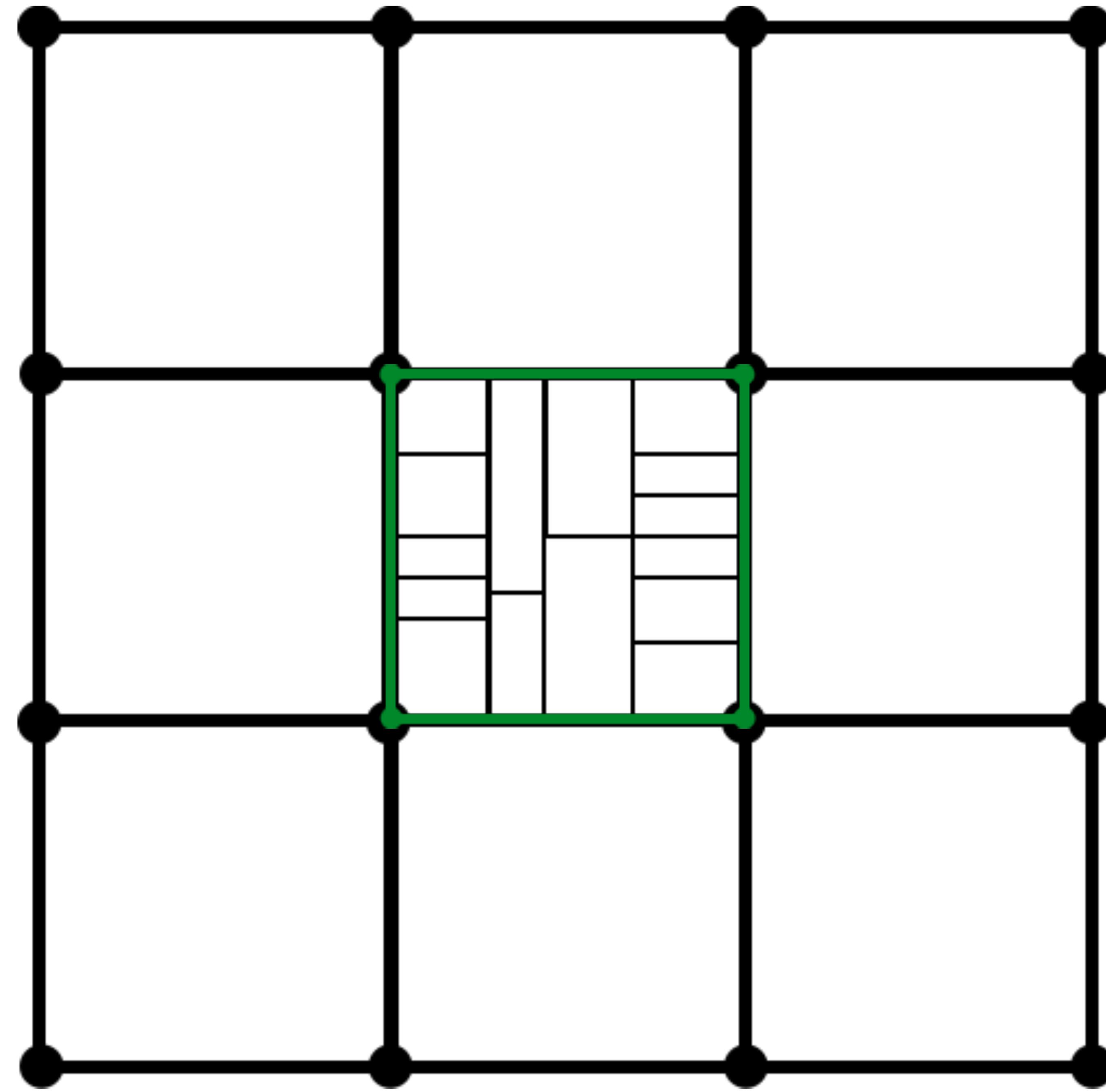


$$\begin{aligned}\chi &= v - e \\ &= 1 - b\end{aligned}$$

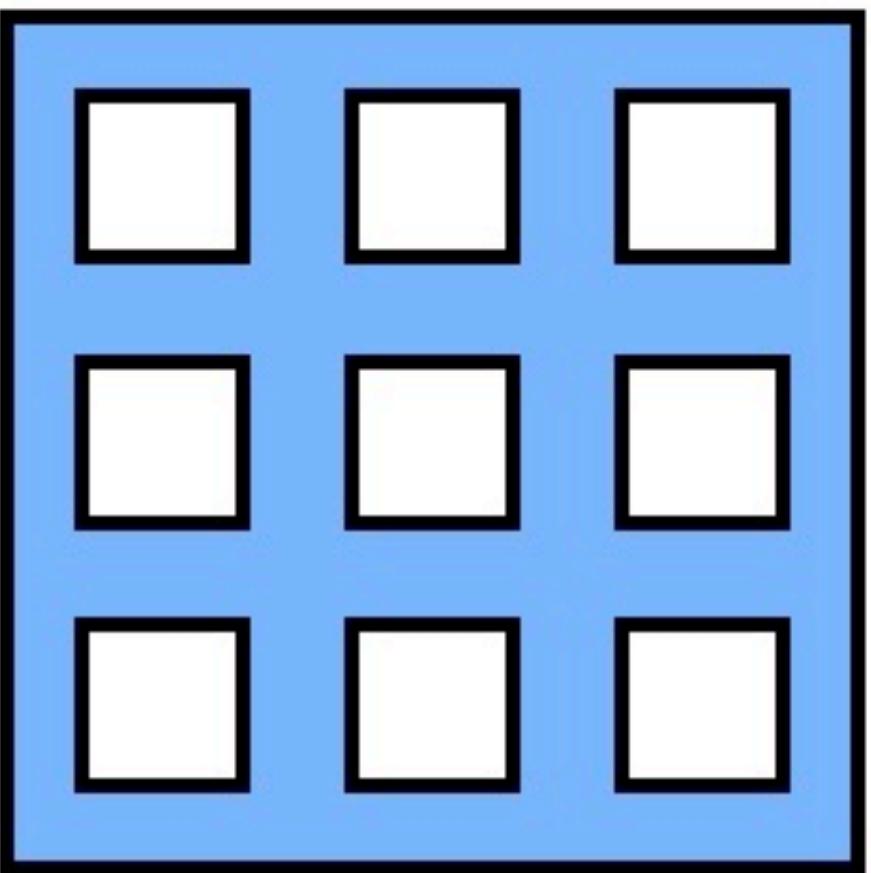






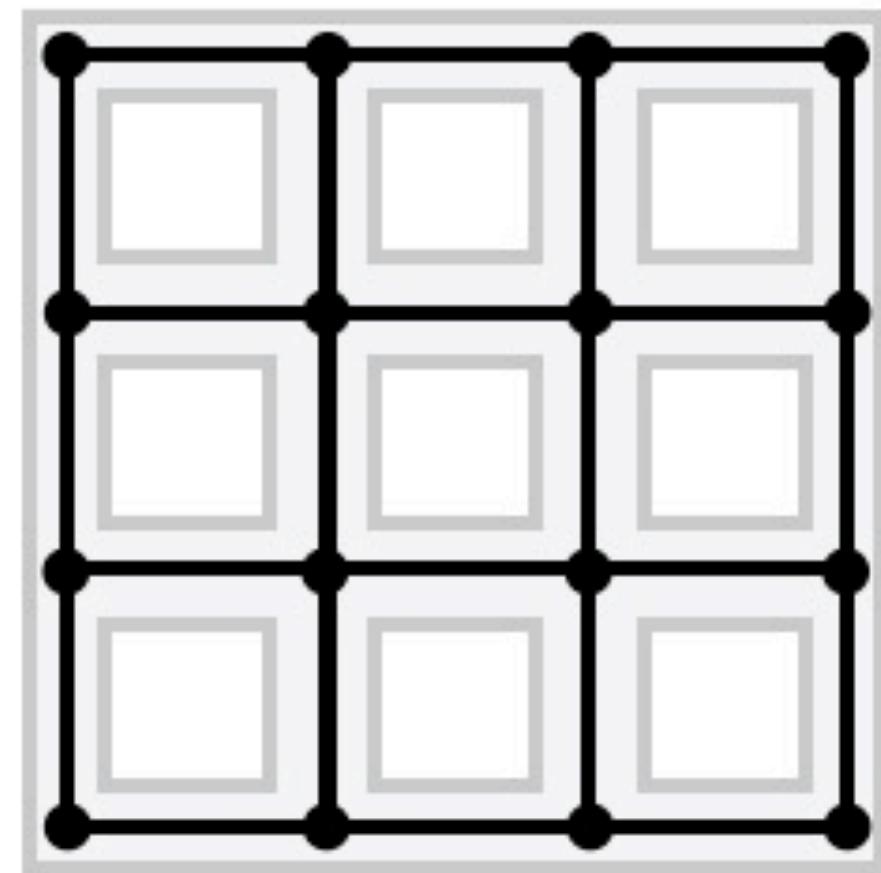


# *City*

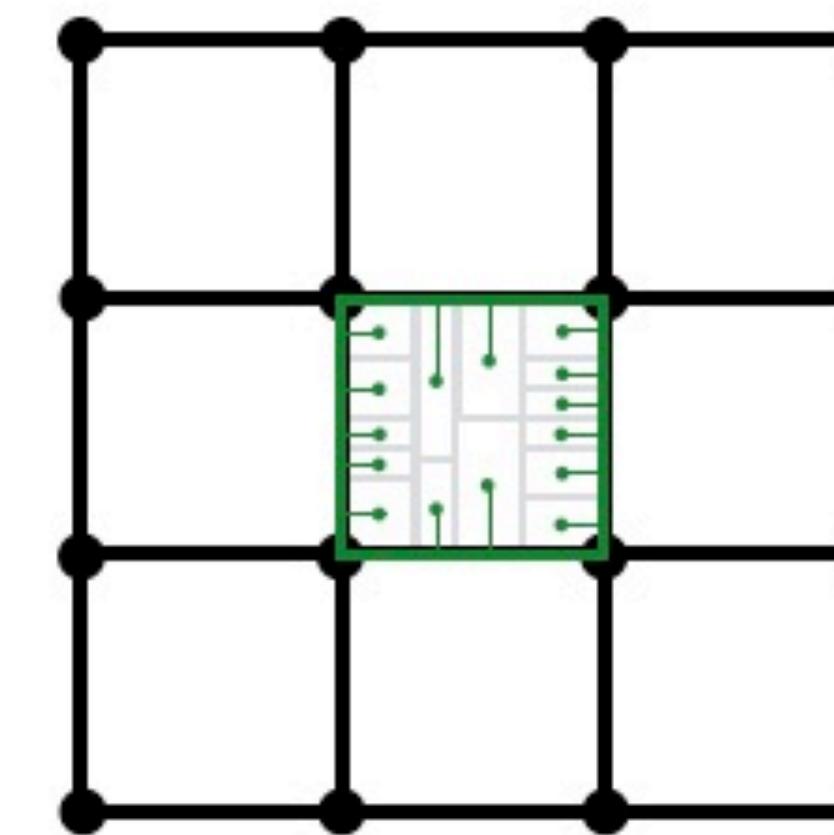


Access Space

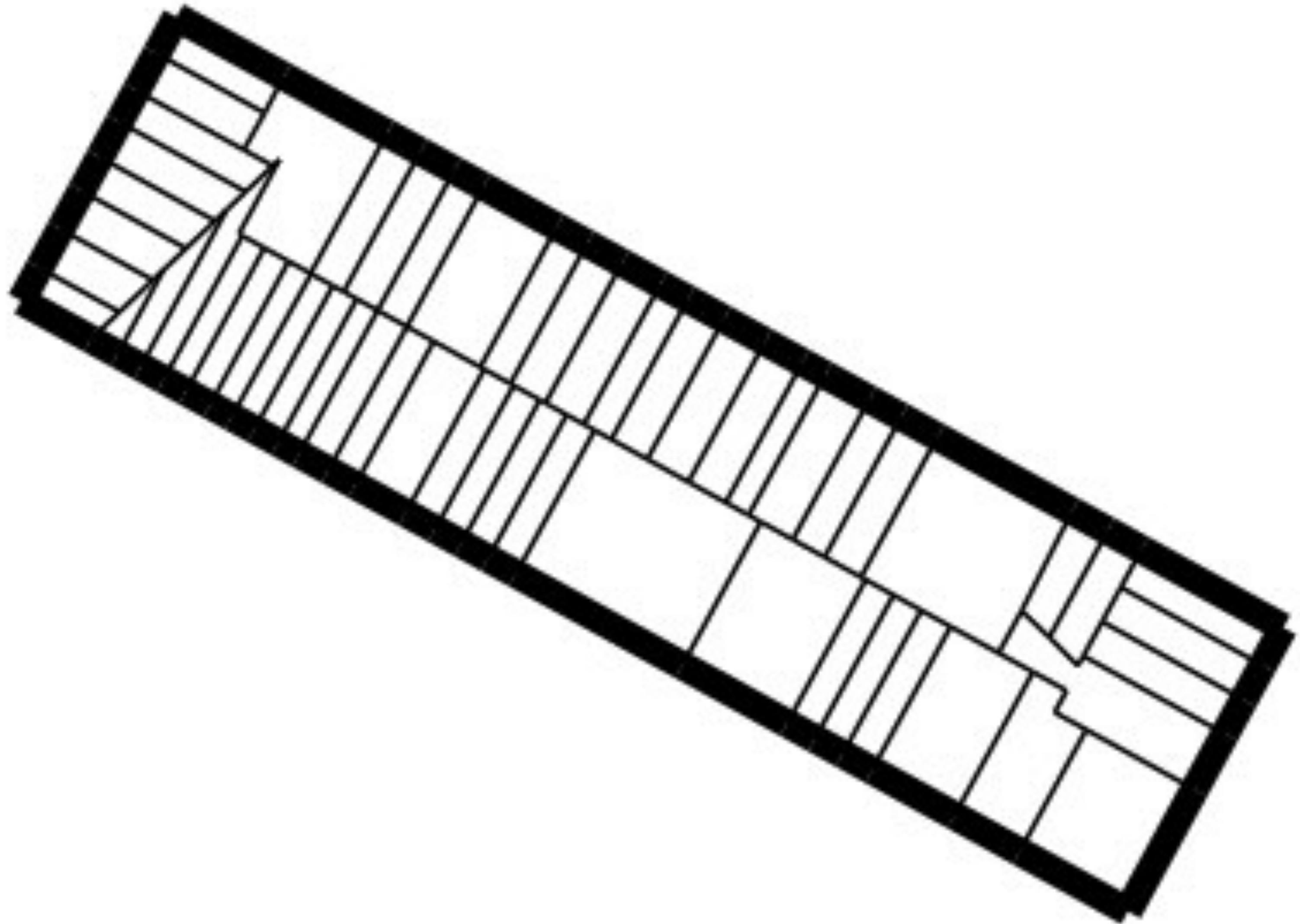
# *Blocks*

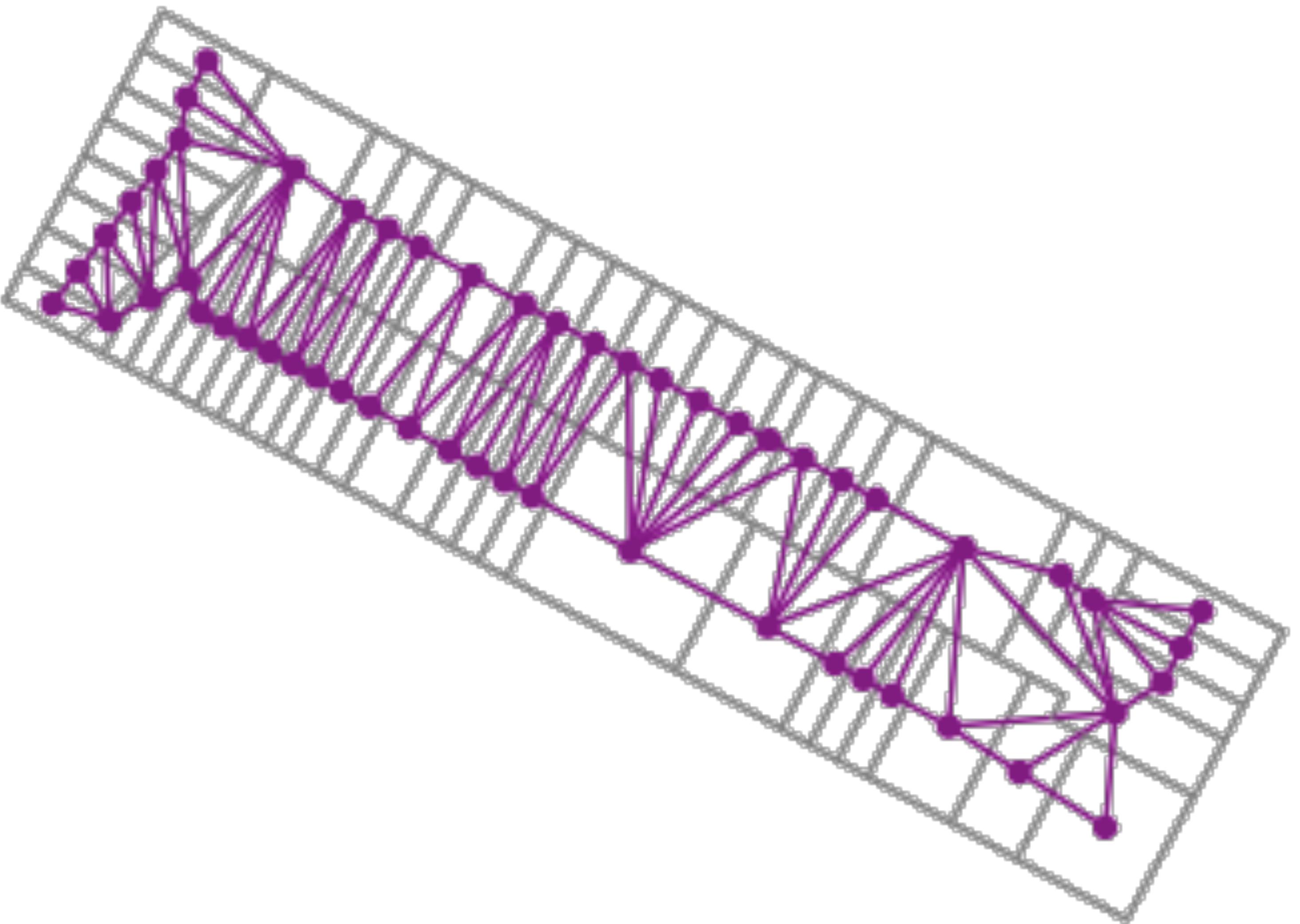


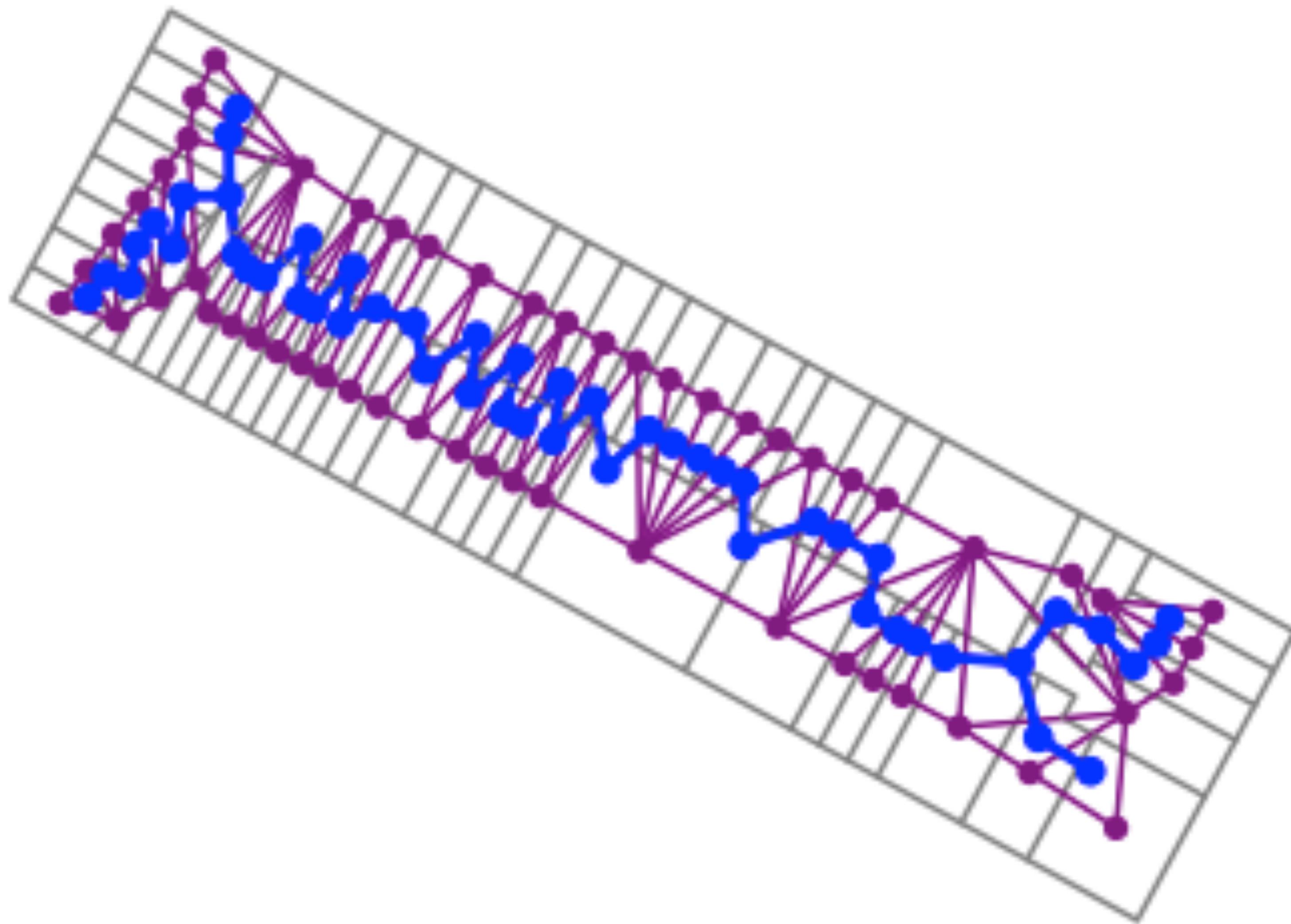
Access Network, Y

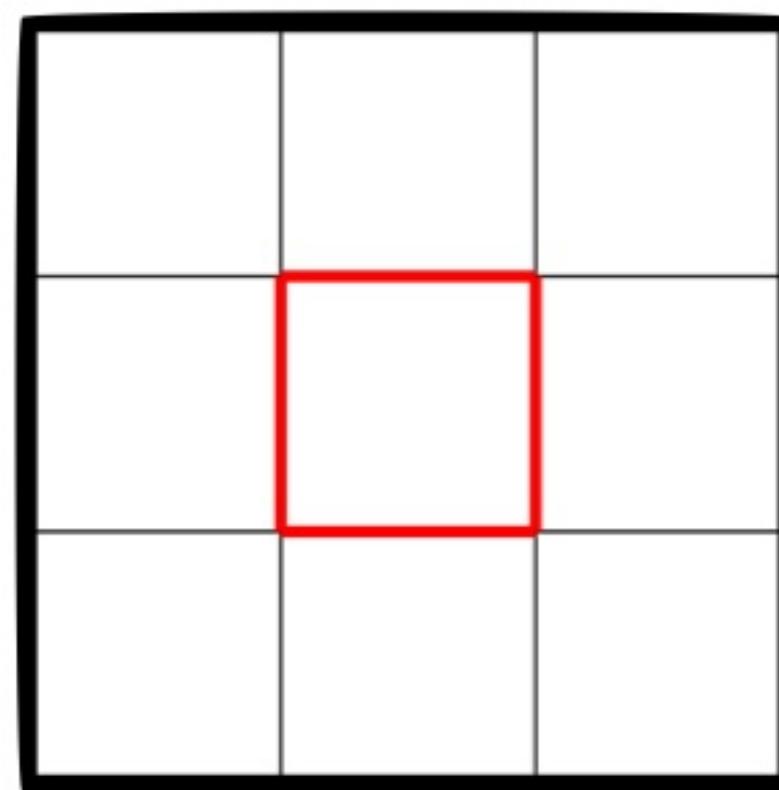


Bridge, X

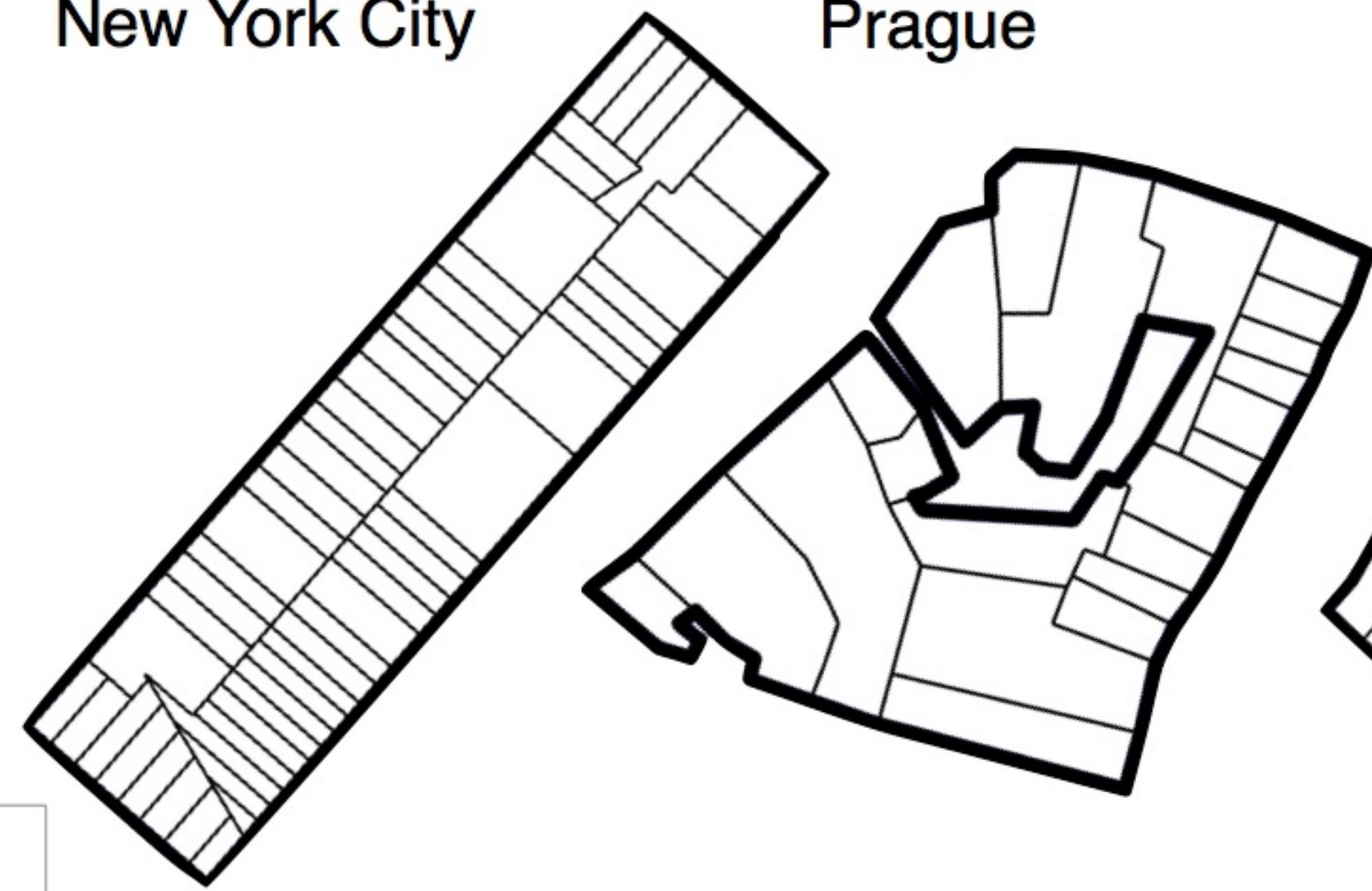






**A.**Lattice,  $S_0$ **B.**

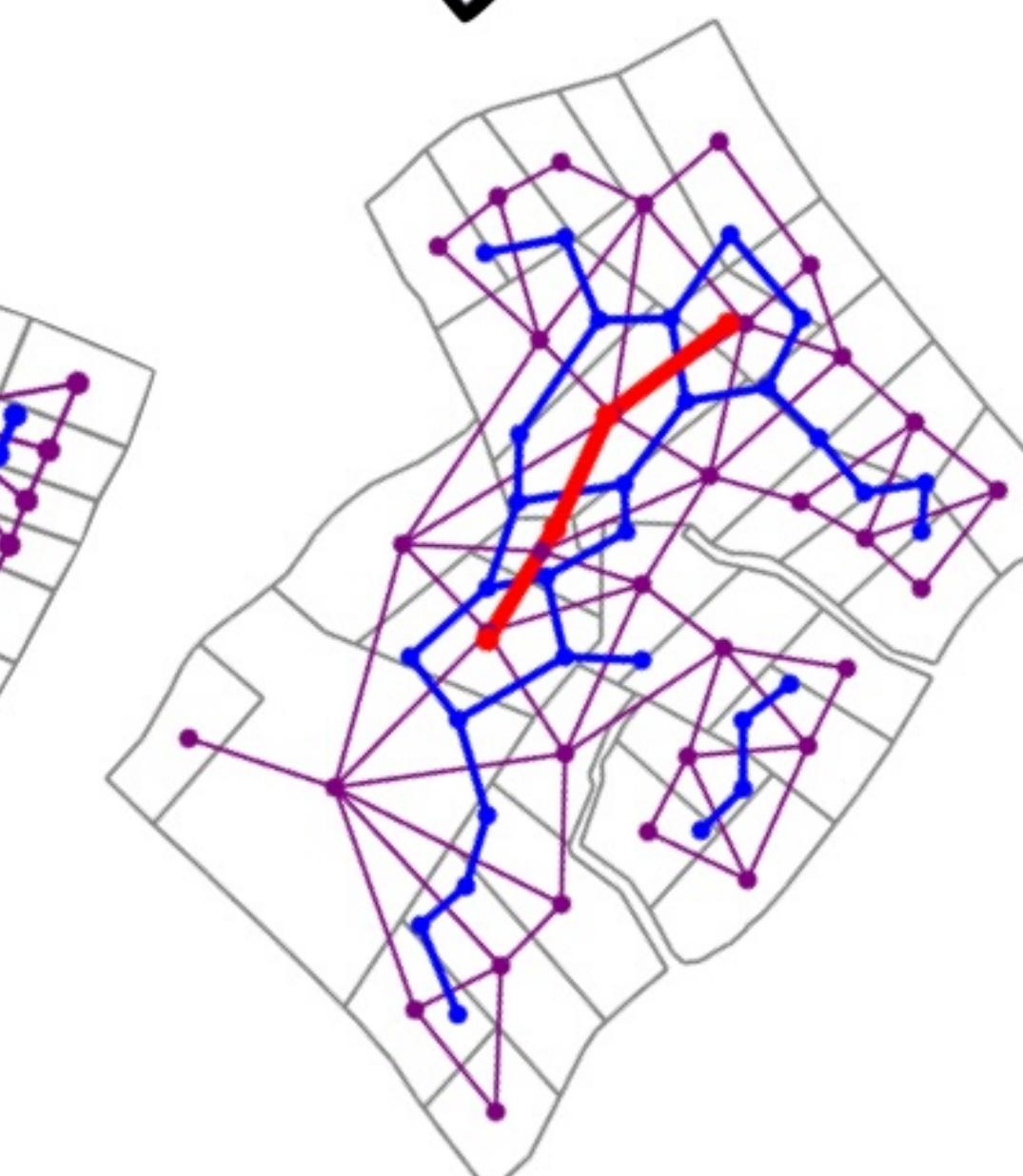
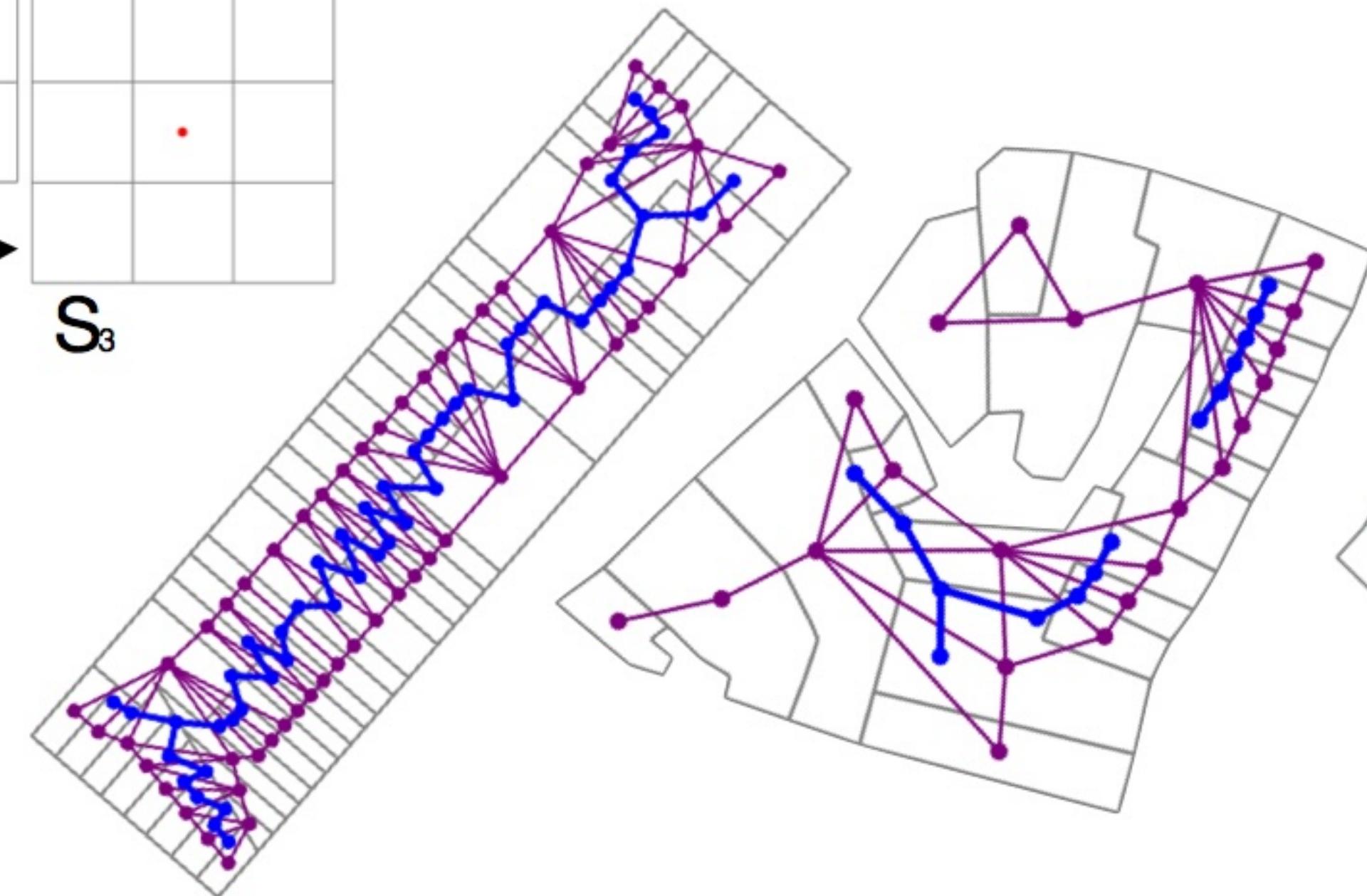
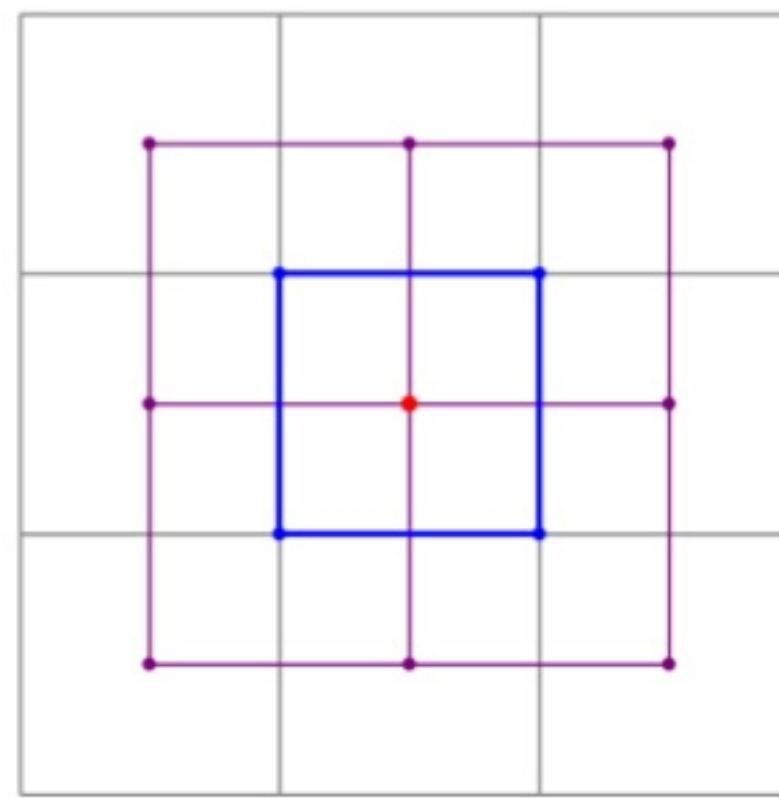
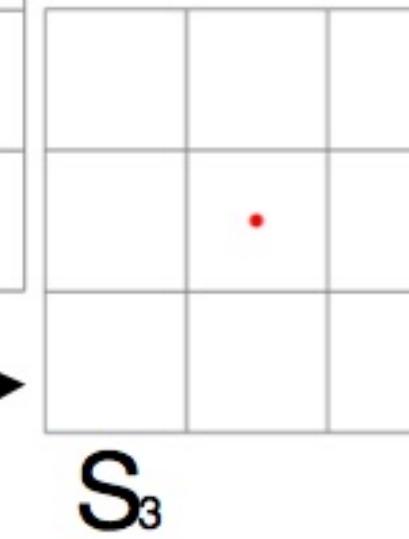
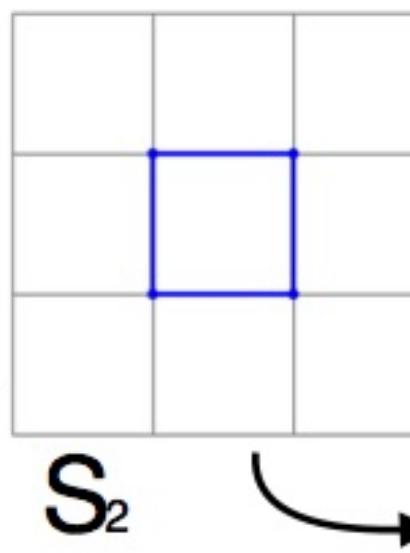
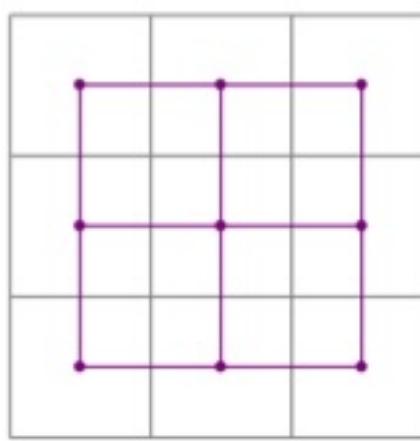
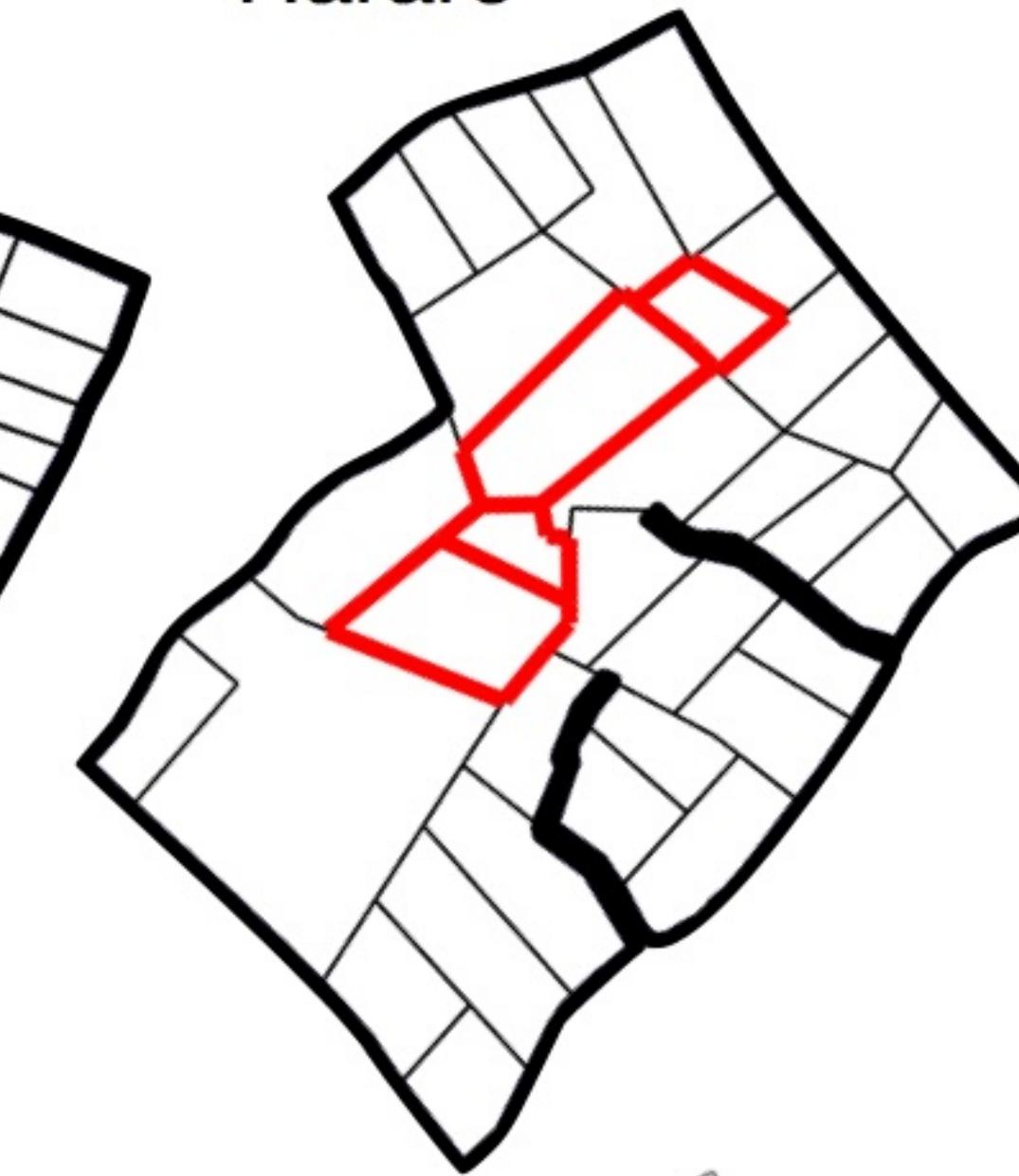
New York City

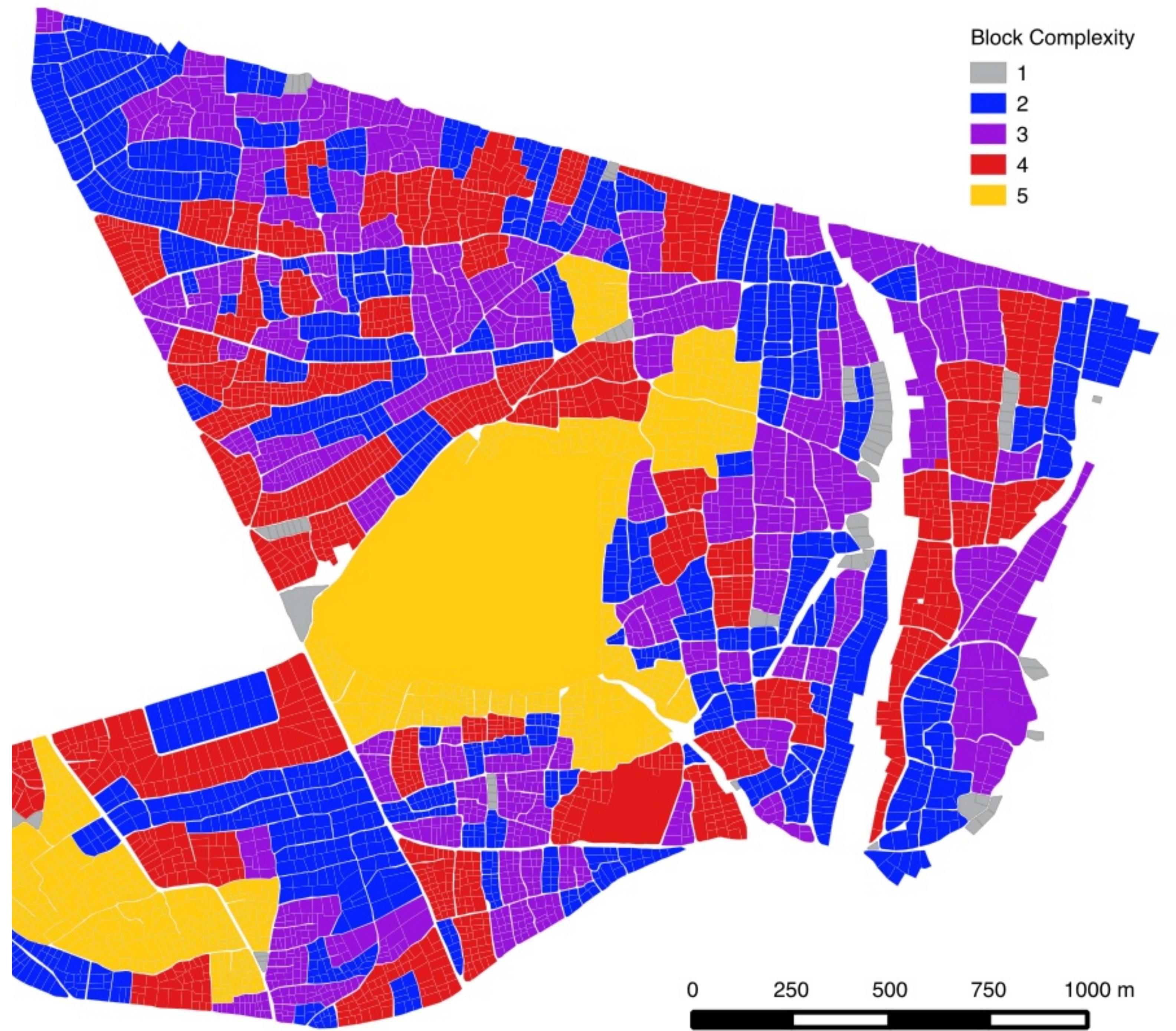
**C.**

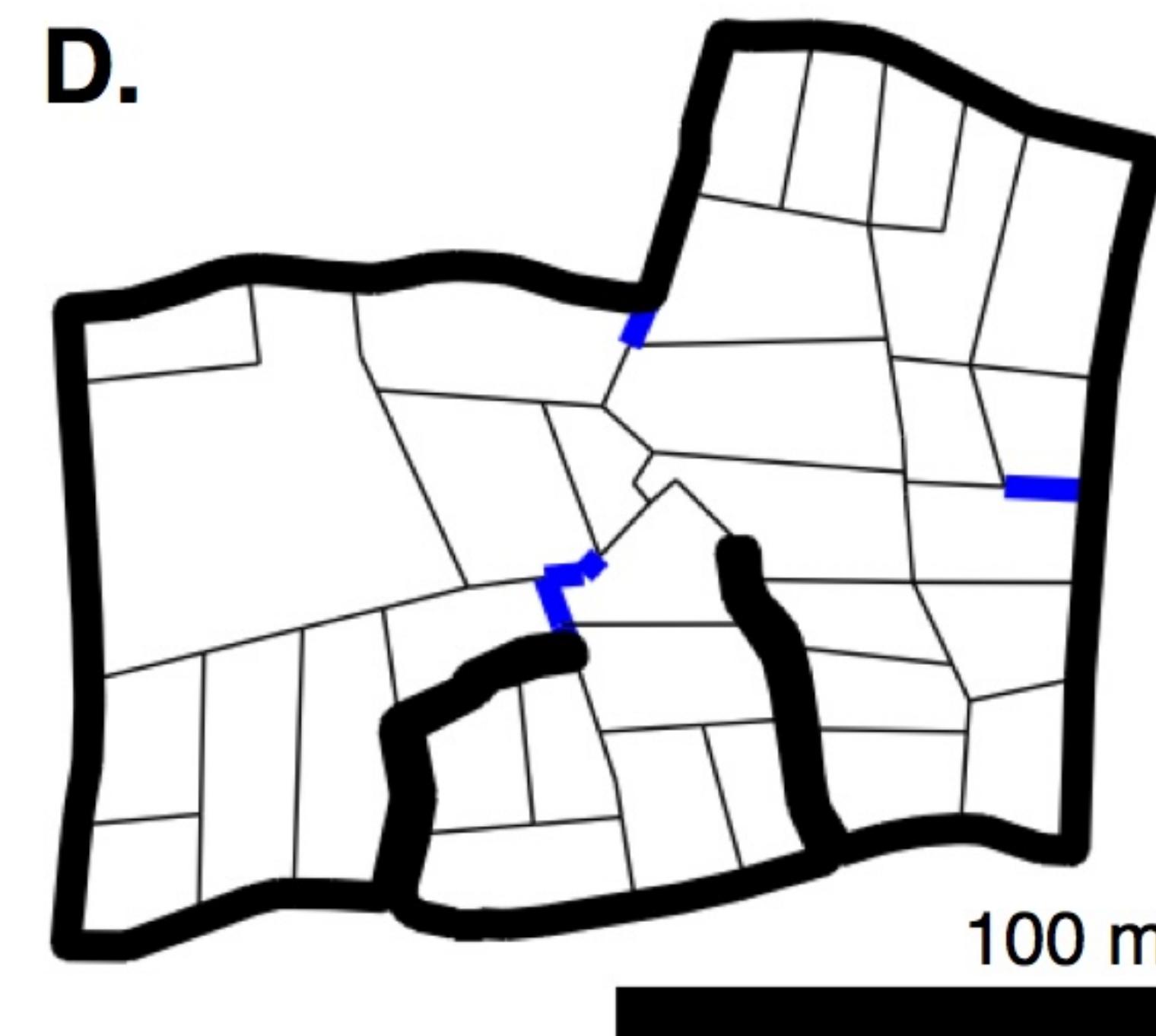
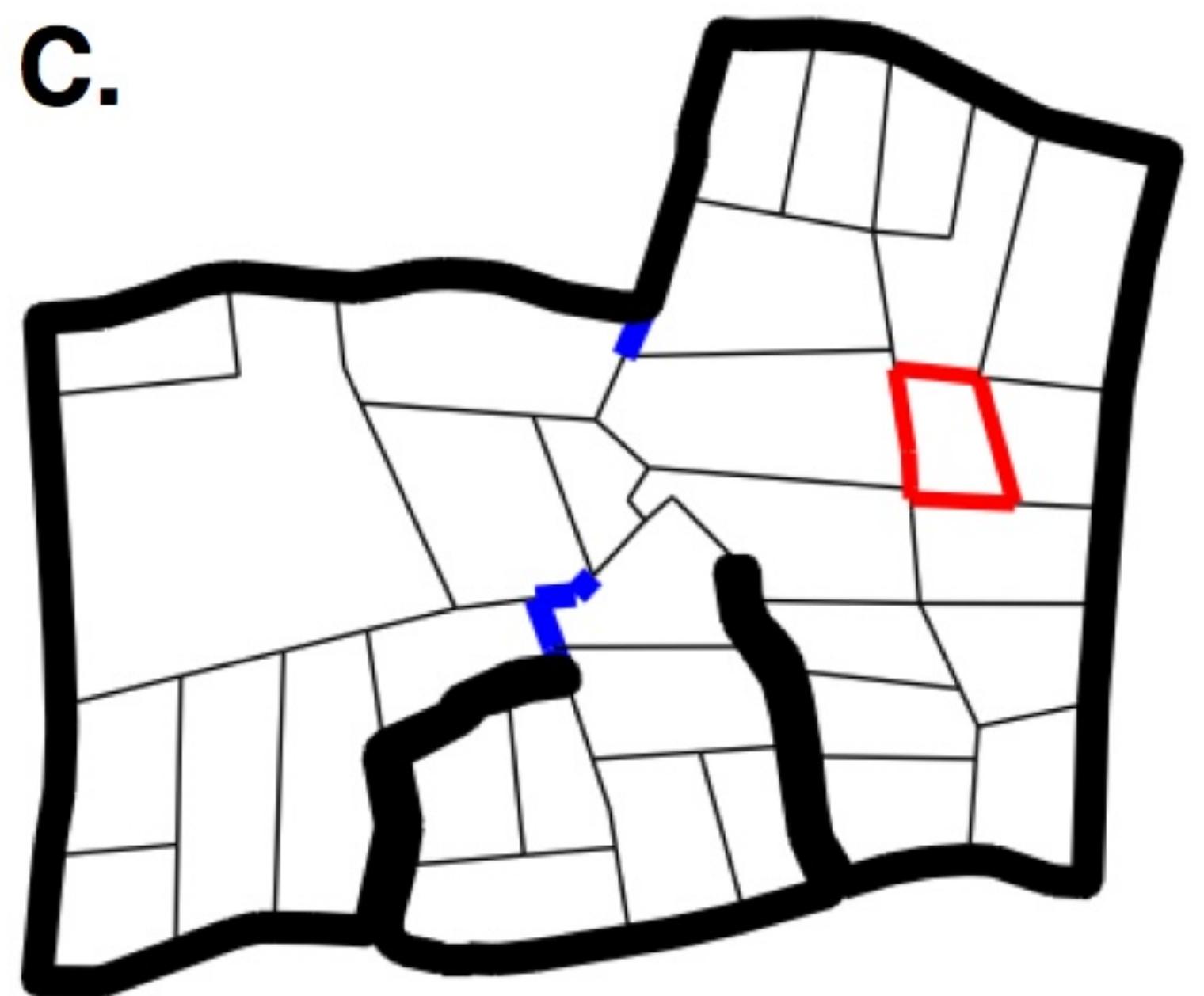
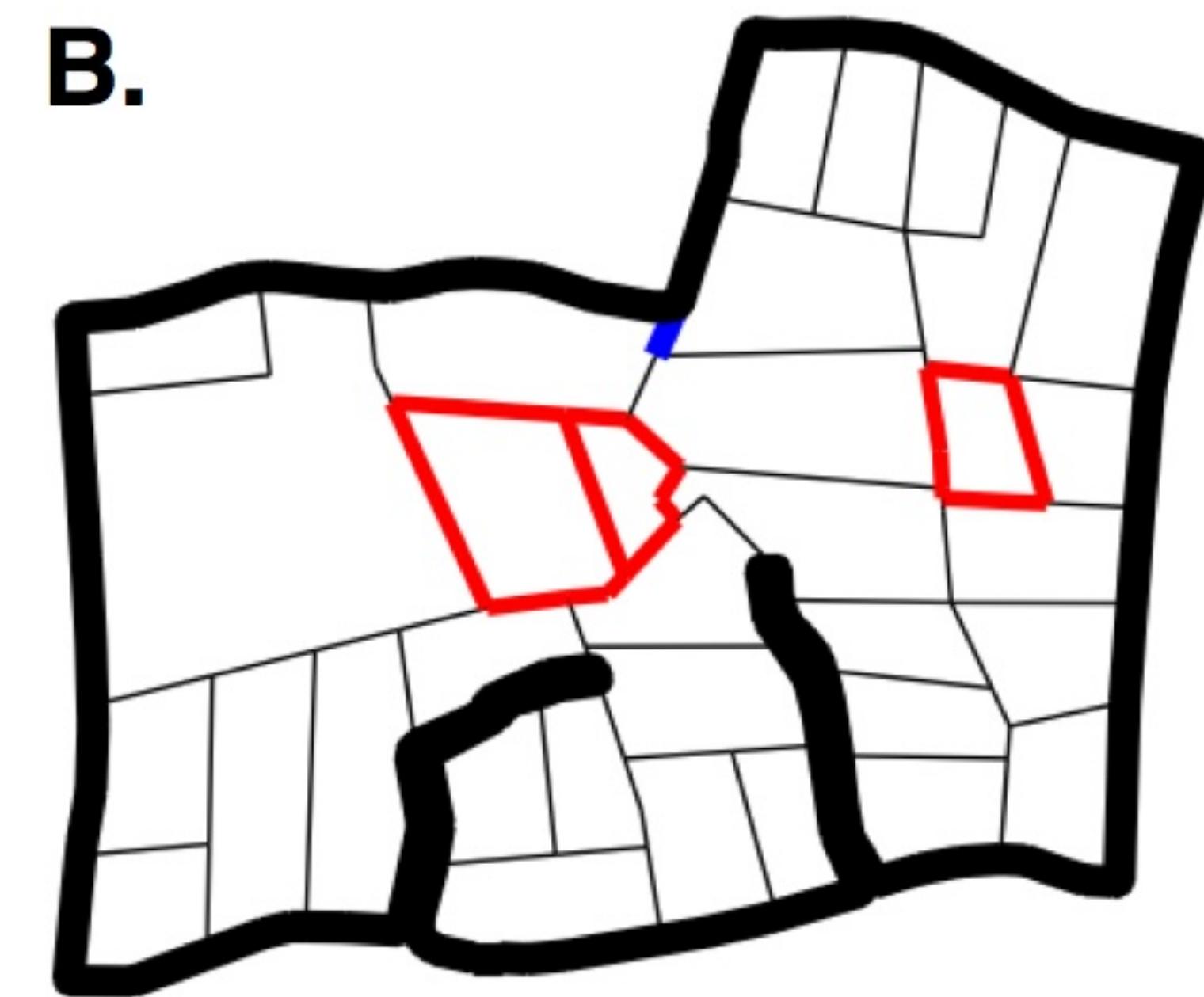
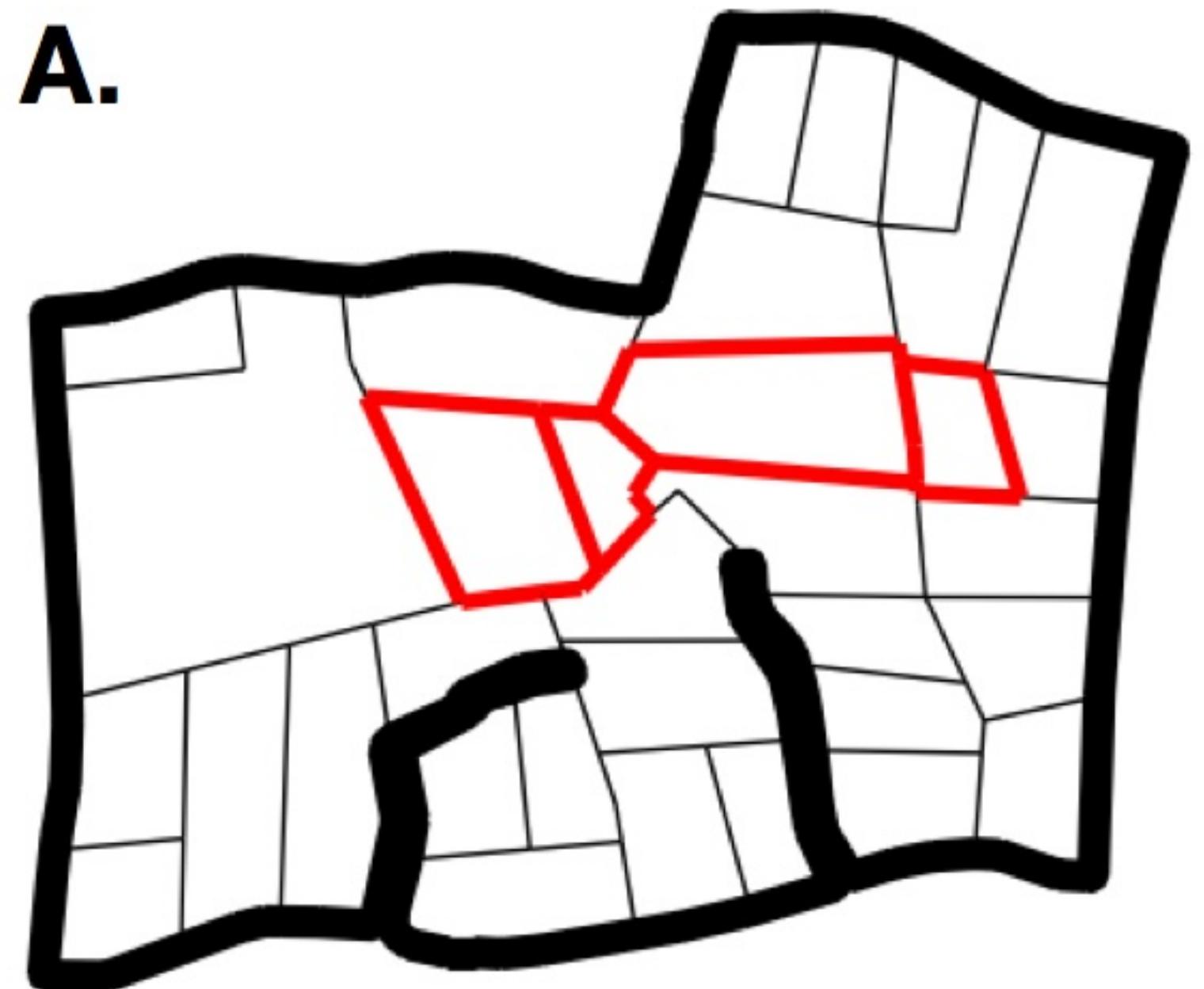
Prague

**D.**

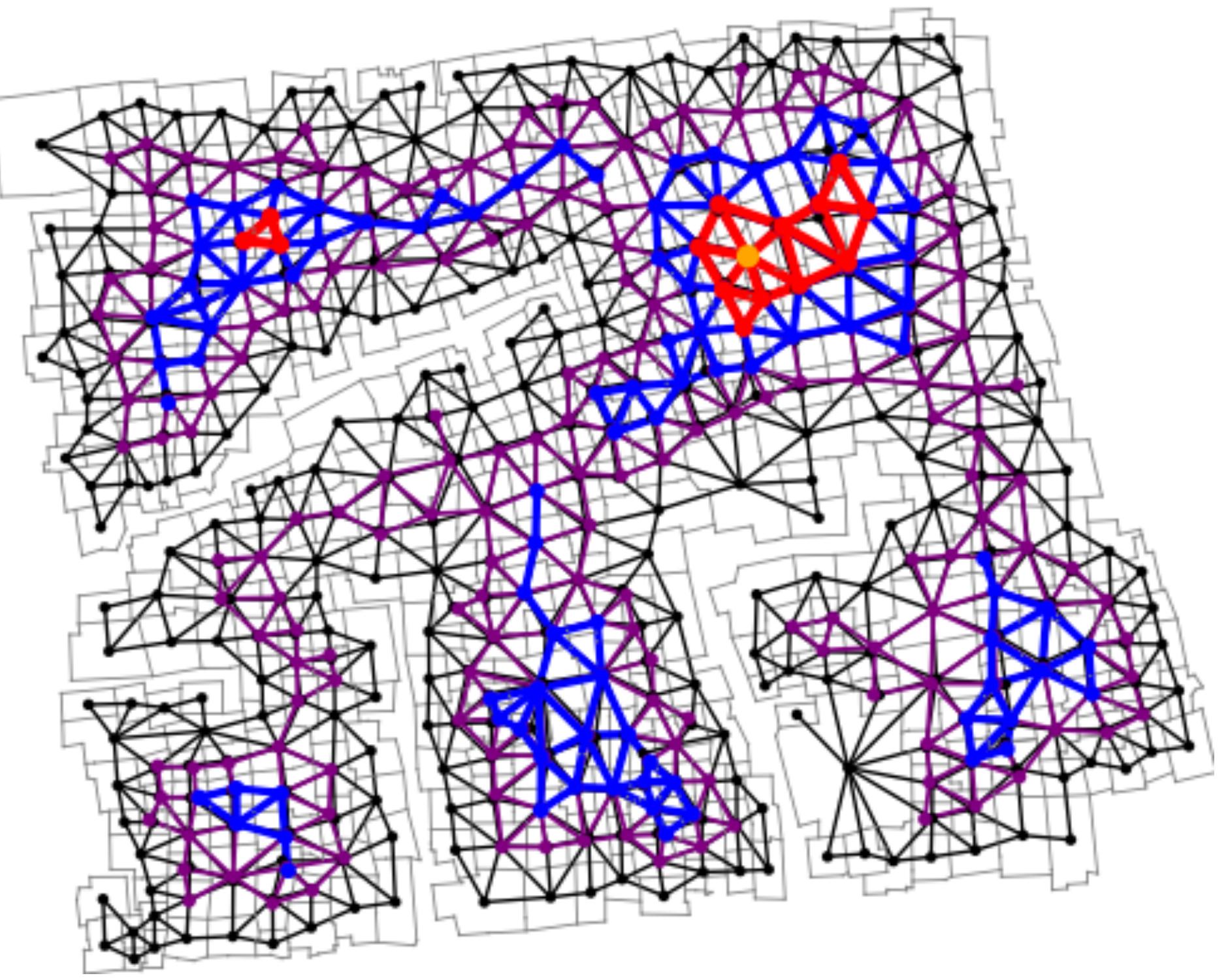
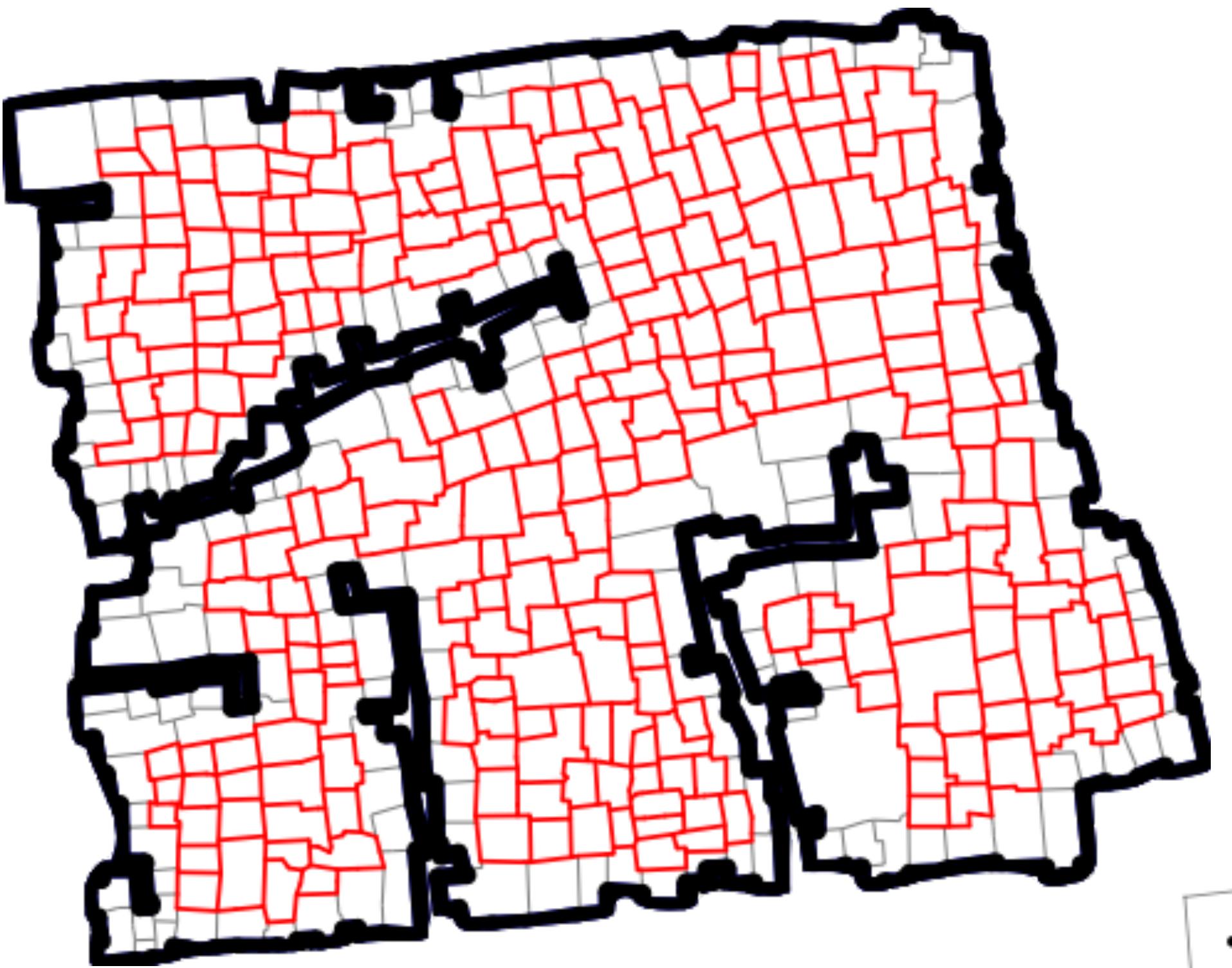
Harare

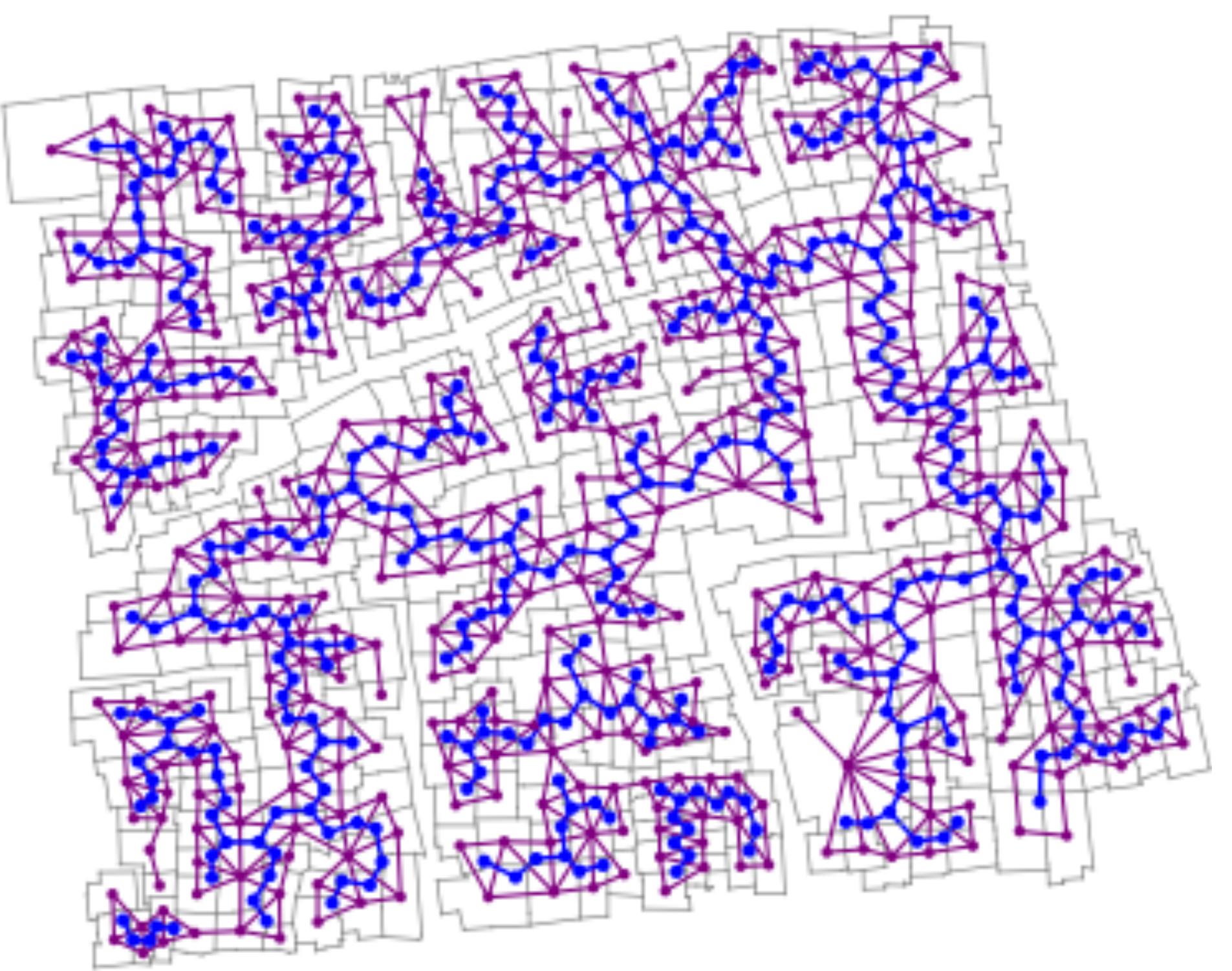
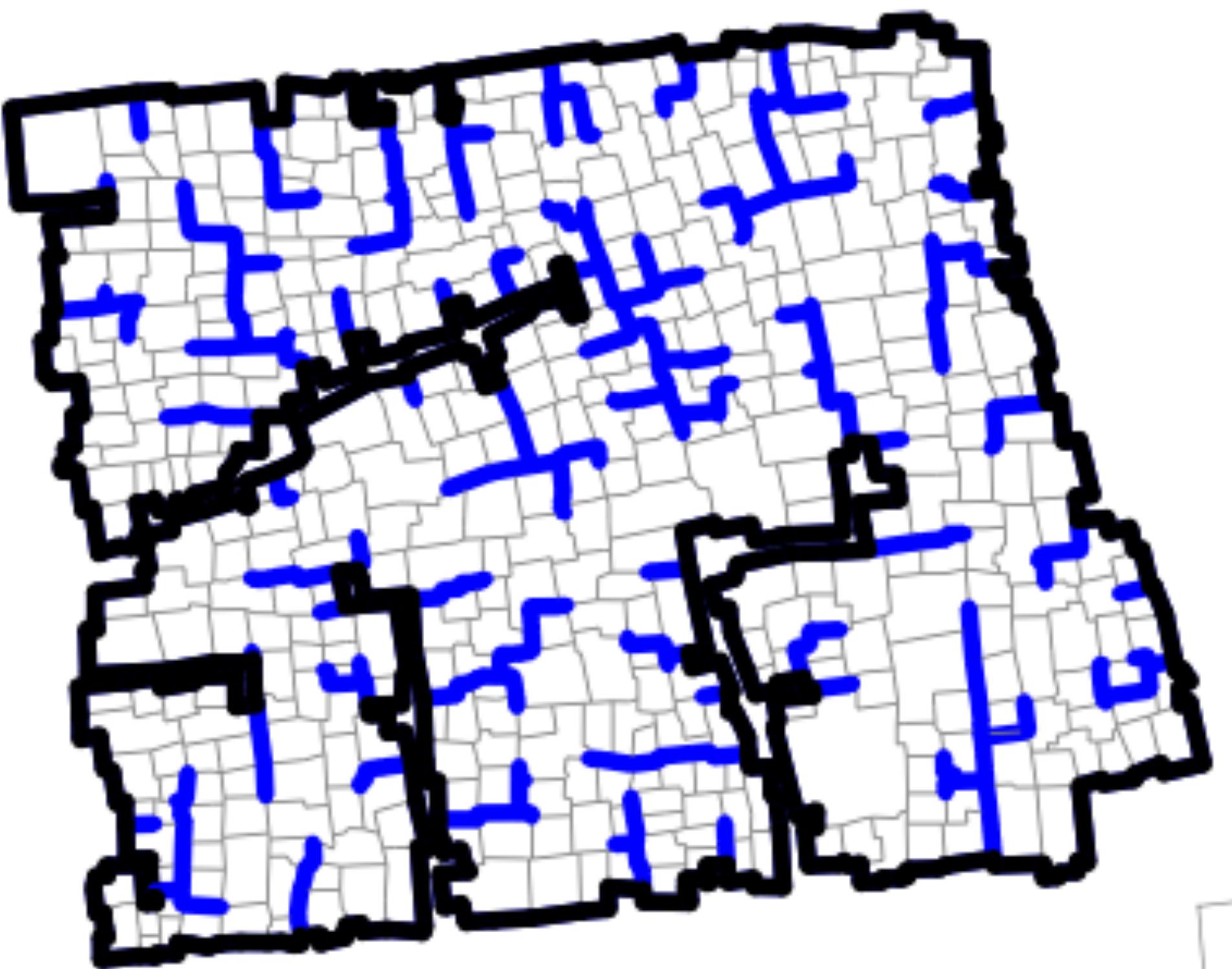


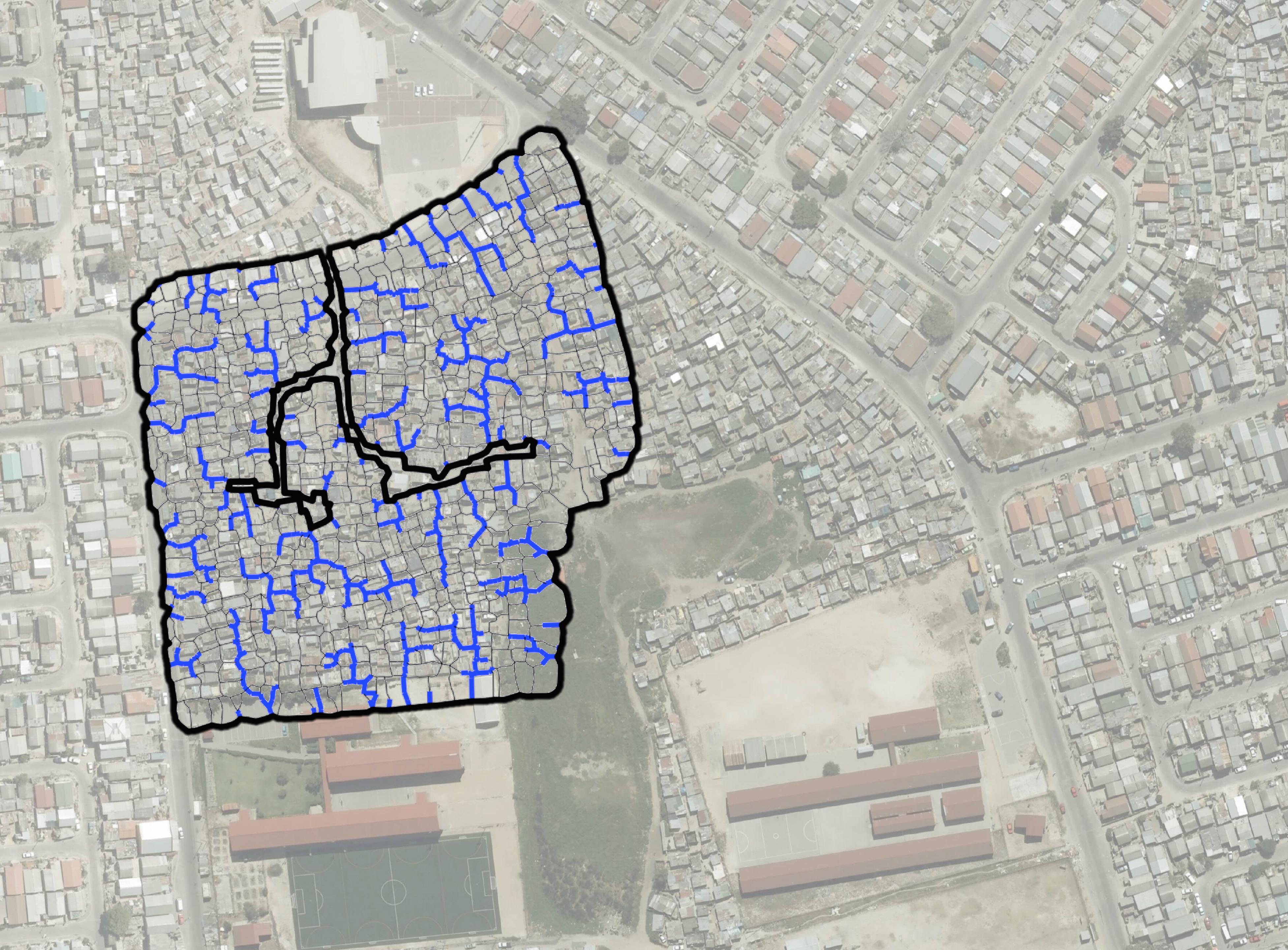




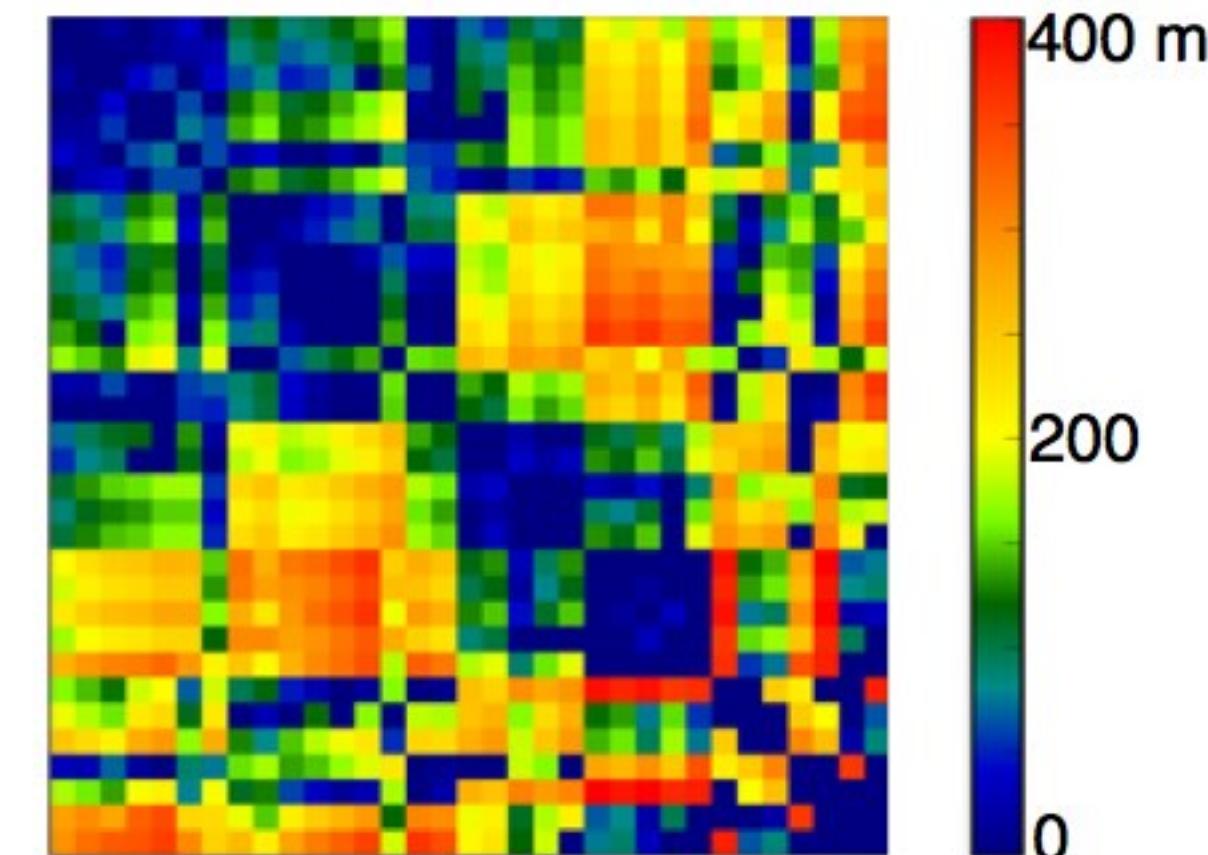
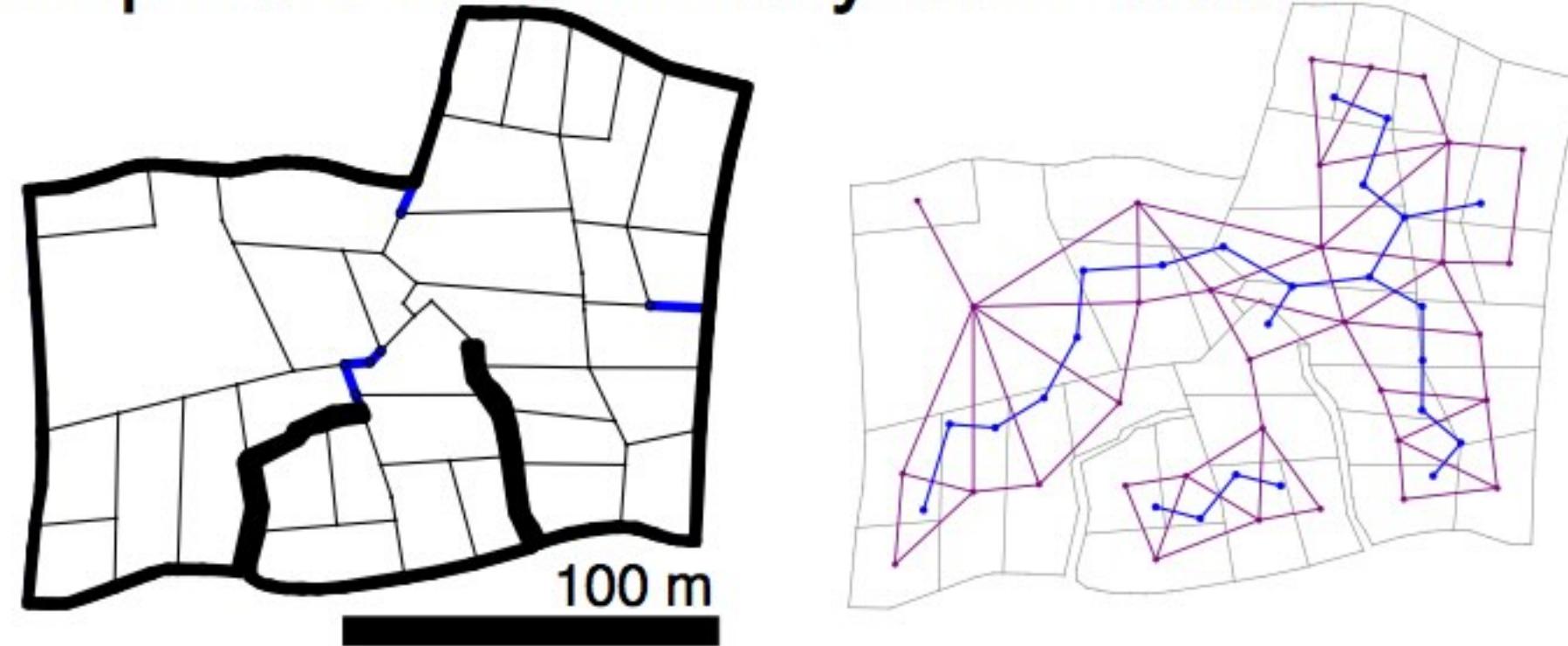




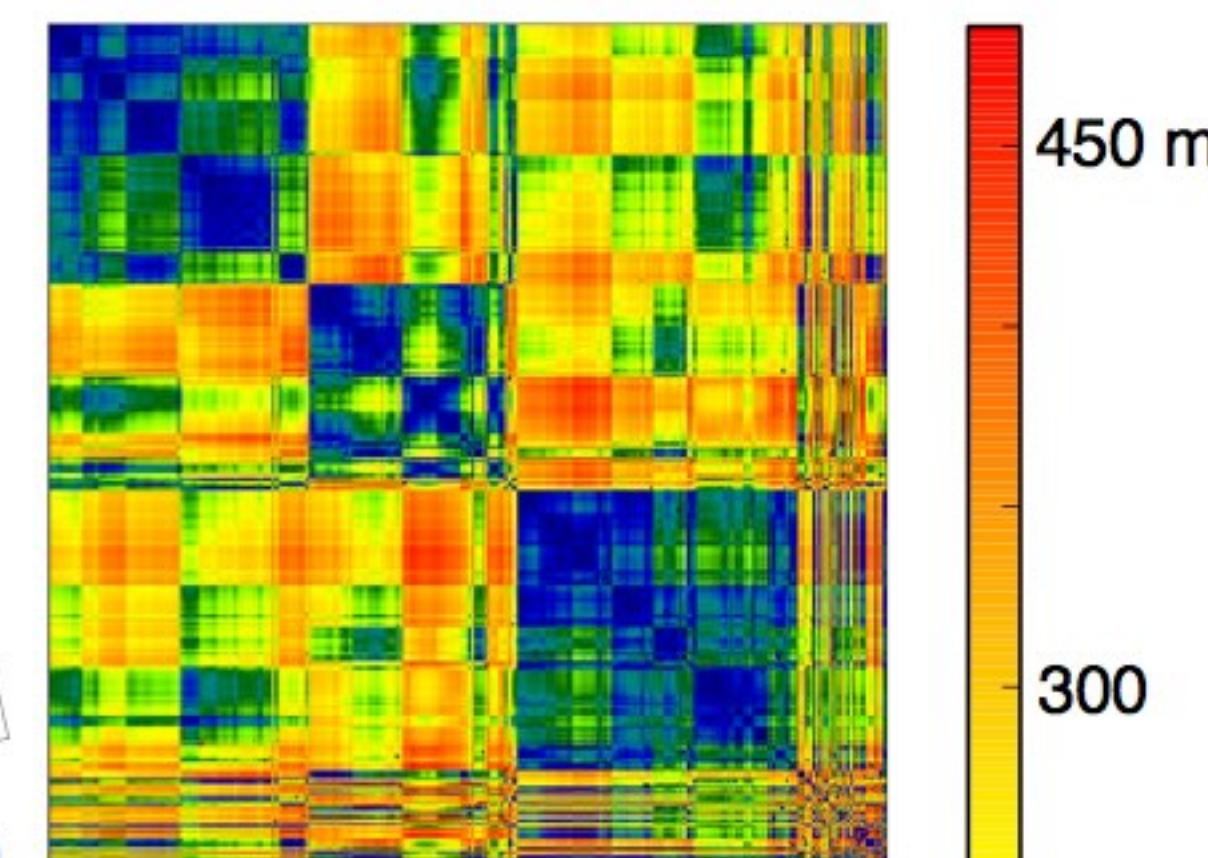
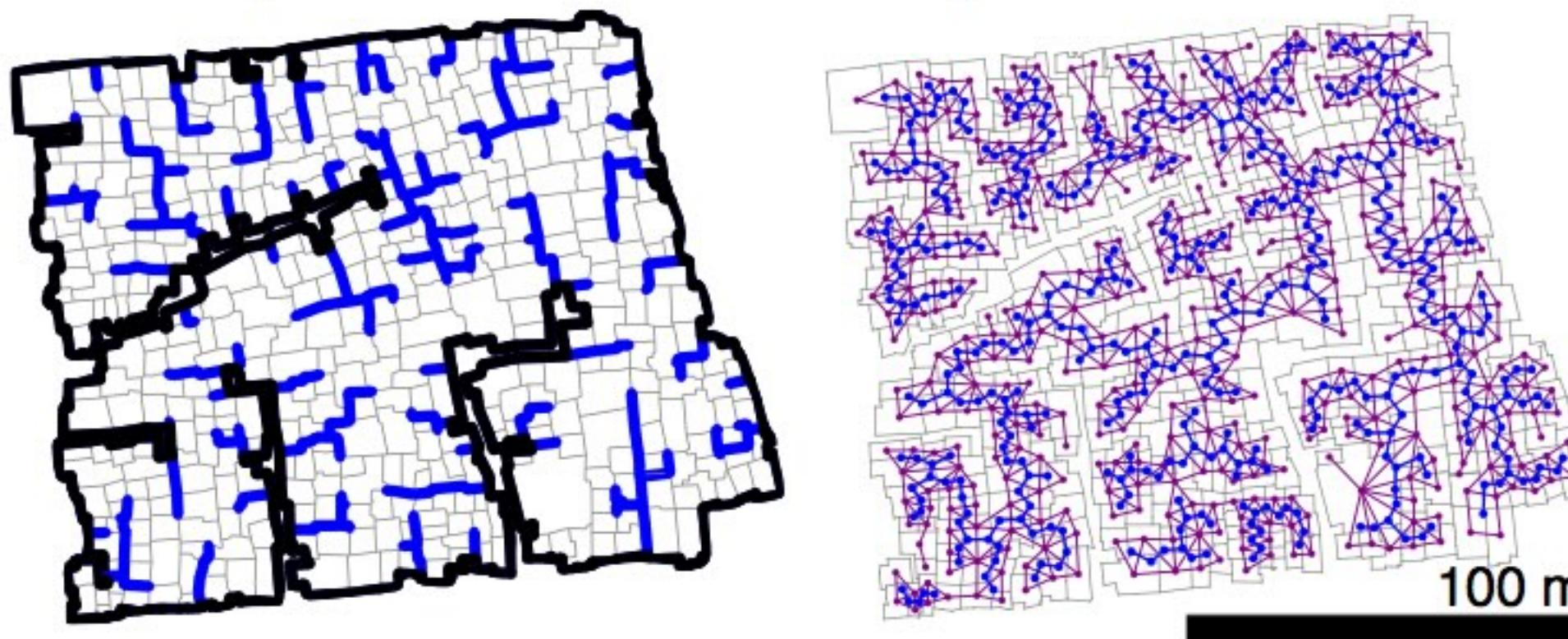




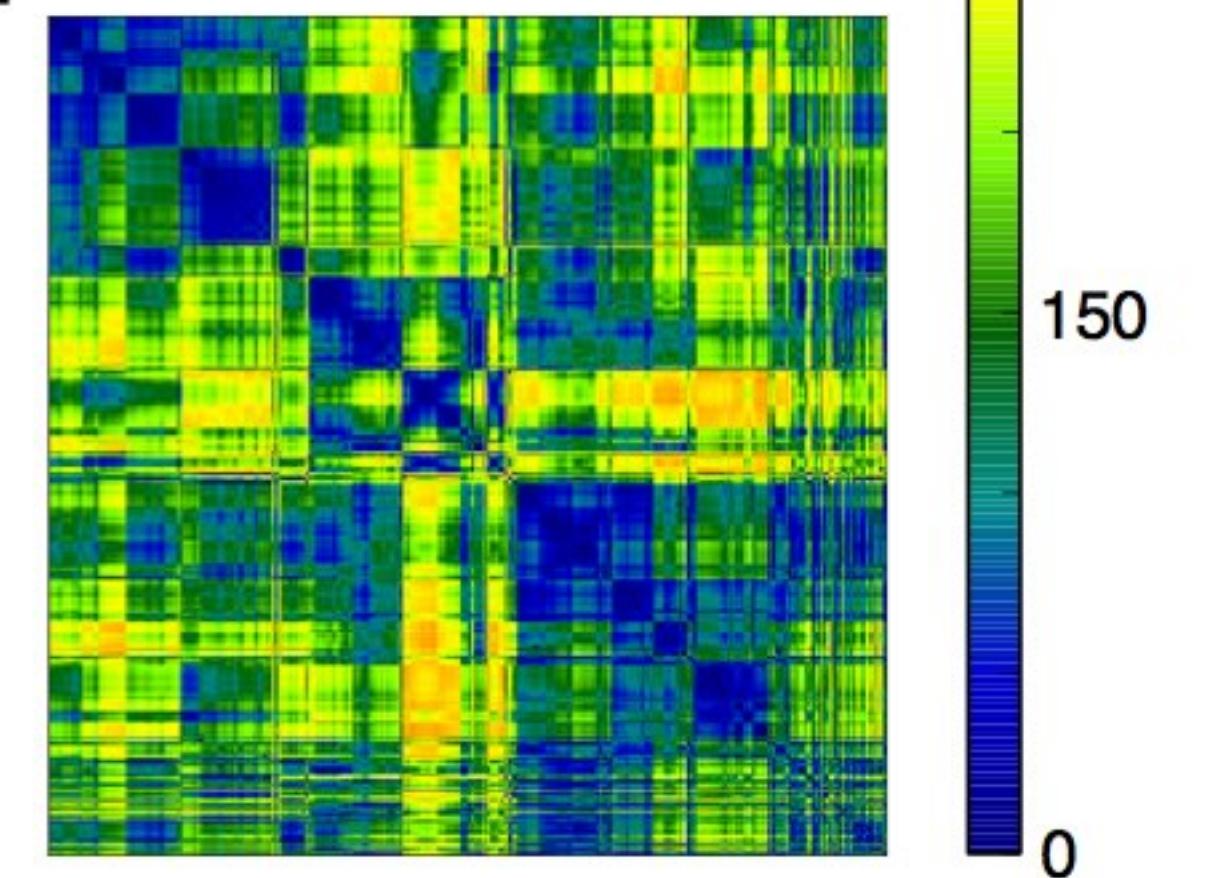
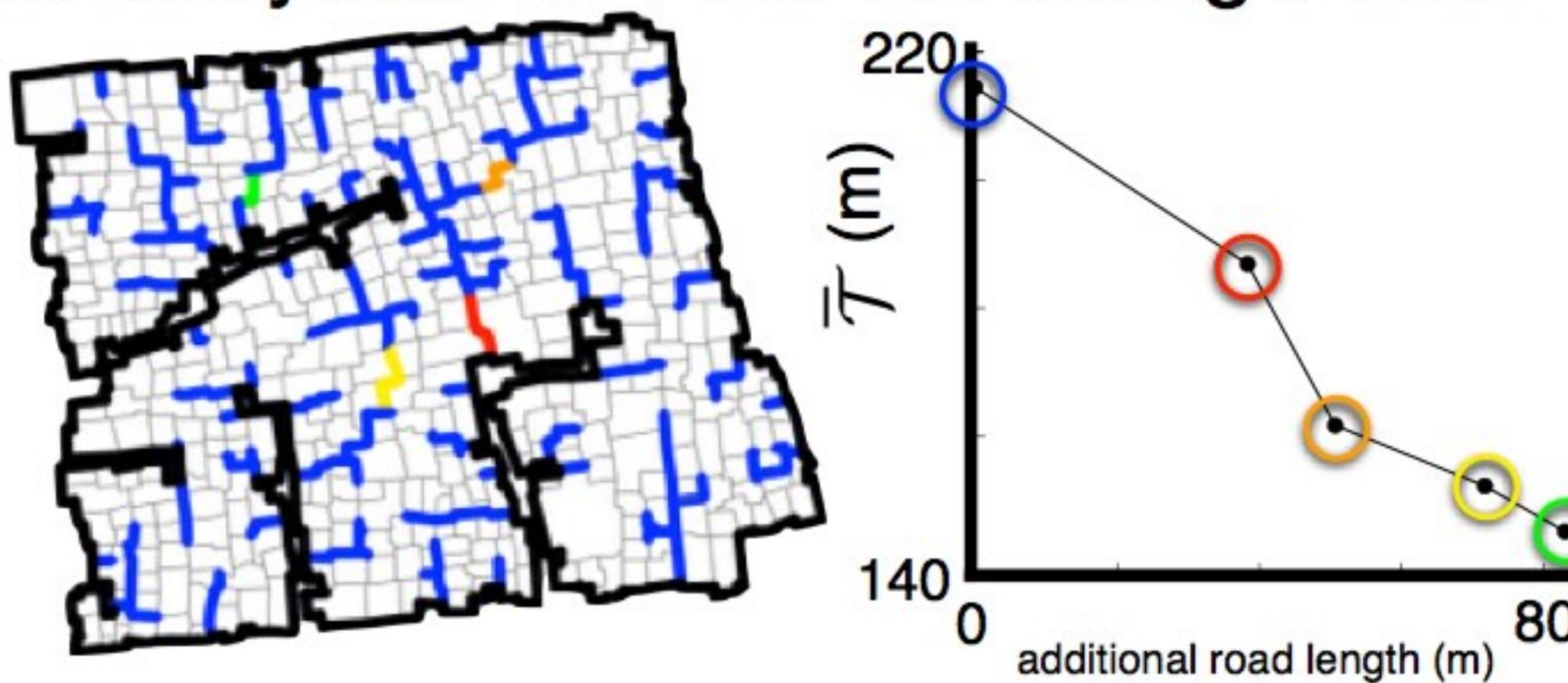
### A. Epworth: minimally connected



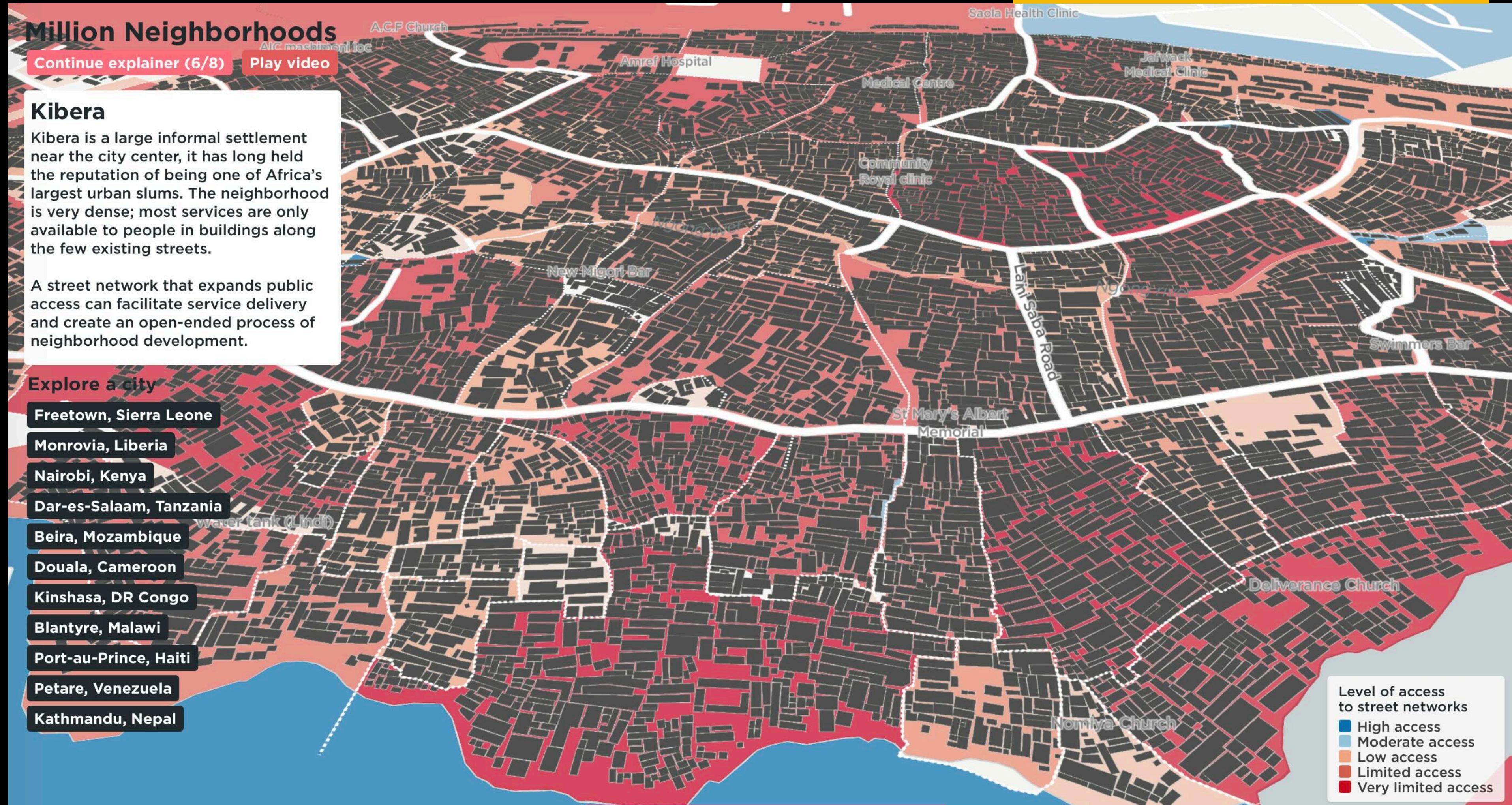
### B. Khayelitsha: minimally connected



### C. Khayelitsha: Four Bisecting Paths



# Humanitarian OpenStreetMap



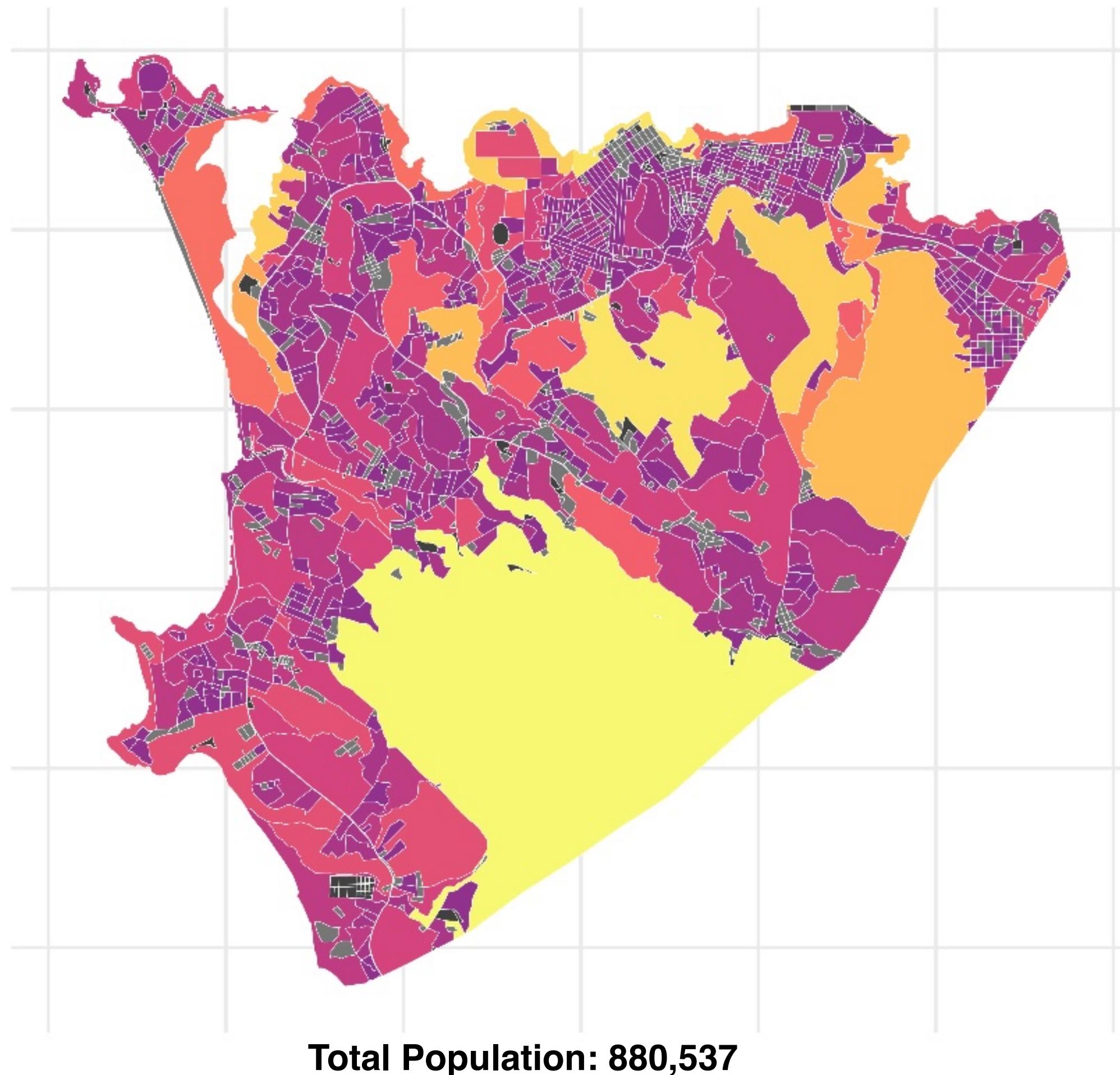


requires >140 km of new streets in Kibera

+opportunities for public spaces, cadastral maps, addresses, basic services

**new data 2022**

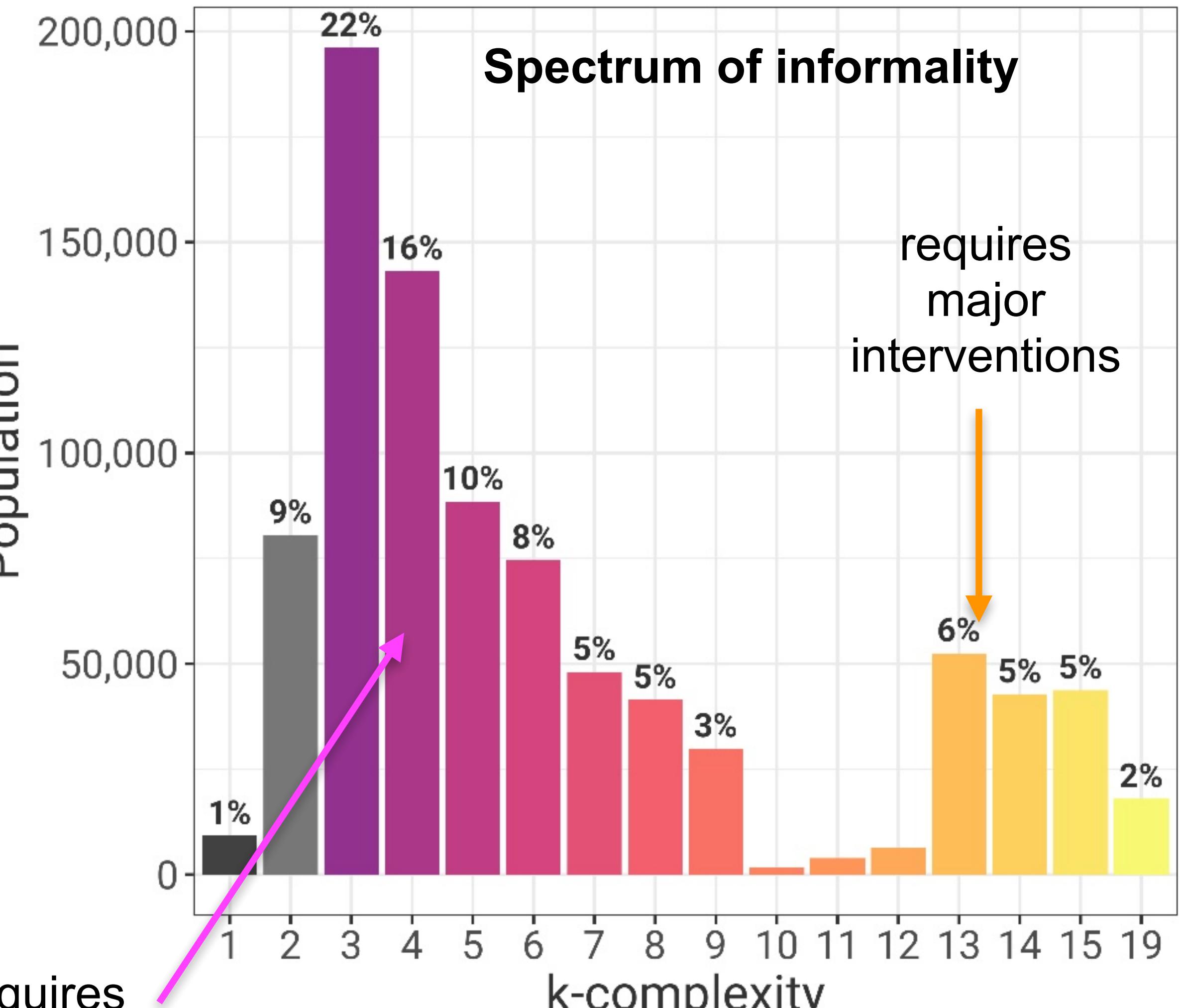
### Informal settlements



k-complexity

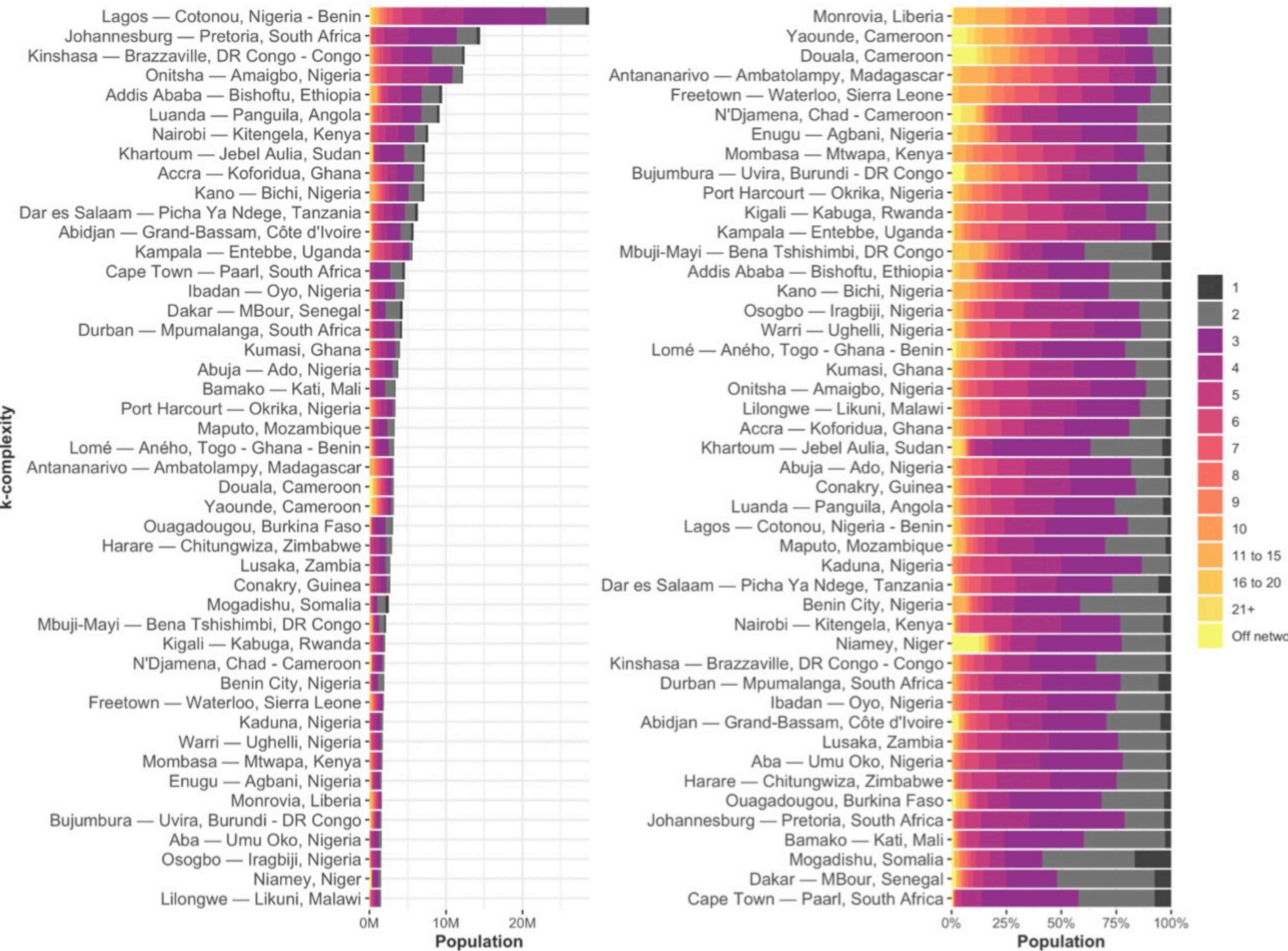
1
2
3
4
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15
16
17
18
19

### Population distribution across levels of informality



requires  
minor extensions  
of streets+services

requires  
major  
interventions



# The Math Behind a Localized Approach to the UN's Sustainable Development Goals

Over 80,000 neighborhoods must be in the process of being upgraded in parallel all over the world each year.

LUIS BETTENCOURT | OP-ED FEBRUARY 28, 2018

