Geocomputation

Geometric Operations and Spatial Queries

Where are we at?

Part I: Foundational Concepts

W1	Geocomputation: An Introduction	
W2	GIScience and GIS software	QGIS
W3	Cartography and Visualisation	QGIS
W4	Programming for Data Analysis	R
W5	Programming for Spatial Analysis	R

Where are we at?

Part II: Core Spatial Analysis

W6 **Geometric Operations and Spatial Queries**

W7 Point Pattern Analysis

W8 Spatial Autocorrelation

R

Part III: Advanced Spatial Analysis

W9 Rasters, Zonal Statistics and Interpolation

W10 Transport Network Analysis

R

Before we start

- Go to www.menti.com
- Use code: 4293 9206

This week

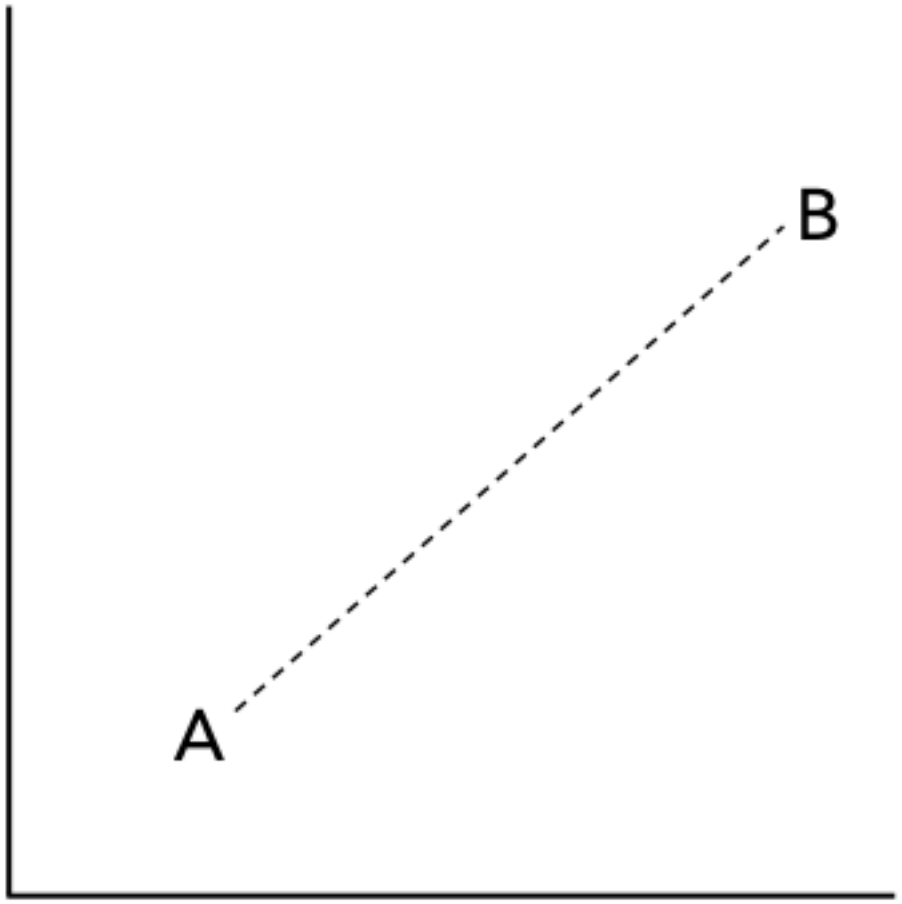
- Spatial properties
- Spatial operations
- Spatial relationships

This week

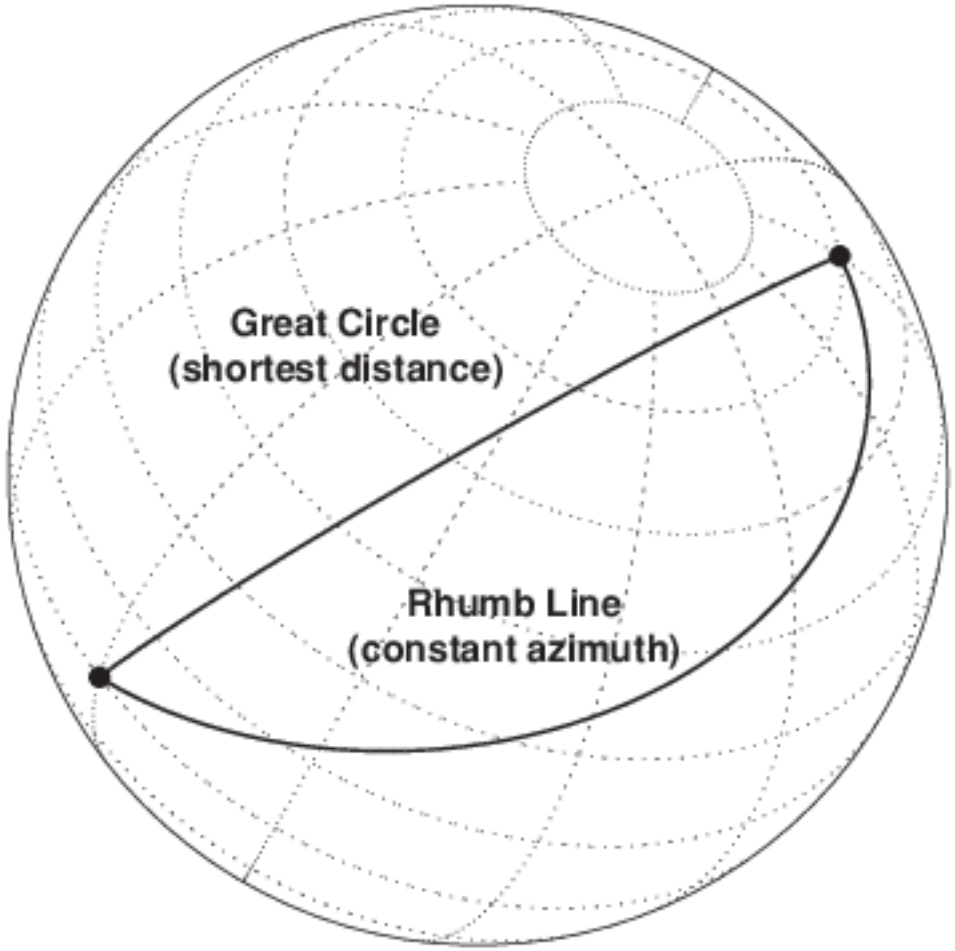
Spatial properties

- Much of spatial data involves the execution of spatial maths on spatial properties.
- We typically work with *“things”* like distance, area, and shape.
- Different ways to think about these properties and how to conceptualise them.

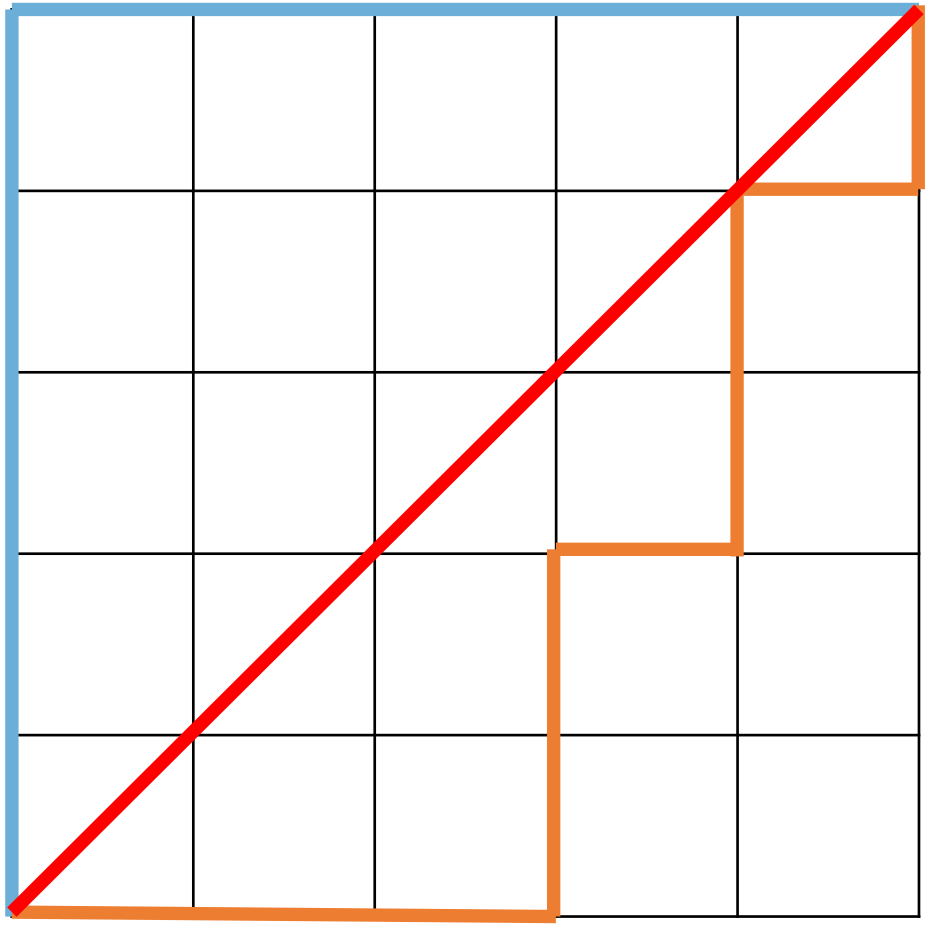
Distance



Distance


Great Circle
(shortest distance)
Rhumb Line
(constant azimuth)

Distance

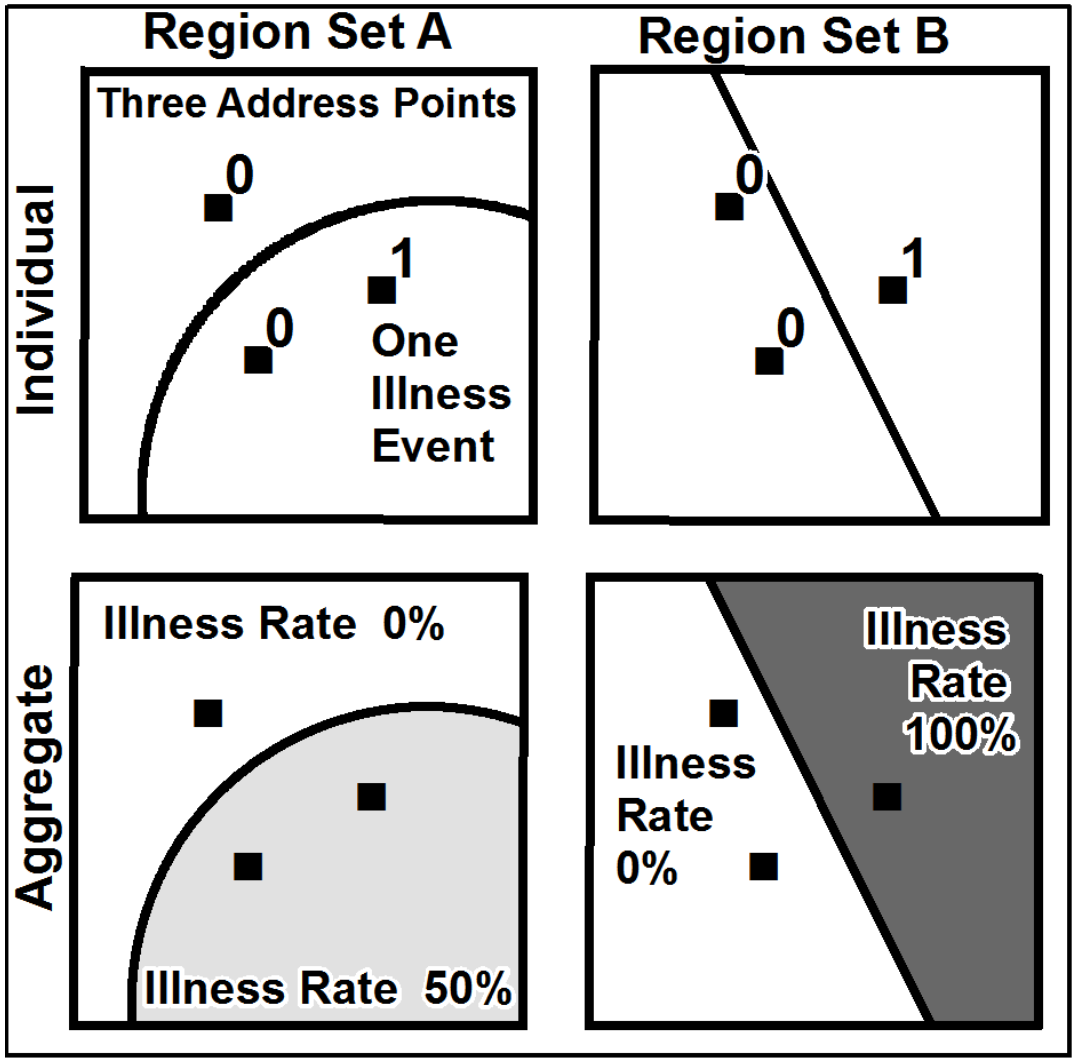


Area

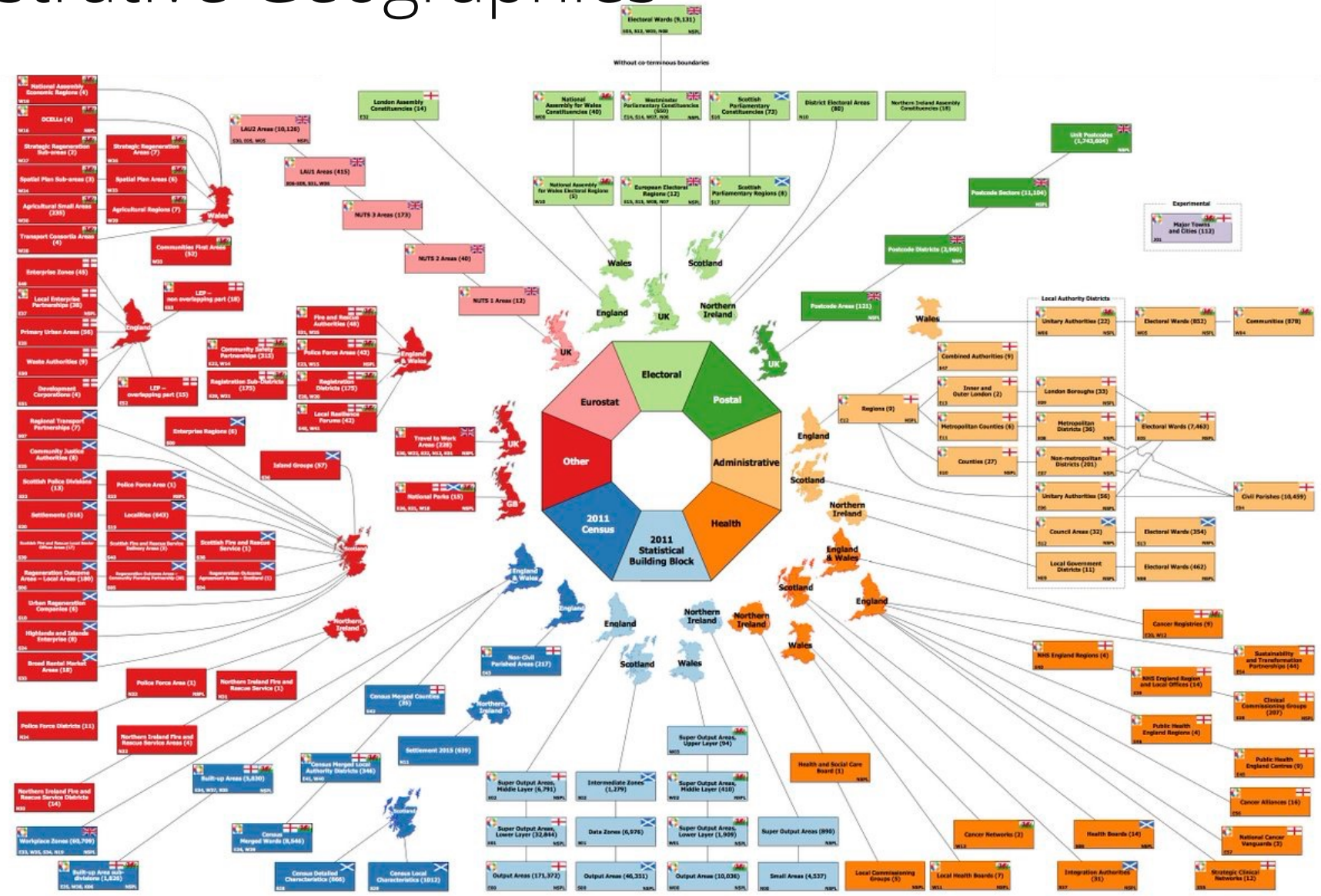
Area

- Precision of the data source will affect calculations (e.g. simplified topology).
- Decision of which geography to use is crucial and depends on what you want to investigate – and keep the Modifiable Areal Unit Problem in mind.

Modifiable Areal Unit Problem



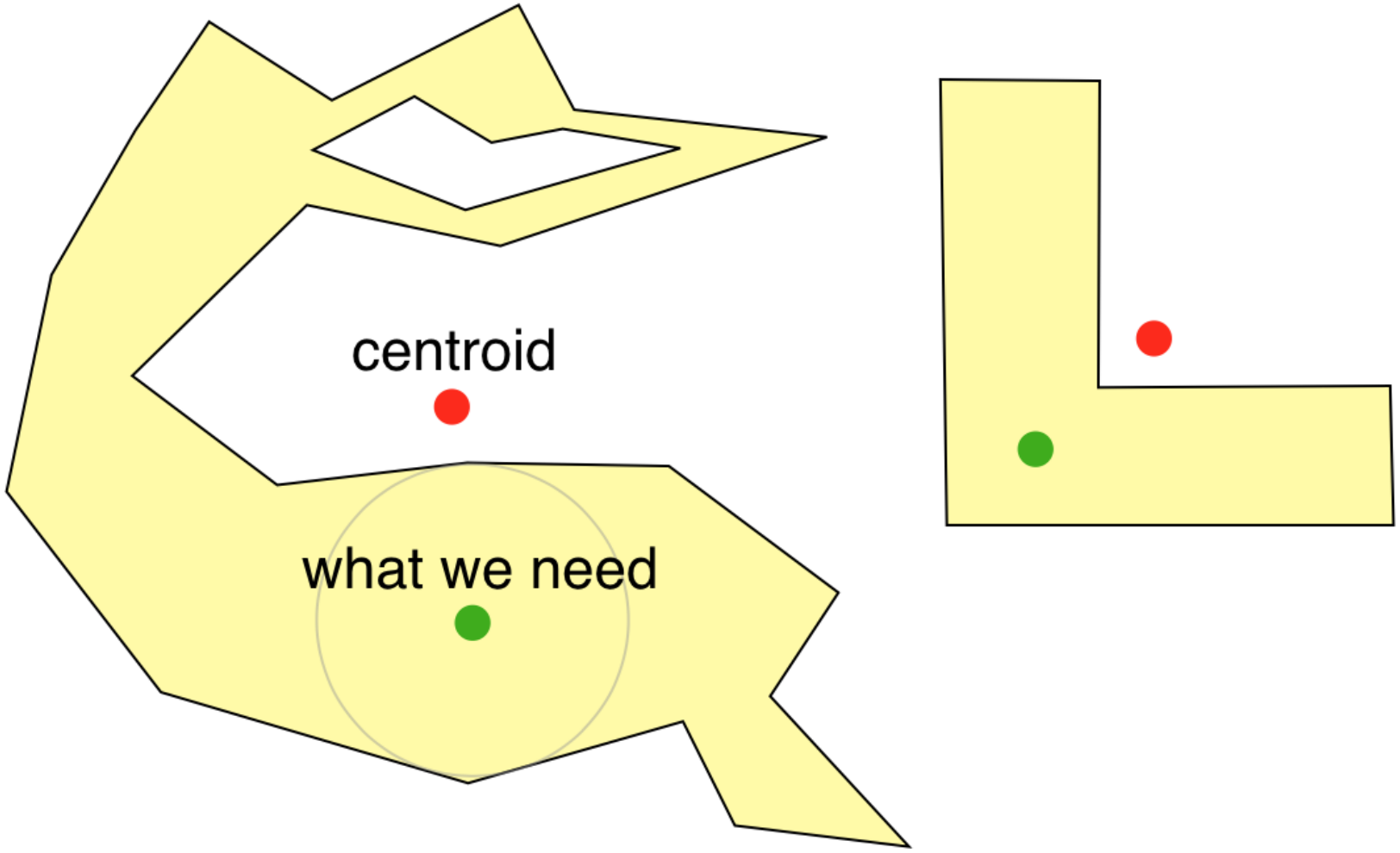
Administrative Geographies



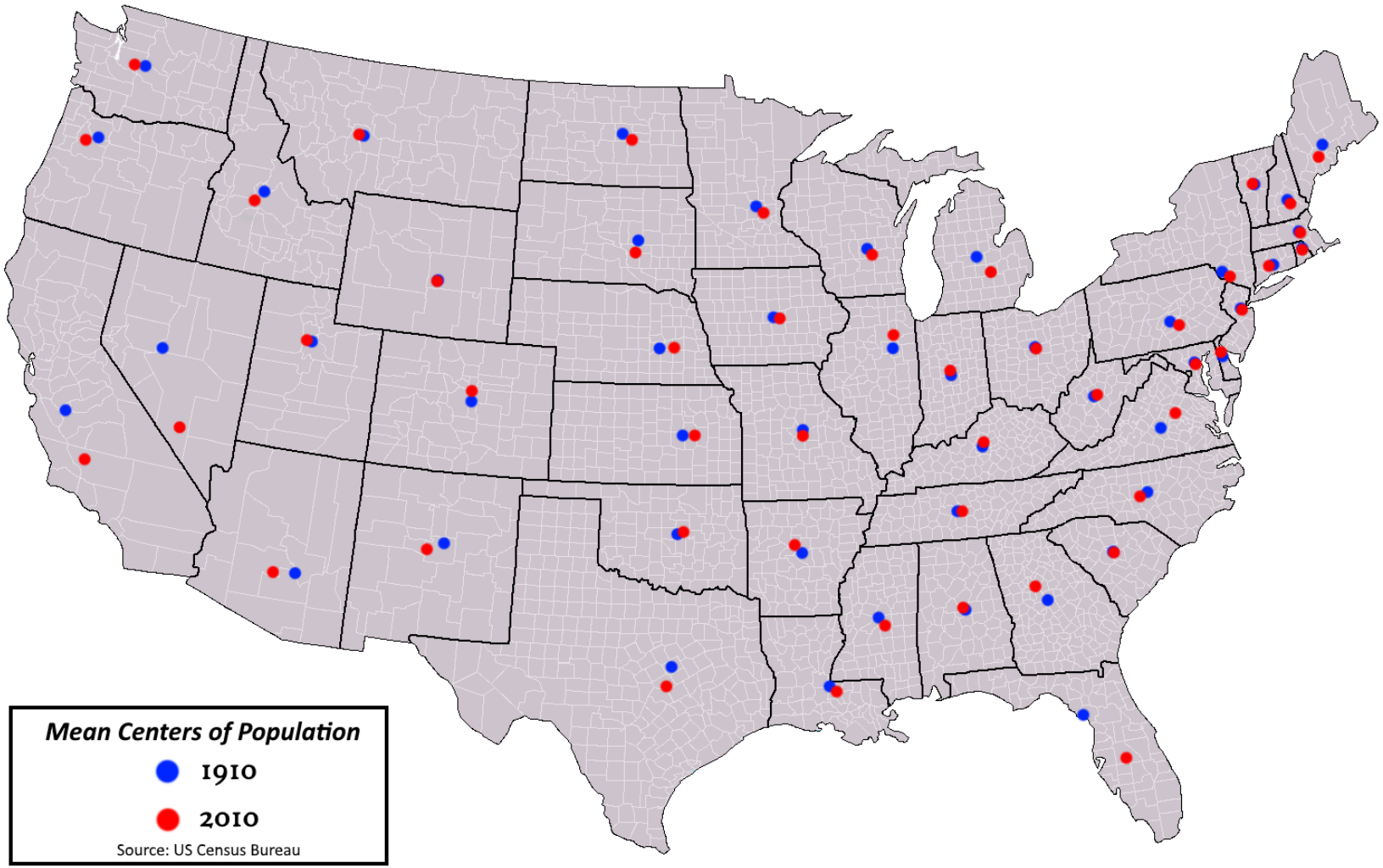
Shape

- Identify and characterise a shape, e.g. following a process of spatially clustering individual objects or geometries.
- Quantifiable with a compactness ratio or perimeter/area ratio.
- Shape can be important to consider when calculating geometric centroids.

Shape



Shape

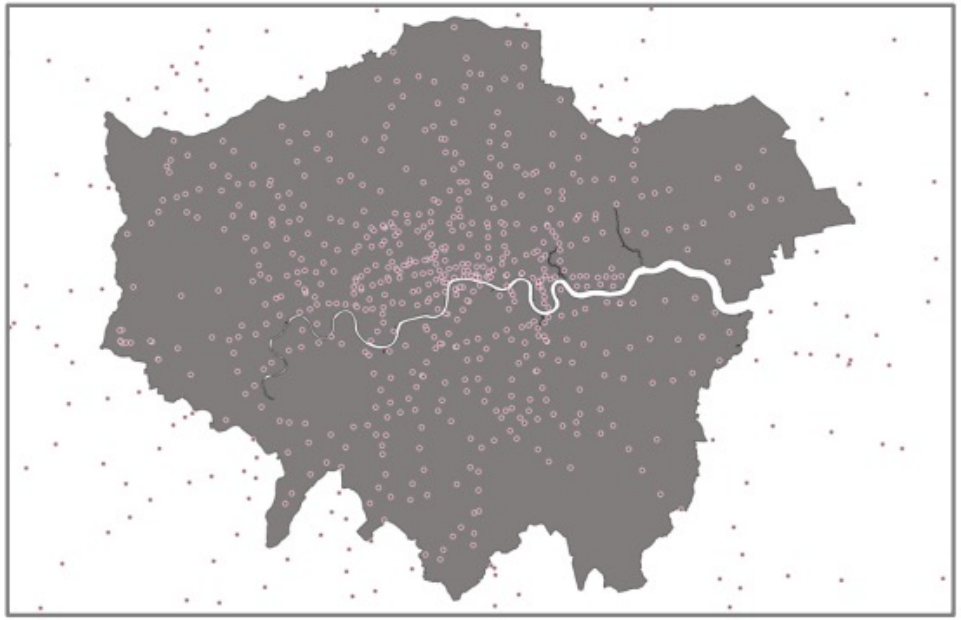

Mean Centers of Population
1910
2010
Source: US Census Bureau

Spatial operations

- Building blocks of spatial data analysis: selecting, filtering, reducing, and merging different geometries.
- Using spatial properties like distance, area, and shape.

Spatial operations

?



Spatial operations

Use of spatial relationships to take data as an input, “do something” with the data and then produce output data that is a derivative of the analysis performed on the input data.

Spatial operations

Use of spatial relationships to take data as an input, “do something” with the data and then produce output data that is a derivative of the analysis performed on the input data.

Spatial relationships

- Spatial relationships define how exteriors, interiors, and boundaries of different geometries interact with one another.
- Known as topological relationship.
- Evaluates adjacency, connectivity, and / or containment.

Spatial relationships

Equals A is the same as B	
Touches A touches B	
Overlaps A and B have multiple points in common	
Contains A contains B	
Disjoint A shares nothing with B	
Covers A covers B (or vice versa)	
Crosses A and B have at least one point in common	

Spatial relationships

- There is some spatial mathematics behind calculating the topological relationships between spatial objects.
- *“Does polygon A overlap with Polygon B?”*
  1 Establish exterior, interior and boundaries of the geometries of each the object.
  2 Calculate the number of times these three properties intersect with one another.
  3 Follow the requirements of the function to understand if it is TRUE or FALSE.

Spatial analysis

`Spatial properties` + `Spatial Relationships` =

`Spatial Analysis`

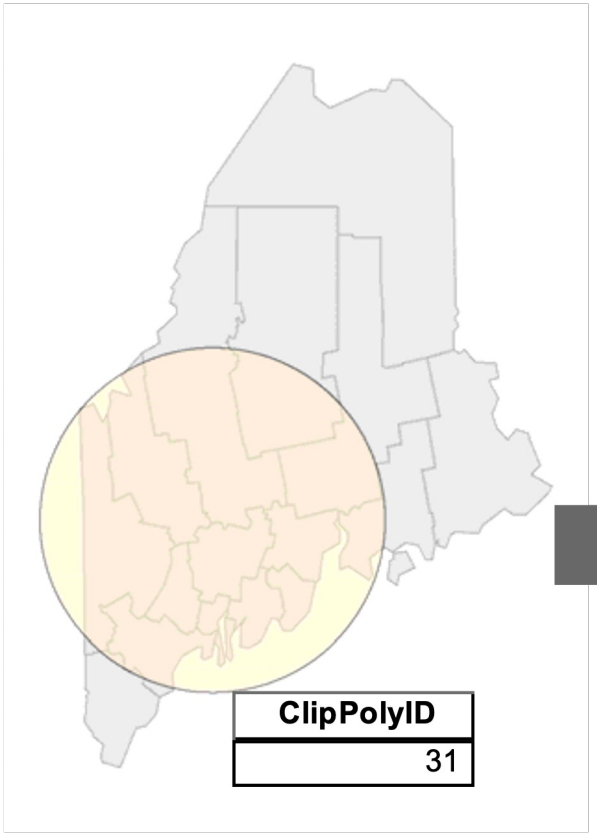
Spatial analysis

`Spatial analysis` =

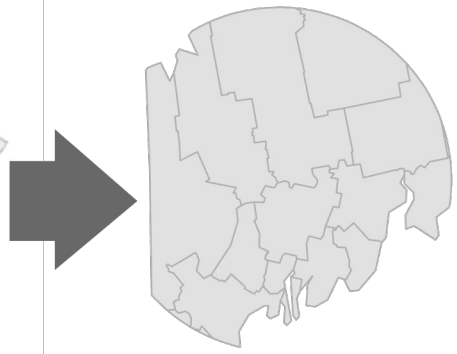
`Geometric Operations` + `Spatial Queries`

Vector operations

NAME
Androscoggin
Aroostook
Cumberland
Franklin
Hancock
Kennebec
Knox
Lincoln
Oxford
Penobscot
Piscataquis
Sagadahoc
Somerset
Waldo
Washington
York



ClipPolyID
31



NAME
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Somerset
Waldo
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Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online] https://mgimond.github.io/Spatial/introGIS.html

Vector operations

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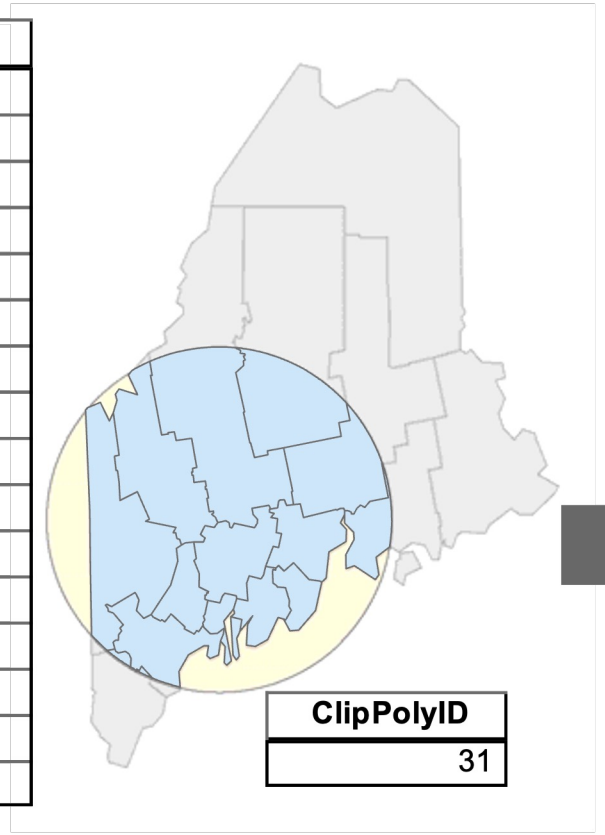

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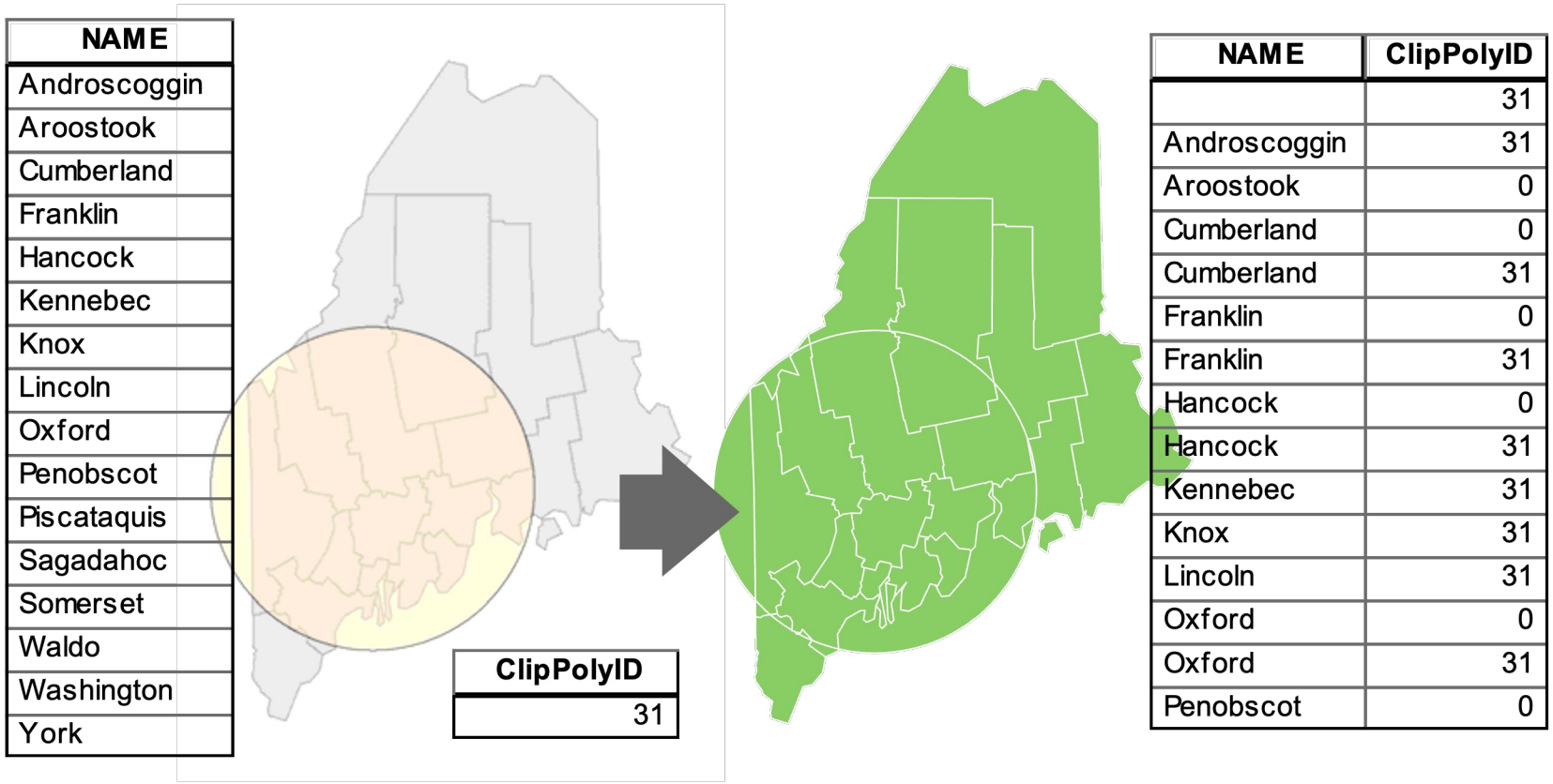
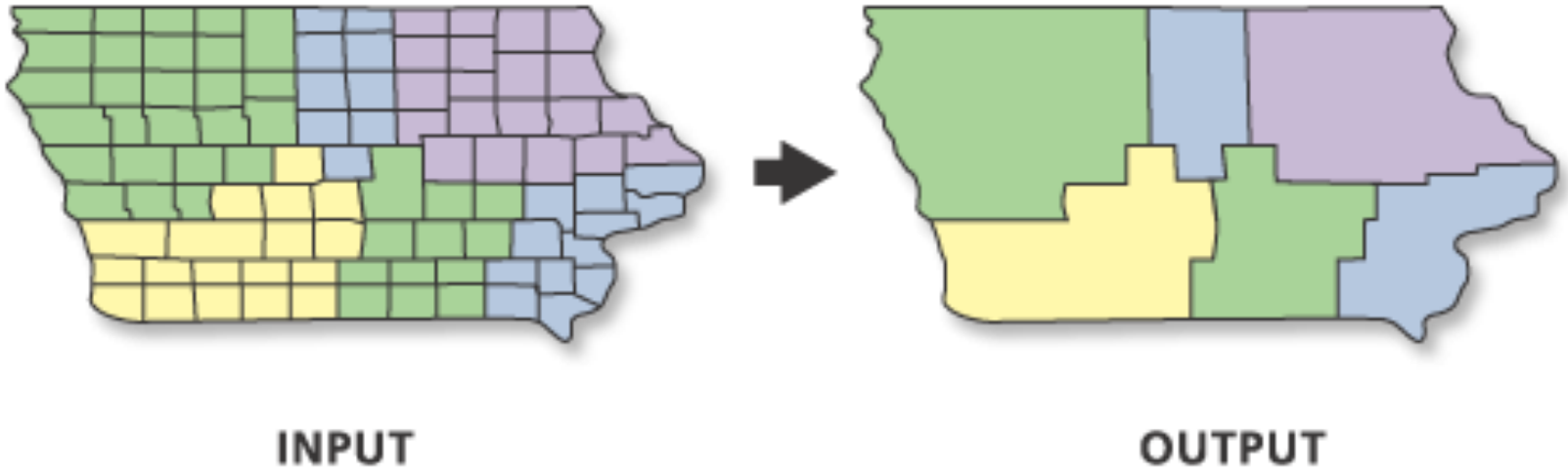
Vector operations



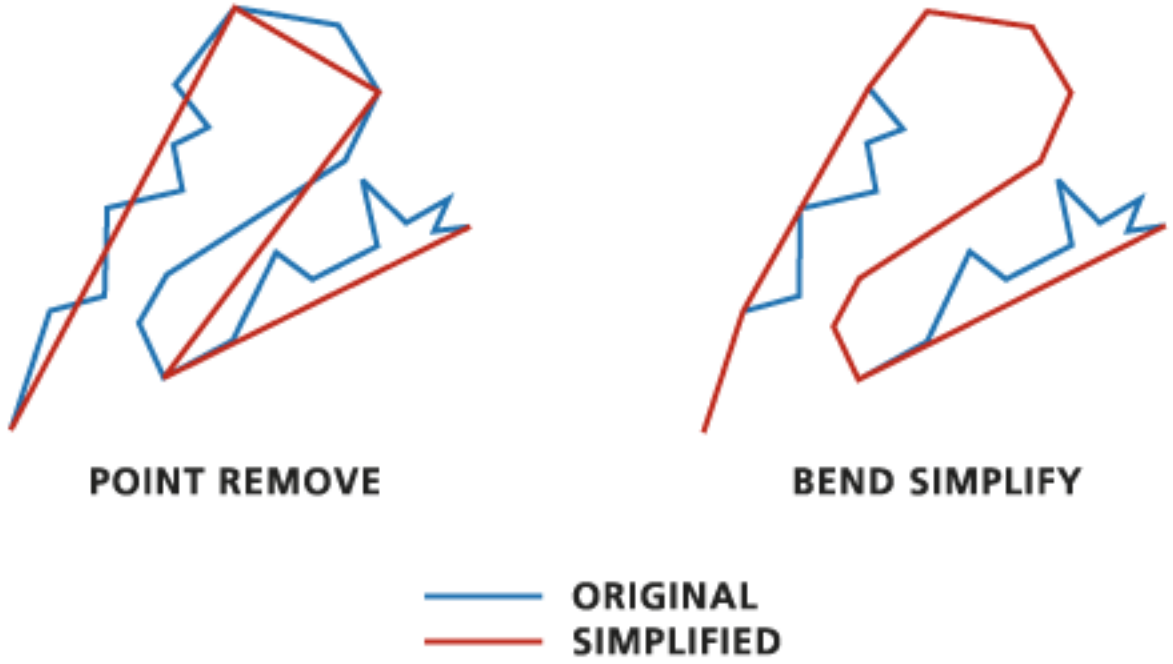
Gimdond, M. 2021. Intro to GIS and Spatial Analysis. [online]
https://mgimond.github.io/Spatial/introGIS.html

Vector operations - Dissolve



ESRI. 2021. Dissolve. [online]
https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/dissolve.htm

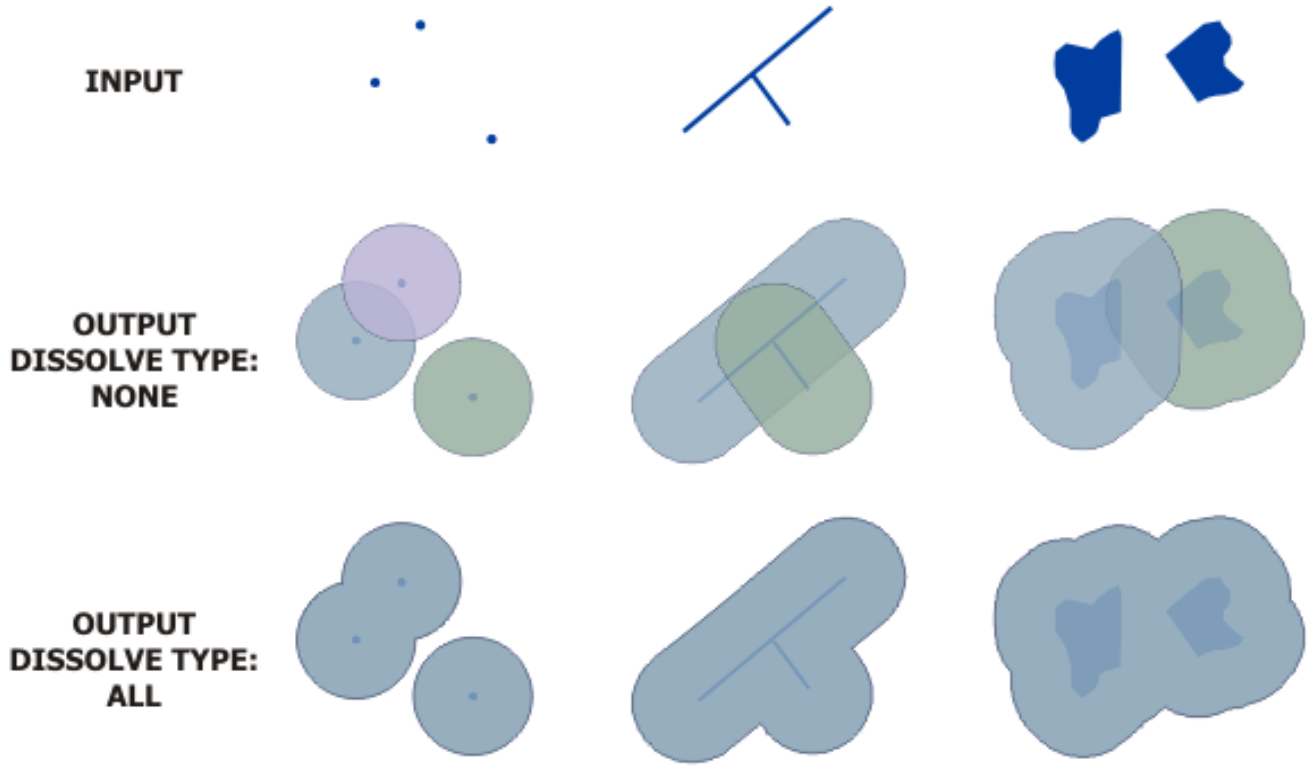
Vector operations - Simplify



ESRI. 2021. Simplify line. [online]
https://desktop.arcgis.com/en/arcmap/10.3/tools/cartography-toolbox/simplify-line.htm

Vector operations - Simplify

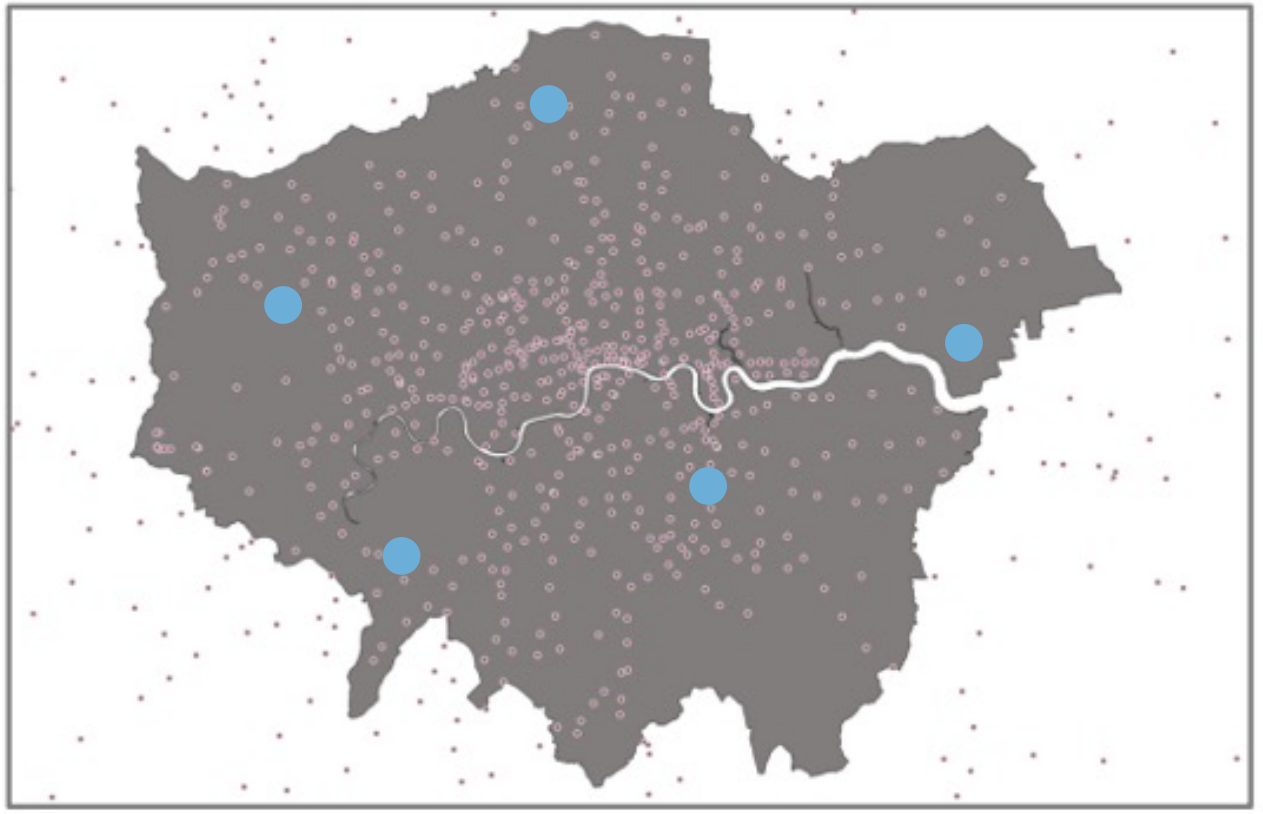
Vector operations - Buffer



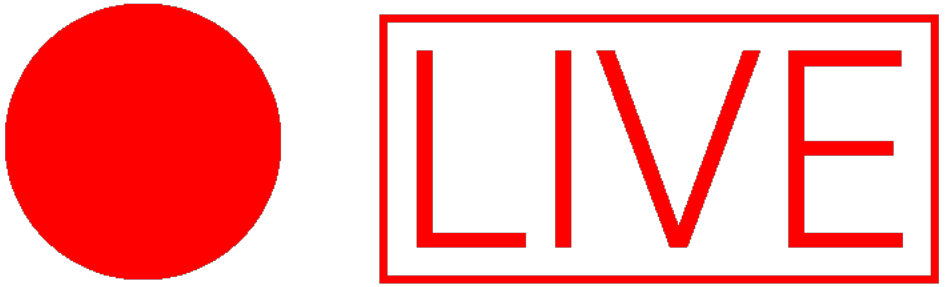
ESRI. 2021. Buffer. [online]
https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm

Vector operations – Spatial query

Vector operations – Attribute query



RStudio



Conclusion

- The core of spatial analysis comes down to executing geometric operations and spatial queries.
- Spatial analysis relies therewith on the spatial properties of an object as well as on the spatial relationships both *within* and *between* spatial objects.

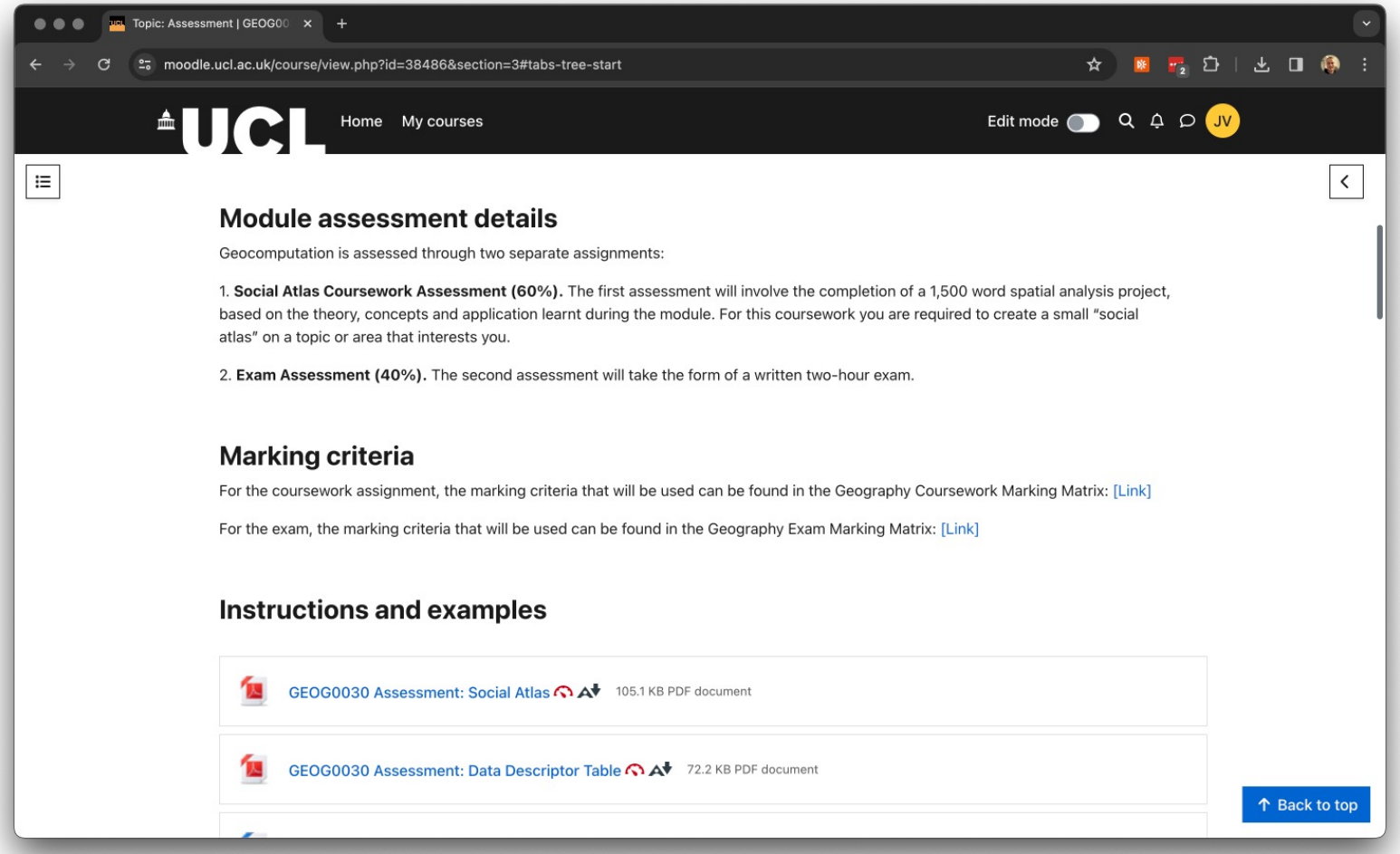
Assessment

- Social Atlas Coursework Assessment (60%): The first assessment will involve the completion of a spatial analysis project, based on the theory, concepts and application learnt during the module. For this coursework you are required to create a small “social atlas” on a topic or area that interests you. Deadline: April 22 2024.
- On Moodle: guidance as well as examples.

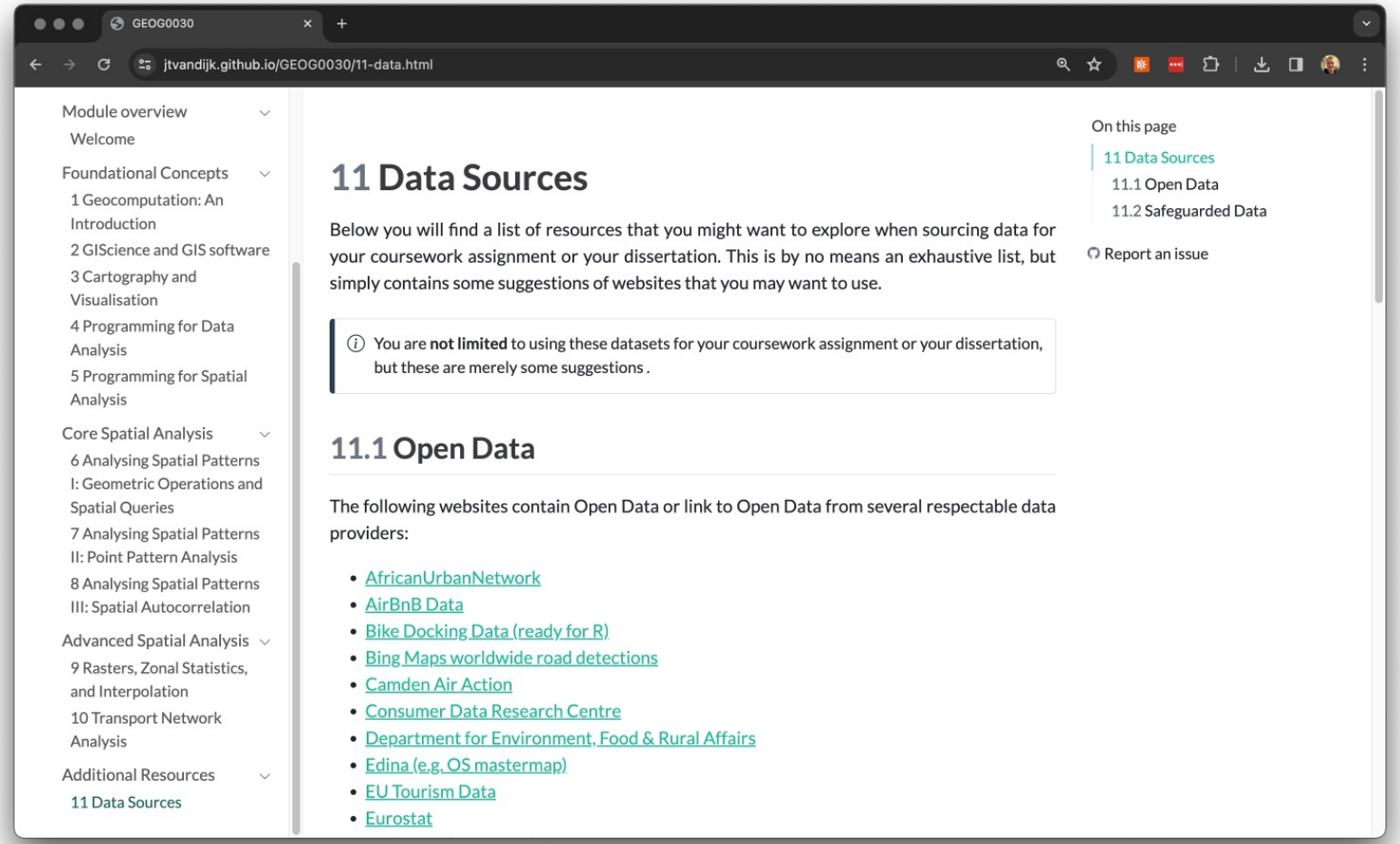
Assessment

- You should create a minimum of 8 maps - and a maximum of 10 - and not exceed 1,500 words.
- You can choose a specific theme, e.g. “Healthy Living”, “Cost of Living in England” or create a research question to answer.
- You should aim to utilise a range of different techniques taught in the Geocomputation module to explore your topic – but make sure you apply the techniques in appropriate manner and with the right data types.
- Greater London cannot be used as a case study.

Assessment


Topic: Assessment | GEOG00
moodle.ucl.ac.uk/course/view.php?id=38486&section=3#tabs-tree-start
UCL
Home
My courses
Edit mode
JV
Module assessment details
Geocomputation is assessed through two separate assignments:
1. Social Atlas Coursework Assessment (60%). The first assessment will involve the completion of a 1,500 word spatial analysis project, based on the theory, concepts and application learnt during the module. For this coursework you are required to create a small "social atlas" on a topic or area that interests you.
2. Exam Assessment (40%). The second assessment will take the form of a written two-hour exam.
Marking criteria
For the coursework assignment, the marking criteria that will be used can be found in the Geography Coursework Marking Matrix: [Link]
For the exam, the marking criteria that will be used can be found in the Geography Exam Marking Matrix: [Link]
Instructions and examples
GEOG0030 Assessment: Social Atlas
105.1 KB PDF document
GEOG0030 Assessment: Data Descriptor Table
72.2 KB PDF document
Back to top

Assessment


GEOG0030
jtvandijk.github.io/GEOG0030/11-data.html
Module overview
Welcome
Foundational Concepts
1 Geocomputation: An Introduction
2 GIScience and GIS software
3 Cartography and Visualisation
4 Programming for Data Analysis
5 Programming for Spatial Analysis
Core Spatial Analysis
6 Analysing Spatial Patterns I: Geometric Operations and Spatial Queries
7 Analysing Spatial Patterns II: Point Pattern Analysis
8 Analysing Spatial Patterns III: Spatial Autocorrelation
Advanced Spatial Analysis
9 Rasters, Zonal Statistics, and Interpolation
10 Transport Network Analysis
Additional Resources
11 Data Sources
11 Data Sources
Below you will find a list of resources that you might want to explore when sourcing data for your coursework assignment or your dissertation. This is by no means an exhaustive list, but simply contains some suggestions of websites that you may want to use.
You are not limited to using these datasets for your coursework assignment or your dissertation, but these are merely some suggestions .
11.1 Open Data
The following websites contain Open Data or link to Open Data from several respectable data providers:
AfricanUrbanNetwork
AirBnB Data
Bike Docking Data (ready for R)
Bing Maps worldwide road detections
Camden Air Action
Consumer Data Research Centre
Department for Environment, Food & Rural Affairs
Edina (e.g. OS mastermap)
EU Tourism Data
Eurostat
On this page
11 Data Sources
11.1 Open Data
11.2 Safeguarded Data
Report an issue

Assessment

TL;DR story of at most 1,500 words tied together by 8-10 related maps.

Questions

Justin van Dijk

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