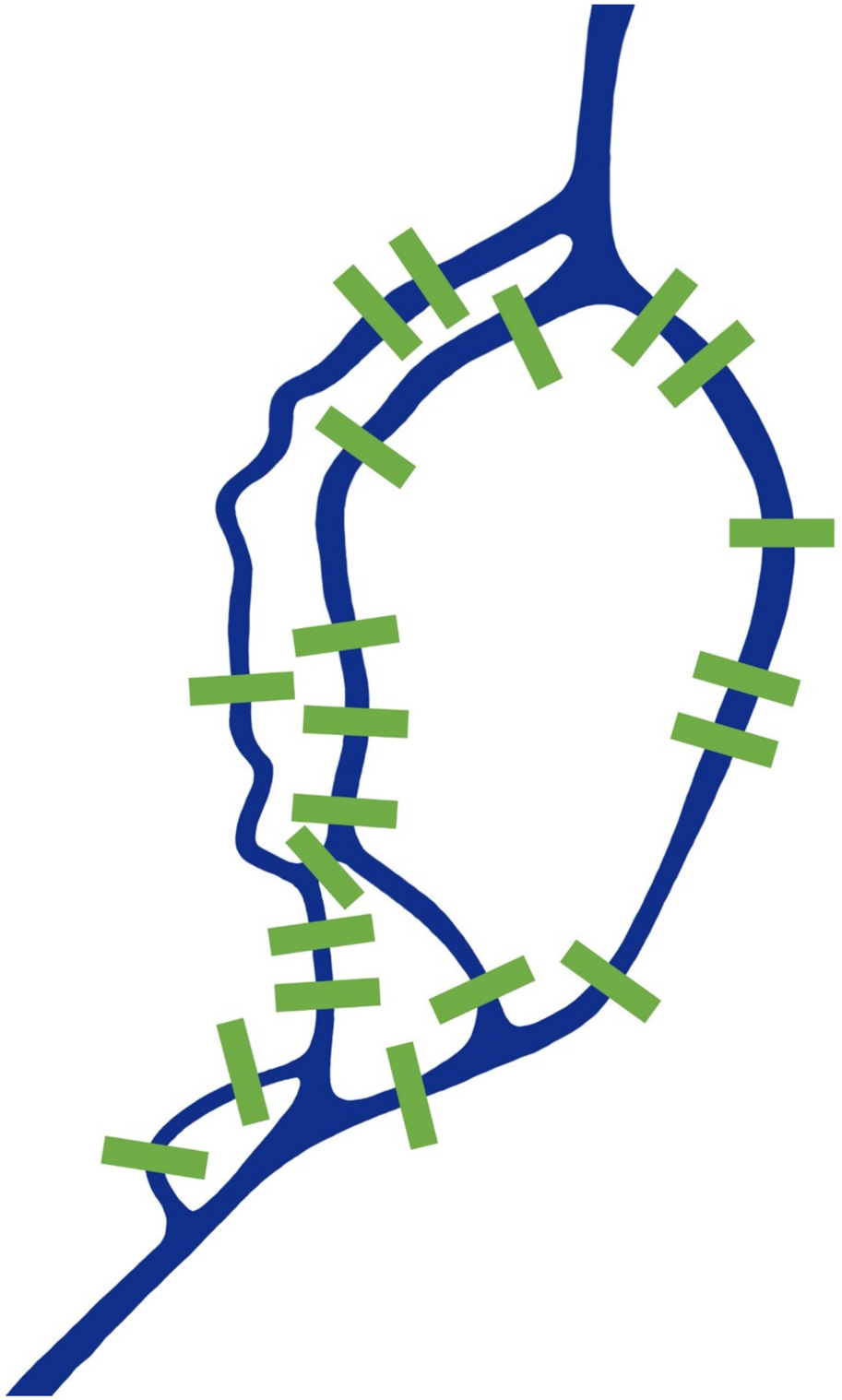


Lübeck, Germany

Rivers and Bridges

This bridge problem is a bit more complex than the others, if you haven't tried any of the other problems try a couple of those first.

This is a map of the river Trave in Lübeck, Germany.

Can you draw a path that goes over each of the bridges once and only once?

Do you think it is possible?

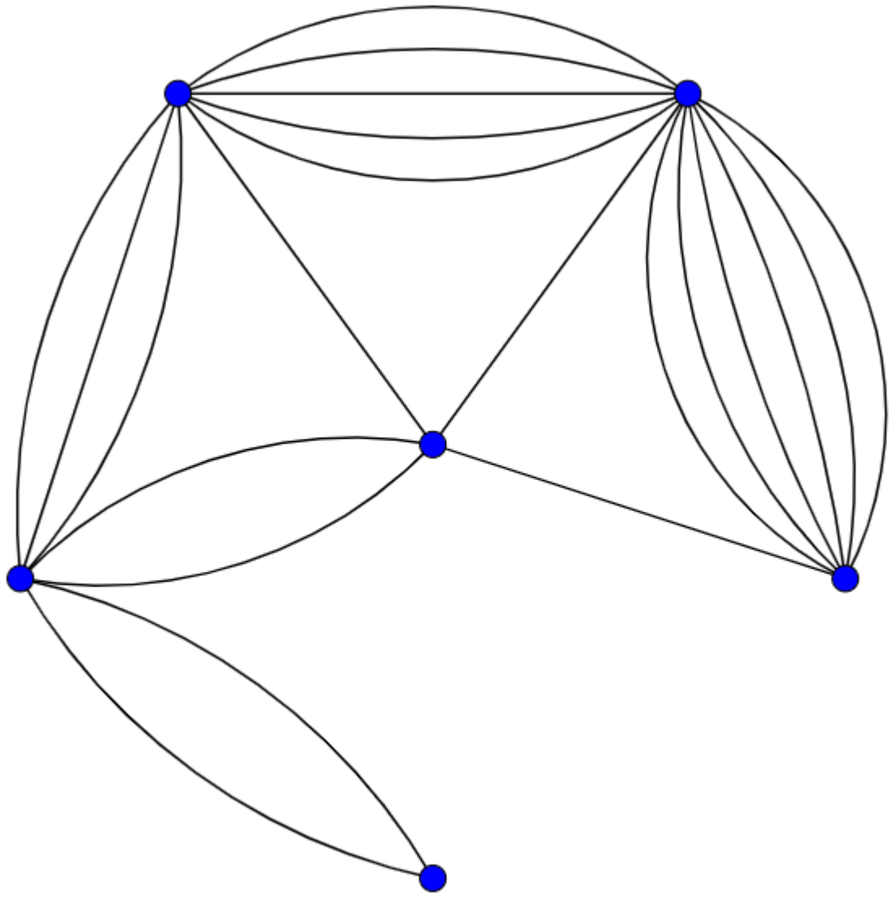
Can you prove this?

We can simplify this problem into one that we can look at mathematically by drawing the system of rivers and bridges as a graph. By a graph we mean a diagram that shows all the important connections. We mark each area of land as a point (called a vertex) and each bridge as a line (called an edge) joining the two points that represent the land that bridge joins.

Have a go at drawing this on top of the map and turn over to see if you got it right.

Here is a graph of this bridge system:

Can you match up each vertex to the area of land it represents?



Does the graphs make it easier to answer any of the questions?

Think about the properties this graph has e.g.

- Number of edges
- Number of vertices

Do any of these relate to whether a path across all of the bridges exists?

Can you make a change so that it becomes possible/impossible to make a path? For example, do you think adding bridges onto any of the stretches of river that go off the page would change whether a path was possible? Why? What if any of the properties of the graph have you changed?