

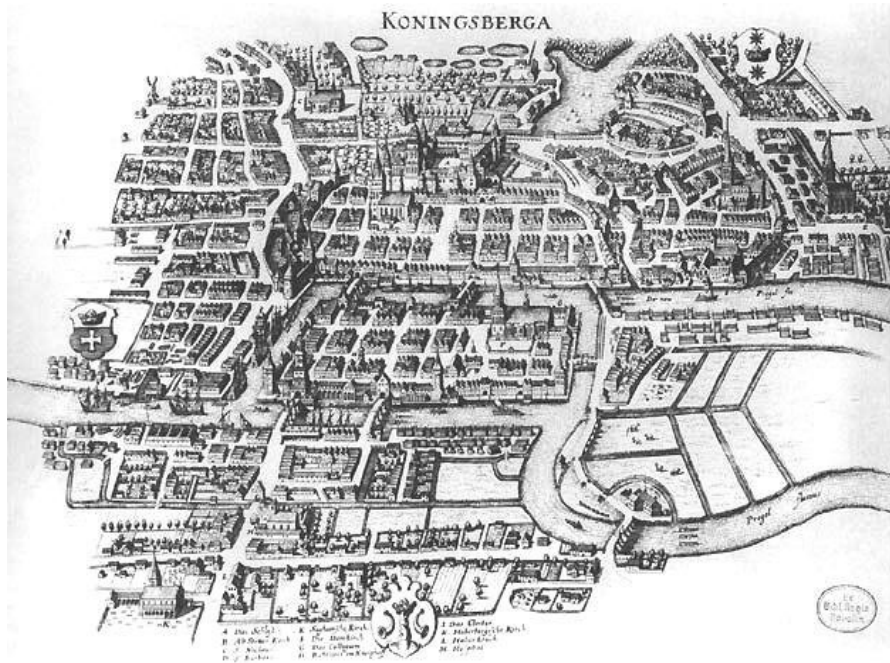
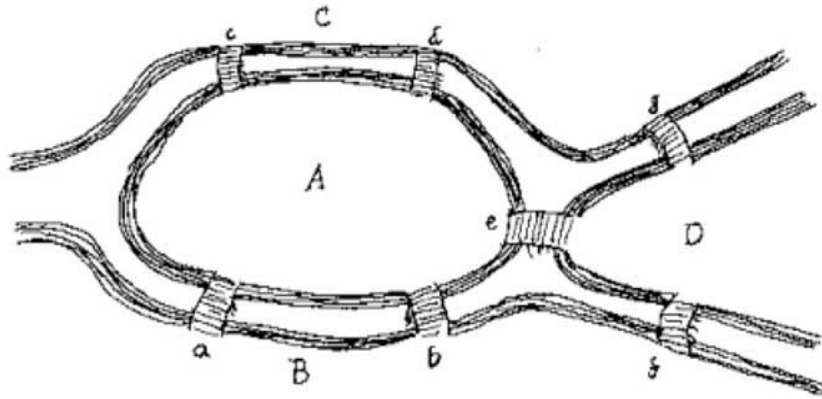
## Socratic Mathematics with Bill Carey

### Session 7: The Bridges of Königsberg

#### Outline:

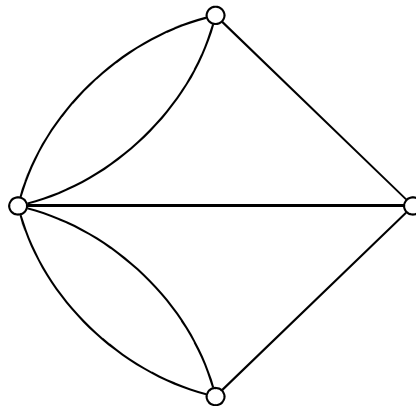
#### The Bridges of Königsberg

- **Contemplation:** For this session we're going to look at Euler's sketch of a map of a city in what was once East Prussia (the uppercase letters represent pubs, and the lower case bridges):





- I've included a full size map that you can print out for folks. The map is an interesting one - of particular note are the rivers and bridges, which will form the core of our discussion questions.
- It's worth a few minutes of contemplation. Hopefully, by this session, you've grown into a good pattern of sharing observations, patterns, questions, and the like. The goal of this time is to bring ourselves to the mathematical objects without any particular question and see how they work on us, just like you would with a poem.
- **Discussion Questions:** Remember that the goal here is to seek out truth together, and convince yourselves that you've found it. As the facilitator, part of your responsibility is to make sure that everyone in the group is heard and on board!
  - Could you work out a route from the bottom left pub to the top right pub that never crosses a bridge twice?
  - Imagine that you were standing on the island in the middle of all the rivers. Could you walk to all the pubs while crossing each bridge exactly once?
  - If you started in a different place, would the answer to the first question change?
  - If you could add or remove one bridge, would the answer to the first question change?
  - Try making up your own cities on the shared whiteboard with bridges and pubs and seeing whether there is a way to start at a particular pub, cross all the bridges, and return to the same pub.
- **Conclusion:** This problem animated Euler's development of Graph Theory, an enormously fruitful branch of mathematics. He would represent downtown Königsberg like this:



- Mathematicians would call that a **graph**. Does that representation make it easier or harder to think about the discussion questions? How? Could you represent some of the cities you imagined as graphs?