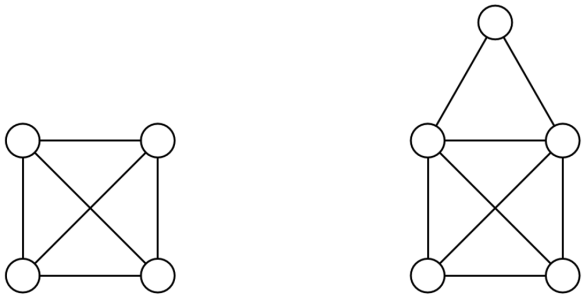
Exercise sheet 1 – Königsberg problem

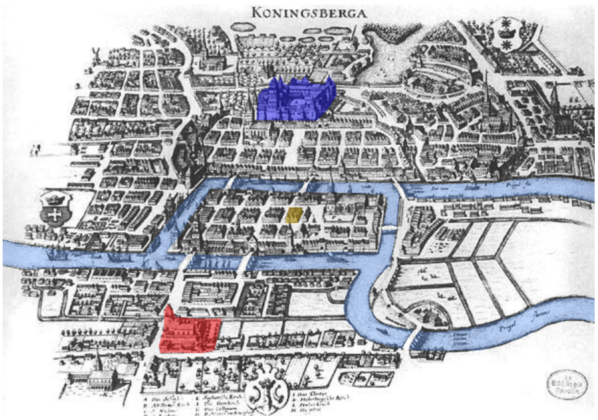
(1) Euler paths

(i) Which of the shown graphs can be drawn without lifting the pencil from the paper and without retracing any lines?. What are the rules behind? (4 pts)

(ii) Draw two graphs with this property and two graphs without it. (4 pts)



(2) Extended Königsberg problem



(i) A Baron living in the blue castle wants to start at his place and end up in the yellow bar on the island in the middle by walking all bridges once before. Where should he build the 8th bridge without enabling the Baroness in the red castle doing the same starting from her place? Identify a path and record it by its sequence of node labels. (4 pts)

(ii) The Baroness, on discovering this deception, comes up with her own plan to build a 9th bridge. It should enable her to walk from her castle to the bar using all bridges

once, but it should make it now impossible for the blue Baron to do the same thing from his castle. Where should the 9th bridge go? Find one path. (2 pts)

(iii) The mayor now decides to scupper their plans and builds a 10th bridge allowing all citizens starting from either side ending crossing the bar by walking all the bridges. Where should it go? (1 pt)

(3) network examples

Find examples in nature, society, or your everyday life that illustrate undirected networks, directed networks, and networks that involve edge weights. (3 pts)