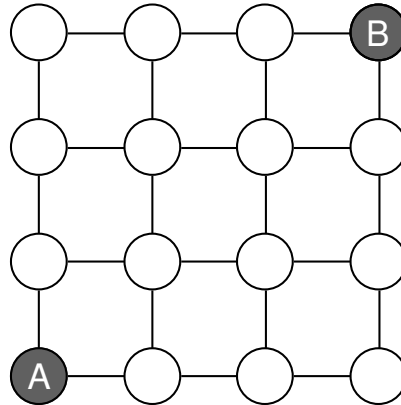


9 Machine Learning and Real-world Data (rdc42)

Consider the following network, where the nodes are arranged in a four-by-four grid. Each node is only connected to its neighbours. We distinguish two nodes: The bottom-left-hand-corner node, which we call A, and the upper-right-hand-corner, which we call B.



- (a) Shortest paths.
  - (i) What is the definition of a shortest path? [1 mark]
  - (ii) How many shortest paths are there from node A to node B? [2 marks]
- (b) Diameter of a graph.
  - (i) What is the definition of the diameter of the graph? [1 mark]
  - (ii) What is the diameter of the graph presented above? [2 marks]
- (c) Betweenness centrality.
  - (i) What is the definition of betweenness centrality? (Please give the formula.) [2 marks]
  - (ii) Name a node with minimum betweenness centrality in the graph presented above. [3 marks]
- (d) Local bridges.
  - (i) What is the definition of a bridge? [1 mark]
  - (ii) What is the definition of a local bridge? [1 mark]
  - (iii) Is there a bridge in the graph presented above? If so, name the edge. If not, explain why not. [2 marks]
  - (iv) Is there a local bridge in the graph presented above? If so, name the edge. If not, explain why not. [2 marks]
- (e) Do real-world networks look like the one in the figure above? If so, describe one. If not, name the properties of the network that make it unrealistic. Be clear and precise using terminology from the lecture. [3 marks]