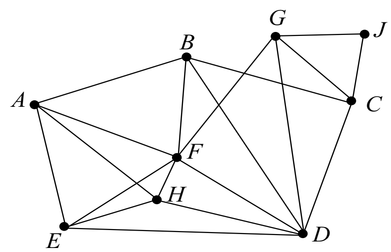
MATH1010 Assignment 4 Winter 2014

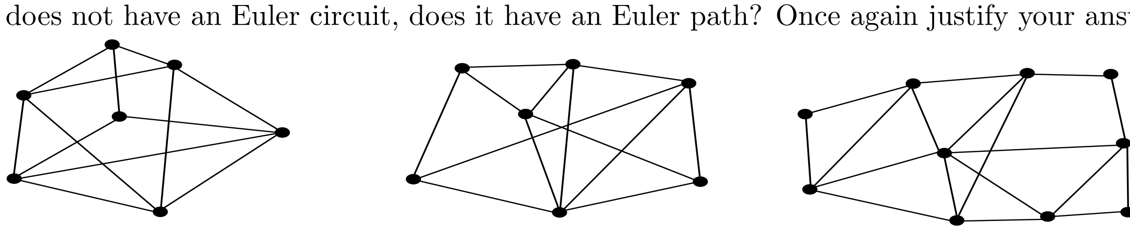
1. In each part of this question you are given a sequence of nodes. You are to proceed through the graph starting with the first node, following the edges that join successive nodes, if possible. Determine whether this is a path, a circuit, an Euler path, an Euler circuit, a Hamiltonian circuit, or none of these. Record your conclusions in the accompanying table with x's. One x has already been placed as an example. Some lines may contain more than one x.

(a) (B,F,G,D,E,A,B)
(b) (A,B,F,G,J,C,D,H,E,A)
(c) (D,F,H,E,B,C,D)
(d) (J,G,C,D,E,A,B,F,A,H,E,F,H,D,F,G,D,B,C,J)
(e) (F,G,C,D,E,H,A,B,D,G,F)



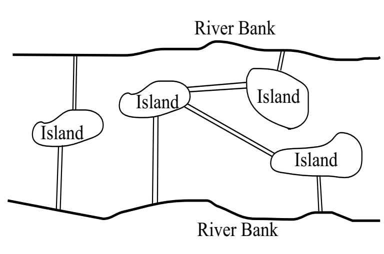
	Path	Circuit	Euler Path	Euler Circuit	Hamiltonian Circuit
(a)	x				
(b)					
(c)					
(d)					
(e)					

2. Determine, with justification, whether each of the following graphs has an Euler circuit. If a graph does not have an Euler circuit, does it have an Euler path? Once again justify your answer.

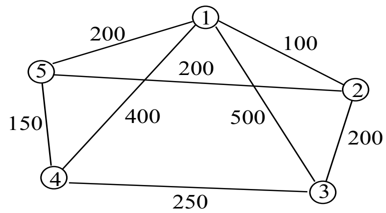


(a) (b) (c)

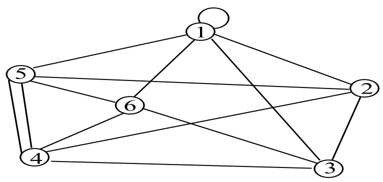
3. Use a graph to determine whether it is possible to walk around the city whose map is shown, starting and ending at the same point and crossing each bridge exactly once. Use the minimum number of nodes possible. If it is not possible to start and stop at the same point, is it possible to start and stop at different points? Justify all statements.



4. The nodes in the graph below represent five cities. Numbers on the edges represent distances between the cities. (a) Find all Hamiltonian circuits starting at node 1. Find the Hamiltonian circuit, or circuits, that minimize travel distance for a salesman who leaves City 1, visits every city, and returns to City 1.

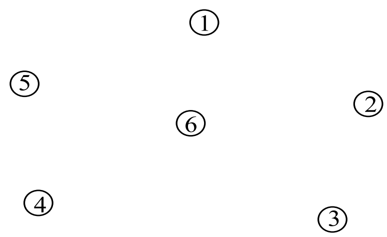


5. Find the adjacency matrix for the following graph.



6. Use the nodes to the right to draw the graph with the adjacency matrix

$$A = \begin{pmatrix} 0 & 1 & 0 & 0 & 1 & 2 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 & 1 \\ 2 & 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$



7. The adjacency matrix for a graph is $A = \begin{pmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \end{pmatrix}$.

(a) Find A^2.
(b) What is the number of routes of length 2 from node 2 to node 4?
(c) What is the number of routes of length 2 from node 3 back to itself?
(d) What is the number of routes of length 3 from node 4 to node 1?
(e) What is the number of routes of length at most two from node 3 to node 2?
(f) What is the number of routes of length at most three from node 1 to node 5?