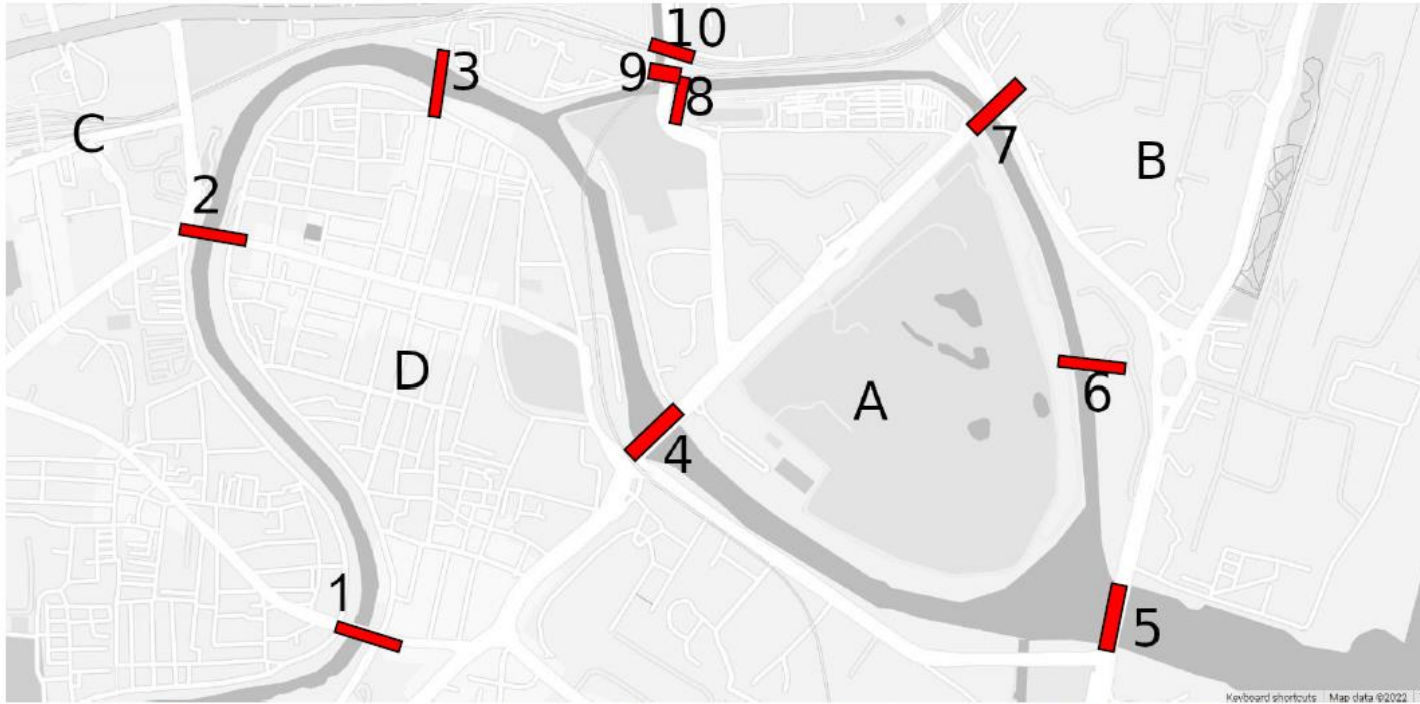# Assignment   The Ten Bridges of Chennai

Consider the map given above showing the area around the Central Railway Station of Chennai (part of Old Madras). There are 4 land masses (A,B,C,D) separated by waterways and linked to each other by10 bridges (indicated by the numbers 1,...,10).

(a) Draw a graph representation of the above by showing land masses as vertices (nodes) & bridges as edges (links).
(b) Write down the corresponding adjacency matrix, with A as the first node, B as the second node, C as the third node and D as the fourth node.
(c) What is the average path length in the network?
(d) Is it possible to find an Eulerian walk through the 10 bridges, i.e., one which goes through all the bridges, visiting each of them once and once only (analogous to the problem of finding a walk through the seven bridges of Konigsberg solved by Euler)?
If yes, mention the sequence in which each bridge can be traversed in such a walk.
If no, provide reasons why there may not be such a path.

(a)

(b)
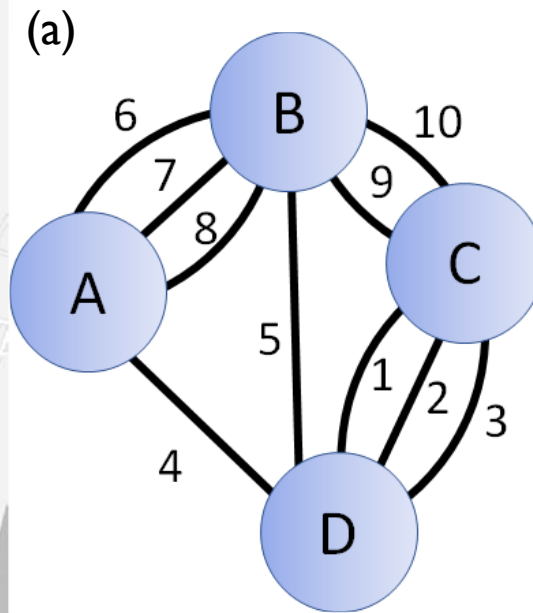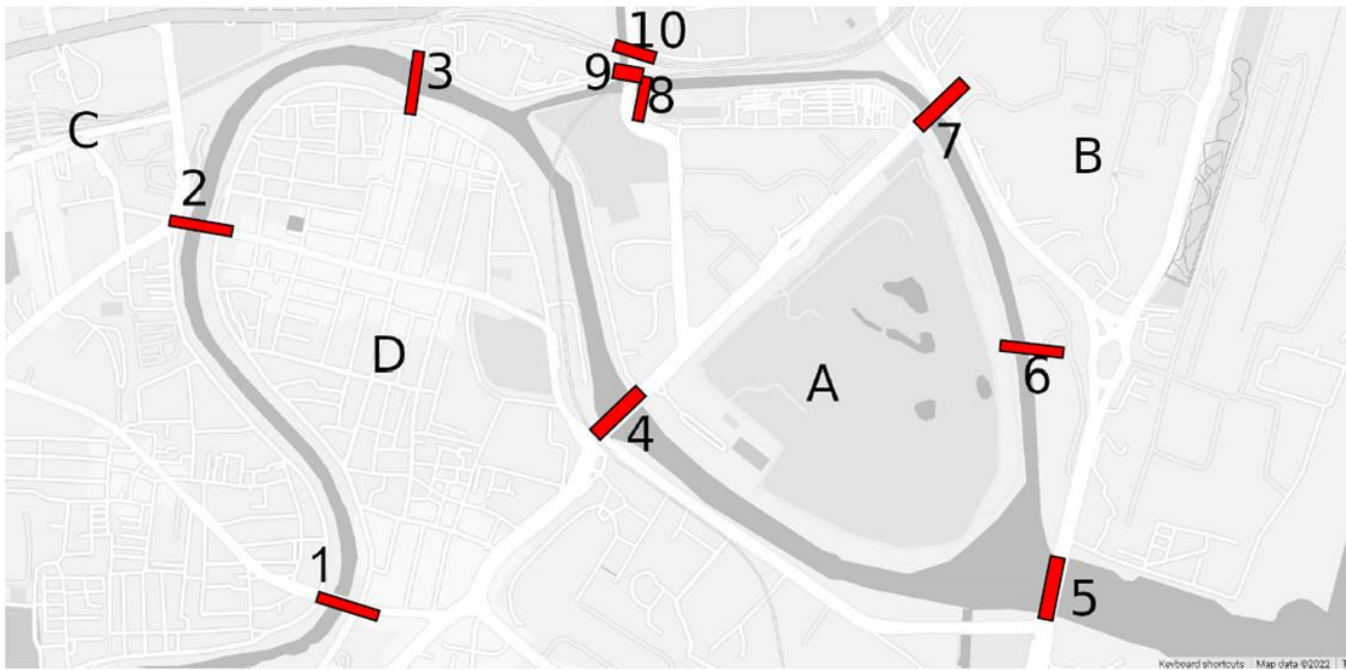
Weighted

	A	B	C	D
A	0	3	0	1
B	3	0	2	1
C	0	2	0	3
D	1	1	3	0

Unweighted

	A	B	C	D
A	0	1	0	1
B	1	0	1	1
C	0	1	0	1
D	1	1	1	0

(c) Take sum of lengths of shortest paths between every pair of vertices (the shortest path between every pair of vertices is 1 except between vertices A and C for which the length is 2), and divide by number of all possible node pairs (4C2 = 6). So the answer is 1+2+1+1+1+1=7/6.

(d) For existence of a Eulerian walk, necessary that either zero or two vertices have odd number of links (degree). Vertex A has degree 4, B has degree 6, C has degree 5 and D has degree 5. Hence it satisfies the criterion.
Example: A possible sequence in which each bridge can be traversed in an Eulerian walk is start from C and then cross the following bridges in turn: 9,6,4,5,7,8,10,1,2,3, ending the walk in D. Many other possible walks also can be found.