A ***graph*** *G is* a set *V* of ***vertices*** and a collection *E* of pairs of vertices from *V*, called ***edges***. The aim of this worksheet is to make **two implementations** of the Graph ADT one based on the ***adjacency matrix*** and other on the ***adjacency map*** representation. Figure 1 illustrates a graph with both representations.

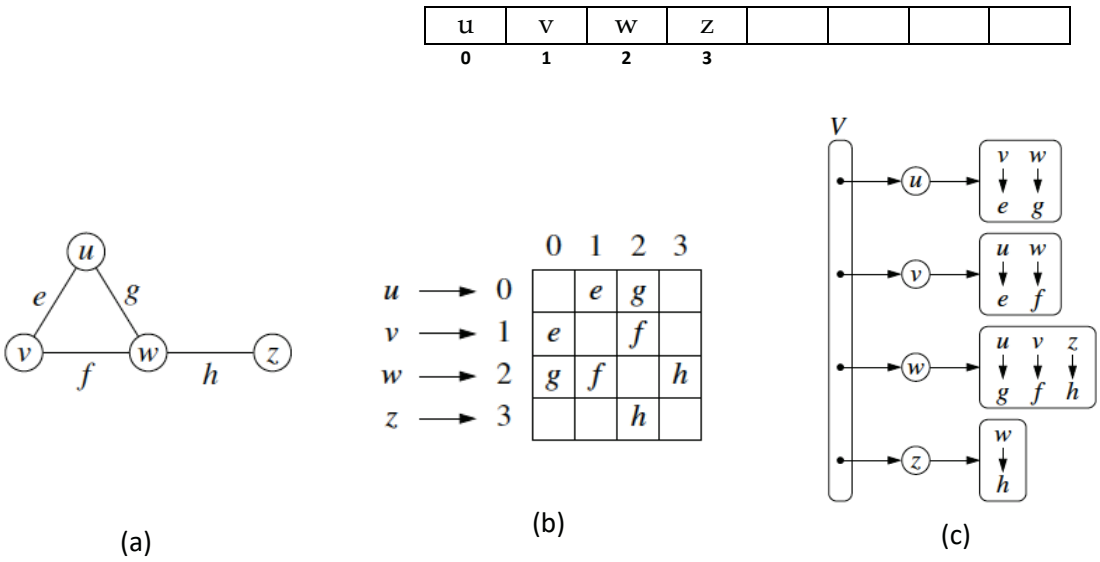

Figure1 - (a) An undirected graph G; (b) a schematic representation of the adjacency matrix
(c) a schematic representation of the adjacency map structure

The Edge class stores the weight of the edge and its both endpoints vertices. The Vertex class, in the adjacency map representation, stores the information associated with the vertex and a map with its outgoing edges.
A graph instance maintains the number of vertices and edges of the graph, a boolean variable that designates whether the graph is directed and a list with all its vertices.

1. Complete the generic class MatrixGraph<V,E> implementing the following methods:
   a. `public Collection<Edge<V, E>> edges()`
   b. `public Collection<Edge<V, E>> outgoingEdges(V vert)`
   c. Test the methods.

2. Complete the generic class MapGraph<V, E> implementing the methods:
   a. `public Collection<Edge<V, E>> incomingEdges(V vert)`
   b. `public Collection<V> adjVertices(V vert)`
   c. Test the methods.

3. Complete the Algorithms class developing the following methods and testing them:
   a. **Breadth-first search** of a graph starting in a vertex with a given information
   b. **DepthFirstSearch** of a graph starting in a vertex with a given information
   c. Minimum distance graph using **Floyd-Warshall** algorithm
   d. Create unit test for the **Floyd-Warshall** algorithm for both representations
   e. **Shortest-path** from a source vertex to a destination vertex of the graph, using Dijkstra's algorithm
   f. **Shortest-paths** from a source vertex and all other vertices of the graph, using Dijkstra's algorithm

4. There are eight small islands in a lake, and the state wants to build seven bridges to connect them so that each island can be reached from any other one via one or more bridges. The cost of constructing a bridge is proportional to its length. The distances between pairs of islands are given in the following table.

	1	2	3	4	5	6	7	8
1	-	240	210	340	280	200	345	120
2	-	-	265	175	215	180	185	155
3	-	-	-	260	115	350	435	195
4	-	-	-	-	160	330	295	230
5	-	-	-	-	-	360	400	170
6	-	-	-	-	-	-	175	205
7	-	-	-	-	-	-	-	305
8	-	-	-	-	-	-	-	-

Find which bridges to build to minimize the total construction cost.