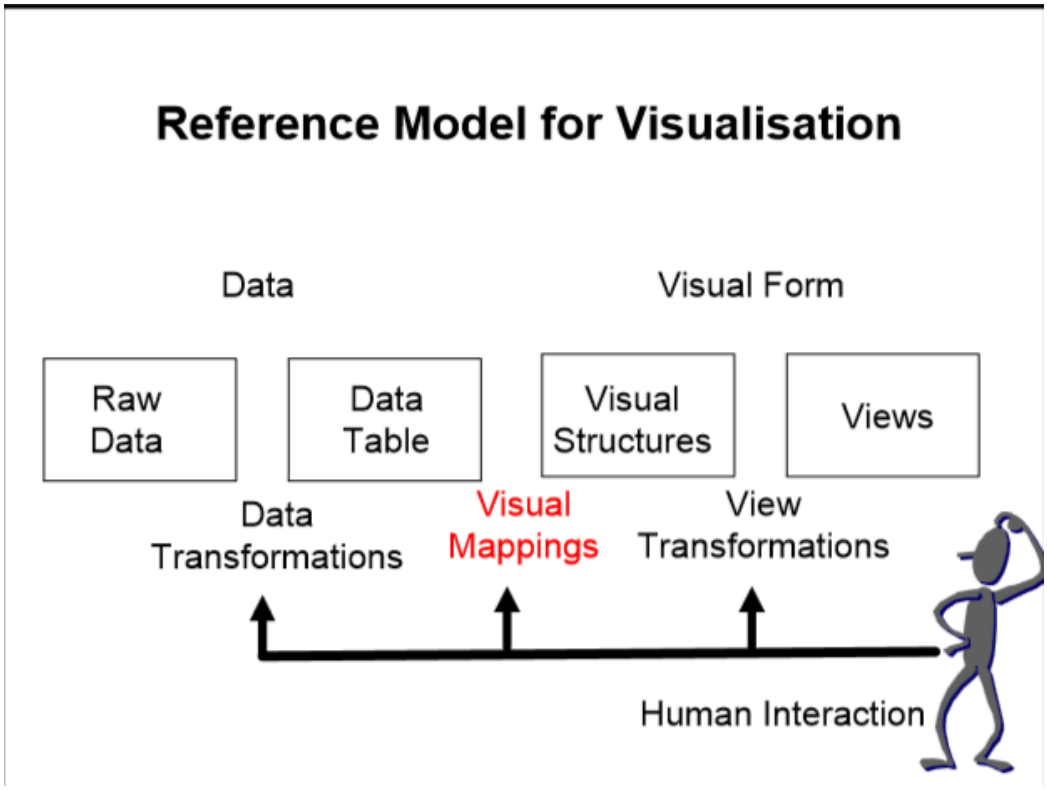
Graph Visualization Design (40%) – 32146 DVVA

This assignment requests each student to design a graph visualization to satisfy a list of specific user's requirements. In the design, students are required to select an appropriate graph layout method and to create a set of optimized graphical properties that are mapping to a set of data's domain-specific attributes for better readability and understanding of the relational data structure as well as six data's attributes. This mapping is called as "*attributed data visualization*", or *infographics design*, or *figurative visualization*.

You are also required to design a particular navigation scheme that includes the viewing scheme and interaction scheme. Each student is required to submit a Design Report to address the following questions. The weight of Design Report is 40%.



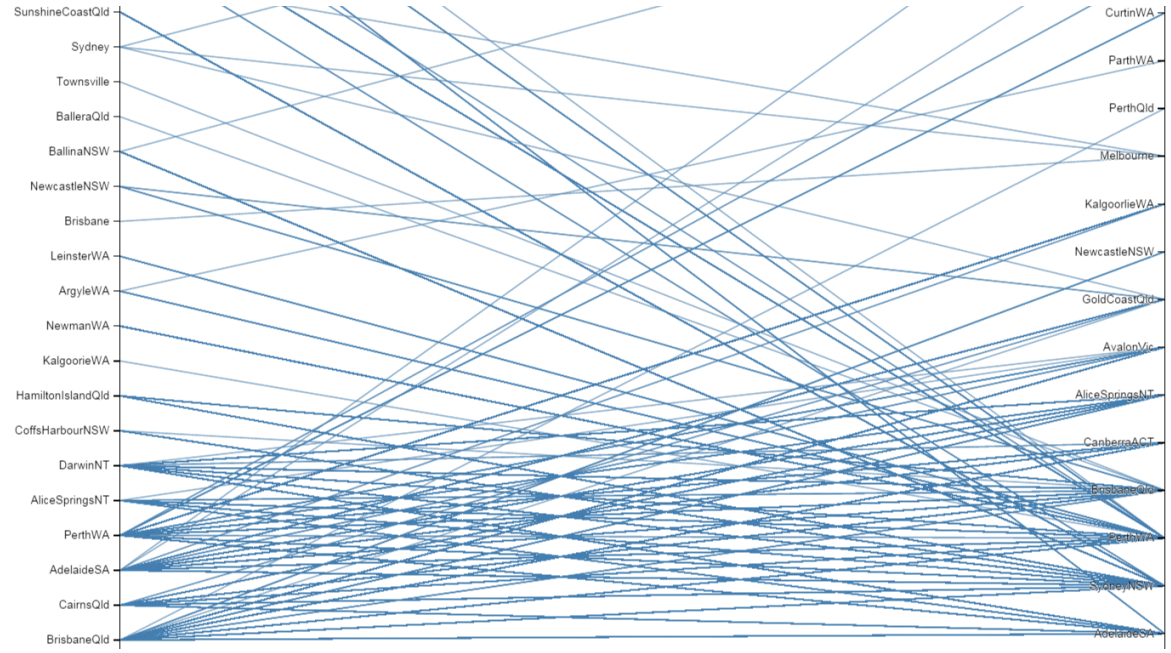
Note that this design includes (only) the design of "Visual Transformation (or Visual Mapping)" and the design of "View Transformation (or Navigation)", according to the above diagram.

General Requirement:
You are required to design a graph (network) visualization of the "*flights*" data as shown below. The expected visualization can clearly show not only the flight's **<*From* -> *To*>** relational structure, but also the other properties (attributes) associated with each flight.

Furthermore, this new visualization should be cooperated with a efficient navigation (browsing or zooming) mechanism to enable users to view the detail of a particular focusing area of the visualization. For example, through the navigation, the user could be then able to see the detail of domain-specific attributes of a "*flight*" behind the *infographics*.

The Dataset

This *flight*s dataset is not only a "*relational*" dataset, but also a "*multidimensional*" dataset. Of course, we could simply use the parallel-coordinate visualization to represent this dataset, while use the polylines to represent the **<*From* -> *To*>** relationships. The Figure below shows such type of the visualization:



Obviously, this polyline-based network visualization does not achieve the high readability. It contains too many edge-crossings or visual clutts. Therefore, we need to use the traditional graph visualization methods to show the **<*From* -> *To*>** relationships, while to apply "*attributed data visualization*" methods to show the domain-specific attributes of data itself.

Detailed Specification:

1. Select a graph visualization metaphor that you believe is most appropriate to be used to represent the *flights* data. Providing support statement (or arguments) to convince others about your selection. (4%)

2. Describe the high level model (or framework) of the visualization to be designed. The model will show the main characteristics of the visual data processing.
    a. Briefly describe the cycle of visual data processing with your proposed model. (4%)

3. Specification of the design of visualization. If using force-directed method, then describe the layout technique to be used for graph drawing. (2%)
    a. Layout design specification, including (but not limited) the following details:
        i. How to deal with the edge-crossing problem (if using a node-link diagram), (2%)
        ii. How to deal with the objects node-overlap problem, (2%)
        iii. How to enhance the readability of the layout, (2%)

iv. Labelling techniques. (1%)

b. Graphics design specification, including (but not limited) the following details
   i. Graphic objects design, (1%)
   ii. Graphic attributes design (and partitioning), (4%)
   iii. How to map domain-specific attributes to graphic attributes (2%),
   iv. How to address the data scale problem, particularly in dealing with the computational cost for running a selected layout algorithm (2%)
   v. How to enhance the readability of domain-specific attributes (2%)

4. Specification of the design of an associated navigation scheme that includes the viewing scheme and interaction scheme. (2%)
   a. View Transformations specification, including (but not limited) the following details:
      i. In-between views design and transformation algorithm, (2%)
      ii. Animated viewing algorithm, if it is involved (optional), (2%*)
      iii. Human cognition process consideration during view transformations. (3%)

   b. HCI design specification, including (but not limited) the following details:

      i. Evaluate the efficiency of selected navigation mechanism by using Fitts's law and a usability study. (3%)

* *Note that there are 5% bonus marks to the optional requirements.*

Flights data with six attributes:

AirSpace Class	From_City	To_City	Price	Aircraft Model	Engine Model
B	Sydney	Melbourne	180.00	A330-203	CF6-80E142
A	Sydney	Brisbane	170.00	A330-202	CF6-80E142
B	Sydney	Canberra	120.00	B737-3B7	CFM56-3B1
B	Canberra	Sydney	120.00	B737-476	CFM-56-3
A	Sydney	Newcastle	90.00	A320-232	V2527-5A
A	Newcastle	Sydney	90.00	A320-232	V2527-5A
B	Sydney	Broken Hill	130.00	A320-232	V2527-5A
B	Broken Hill	Sydney	130.00	A320-232	V2527-5A
C	Melbourne	Sydney	180.00	A330-243	772B-60
B	Melbourne	Canberra	140.00	A320-232	V2527-5A
B	Canberra	Melbourne	140.00	A320-232	V2527-5A
A	Melbourne	Adelaide	175.00	B737-3B7	CFM56-3B1
A	Melbourne	Hobart	130.00	A320-232	V2527-5A
A	Melbourne	Bendigo	70.00	B717-200	Unknown
A	Bendigo	Melbourne	70.00	B717-200	Unknown
A	Melbourne	Launceston	100.00	B737-3B7	CFM56-3B1
C	Adelaide	Melbourne	175.00	B737-3B7	CFM56-3B1
C	Adelaide	Broken Hill	100.00	A320-232	V2527-5A
C	Broken Hill	Adelaide	100.00	A320-232	V2527-5A
D	Adelaide	Perth	220.00	A330-203	CF6-80E142
D	Adelaide	Darwin	230.00	A330-203	CF6-80E142
D	Darwin	Adelaide	230.00	A330-203	CF6-80E142
E	Darwin	Alice Springs	120.00	B737-476	CFM-56-3

	E	Alice Springs	Darwin	120.00	B737-476	CFM-56-3
	D	Perth	Adelaide	220.00	A330-203	CF6-80E142
	C	Perth	Albany	100.00	A320-232	V2527-5A
	C	Perth	Kalgoorlie	80.00	A320-232	V2527-5A
	C	Perth	Broome	90.00	A320-232	V2527-5A
	B	Albany	Perth	100.00	A320-232	V2527-5A
	C	Kalgoorlie	Perth	80.00	A320-232	V2527-5A
	B	Broome	Perth	90.00	B737-476	CFM-56-3
	B	Launceston	Melbourne	100.00	B737-476	CFM-56-3
	B	Launceston	Hobart	80.00	A320-232	V2527-5A
	A	Hobart	Melbourne	130.00	B737-3B7	CFM56-3B1
	A	Hobart	Launceston	80.00	A320-232	V2527-5A
	B	Brisbane	Sydney	170.00	A330-203	CF6-80E142
	A	Brisbane	Mt Isa	170.00	B737-3B7	CFM56-3B1
	A	Brisbane	Rockhampton	180.00	B737-3B7	CFM56-3B1
	A	Brisbane	Cairns	230.00	A330-203	CF6-80E142
	B	Brisbane	Darwin	240.00	A330-203	CF6-80E142
	A	Mt Isa	Brisbane	170.00	A330-202	CF6-80E142
	B	Rockhampton	Brisbane	180.00	A330-202	CF6-80E142
	A	Cairns	Brisbane	230.00	A330-203	CF6-80E142
	A	Darwin	Brisbane	240.00	A330-203	CF6-80E142
	B	Mt Isa	Darwin	120.00	B737-3B7	CFM56-3B1
	B	Darwin	Mt Isa	120.00	B737-3B7	CFM56-3B1
	B	Adelaide	Pt Augusta	50.00	B717-200	Unknown
	C	Pt Augusta	Adelaide	50.00	B717-200	Unknown