Travelling Salesman Problem

1 Definitions

The travelling salesman problem looks for a **walk** that gives the minimum **tour**.

Walk - A finite series of edges so that the end of one vertex is the start of the next

Tour - A walk that visits every vertex and returns to the starting vertex
Add more information about upper and lower bounds here when you understand it more

2 The differences between classical and practical problems

Classical Problem - Must visit each vertex **only once** before returning to the start.
Practical Problem - Must visit each vertex **at least once** before returning to the start

3 Converting a network into a complete network of least distances

If a network is converted into a complete network of least distances, the classical and practical problem are the same.

To create a complete network of least distances, you must ensure the **triangle inequality** holds for all triangles in the network.

Triangle inequality:
The longest side of any triangle $\leqslant$ The sum of the two shorter sides

In a network where the triangle inequality does not hold, replace the longest arc with the sum of the two shorter ones.

4 Using a Minimum Spanning tree to find the upper bound of the travelling salesman problem

Method:

- Find the minimum spanning tree(Prim's or Kruskal's). This guarantees all vertexes are included.
- Double the length of the minimum spanning tree as the route includes going there and back.
- Find "short cuts"(using the non included arcs to bypass repeated edges.

This algorithm gives the initial upper bound