



This activity is about deciding on a tour around local places of interest. The optimum solution can involve the use of the algorithms to solve the **Chinese Postman Problem** and/or the **Travelling Salesman Problem**.

Information sheet

Chinese Postman Problem

The Chinese Postman Problem involves minimising the total distance walked by a postman delivering mail. The postman must begin and end his journey at one vertex of the network, and must visit each **edge** of the network at least once.

It is based on **Euler's** findings for **traversable** graphs.

Remember that a **traversable** graph is one that can be drawn without taking a pen from the paper and without retracing the same edge.

In graph theory you are trying to find a **Eulerian trail** if one exists.

The best solution involves making use of the **Route Inspection** algorithm and possibly **Dijkstra's** algorithm.



Travelling Salesman Problem

The Travelling Salesman Problem involves minimising the total distance travelled by a salesman to visit all of a range of different places. The salesman must begin and end his journey at one **vertex** of the network, and must visit every vertex of the network at least once.

Ideally, you want to find a **Hamiltonian cycle** (when each vertex is visited **exactly once**, starting and finishing at the same vertex) of minimum weight.

No one has yet found an algorithm to solve this problem!

The only way to minimise the tour is to find all of them and pick the shortest, which in most cases is not practical as there are too many of them.

The best solution involves finding the **least upper bound** and **greatest lower bound** for the tour, by making use of the **Nearest Neighbour** algorithm and **Kruskal's** or **Prim's** algorithms.



Try this

Some foreign students will be visiting your school or college later in the year.

You have been asked to plan a tour for them on the first full day of their visit to show them some of the local places of interest. The intention is to give the visitors a good idea of what is available in the area, but not to spend much time at each place.

Your task is to draw up an itinerary for the day, visiting as many places as possible. You should describe the route in detail, giving estimates of the distance between each place and the next, and the time you are allowing for each part of the journey and each stop.

Think about ...

- what places of interest you should select for your tour
- is it the *route* that is of interest for your tour, or the *places* you are travelling to?
- what possible routes are there between places, remembering you will need to estimate distances and times, perhaps using maps or the internet
- how you should weight the edges of your network which represent the roads that might be used.

In writing up your work you should:

- identify the purpose of the assignment
- explain how you identified and found appropriate data
- explain clearly how at least one aspect can be appropriately modelled by a network
- use appropriate techniques to describe and analyse the data
- draw conclusions and summarise your findings
- discuss the effectiveness of the methods you have used, explaining any limitations.

Reflect on your work

- Describe your approach to this problem.
Which algorithm(s) did you use?
- How can you evaluate your route to decide if you have found the best possible tour?