

The Traveling Salesman Problem

Name: _____

Objectives

- Introduce students to a real world problem solved by OR practitioners
- Demonstrate the use of heuristics to obtain good solutions to optimization problems
- Give students an appreciation of the difficulty of solving optimization problems exactly

Optional Reading Assignment:

- Read Handout 2 on the traveling salesman problem.

Pre-Lab Exercise:

Consider the drawing on the other side of this page, which is called a *graph*. The circles represent cities, and are called the *nodes* of the graph, and the lines connecting pairs of nodes are called *edges*. To determine the distance between a pair of points, one simply considers the sum of the vertical distance and the horizontal distance between the two nodes, where the length of each edge is 1. For example, the distance between the nodes labeled A and W is 7 (3 vertical + 4 horizontal). Another way to view this distance is the minimum number of edges that one must cross to get from one point to the other. For the traveling salesman problem, an ordering of cities is often called a *tour*.

1. Find as good a tour as you can, and plot it on the graph itself.
2. How long is your tour?
3. What difficulties did you encounter in choosing your tour?
4. What methods did you use in finding this tour? Did you just eyeball it or did you try to develop and apply a simple algorithm? Once you had a feasible tour, did you try to improve upon it by changing it a little at a time or did you start again from scratch to try to find a better route?
5. Can you give an explanation why this is the shortest tour? (If you can prove that this is a shortest tour, then it is said to be an *optimal* tour.)
6. Suppose that you considered a similar data set, but one in which there were 7 rows and 7 columns of nodes (as opposed to 8 and 6 above, respectively). Can you find an optimal solution now? How do you know that it is optimal? (This last question is not so easy.)

