

The Shortest Path Problem

Name: _____

Objectives:

- Introduce students to the concept of a shortest path tree
- Show students the inner workings of a combinatorial algorithm
- Demonstrate the usefulness of sensitivity analysis in problem solving
- Show students that we use crude optimization algorithms in our everyday lives
- Demonstrate the concept of the triangle inequality

Key Ideas:

- shortest path
- Dijkstra's Algorithm
- shortest path tree
- triangle inequality
- sensitivity analysis
- combinatorial optimization

Prelab Exercise:

Please write your answer on the back of this sheet.

As a going-away present, your grandmother, a macramé expert, made you a scale model of the US Interstate system out of string. There's a piece of string for each piece of Interstate highway with knots connecting it to the nearest intersections with other Interstates. The model is quite accurate, with an inch of string equalling 100 miles. Your roommate asks you why you keep such a useless piece of junk. You reply that it is actually quite useful, since it allows you to figure out the shortest distance route between any two points on the Interstate system. How can you do this? (Your answer will not require any algorithms or complicated calculations).

As a small example you might think about what the part of this model would look like for western New York state, and think about computing the shortest route to get from Binghamton to Buffalo. (Just cut-and-paste the following as one contiguous string into your browser.)

`https://www.google.com/maps/place/Albany,+NY/@42.5563832,-78.6604602,8z/`

`data=!4m5!3m4!1s0x89de0a34cc4ffb4b:0xe1a16312a0e728c4!8m2!3d42.6525793!4d-73.7562317`

Would the same approach work if there were such a thing as a one-way Interstate?