Spatial algorithms and optimisation

Learn and practise | Free preview

A sample from this topic. The complete topic collection contains three different resources and worked solutions.

Read the explanation and worked example. Show your working; use a calculator only where asked.

What you will practise

• Design, test and refine algorithms for routes, layouts and spatial constraints.

• Explain a method and check the reasonableness of a result.

Useful starting skills: Use the prerequisite operations and representations shown in the worked example.

A spatial algorithm makes its inputs, permitted actions, constraints and goal explicit. For a route problem, record the vertices and available edges with their lengths or times, then compare valid routes. A shortest-distance solution may differ from a shortest-time solution.

Test a proposed rule on ordinary cases and on cases with blocked routes or equal alternatives. Digital tables, maps or geometry tools help test many candidates, but communicate the reason the chosen solution meets the constraints. A local rule such as choosing the nearest next point need not find the best complete route.

Worked example

An undirected network has edges AB=4, AC=2, CB=1, BD=3 and CD=7. Find a shortest route from A to D.

A–B–D has length 7. A–C–D has length 9.

A–C–B–D has length 2+1+3=6.

With all edge lengths positive, a shortest route needs no repeated vertex; these and A–B–C–D exhaust the simple routes.

Answer: A–C–B–D, length 6

Try it yourself

Name: _____ Date: _____

1. An undirected network has AB=3, BC=4, AC=10. Find a shortest route from A to C and its length.

2. On a square grid, move only one unit horizontally or vertically. What is the shortest unobstructed route length from (0,0) to (4,3)? Give a route.

Answers and explanations

Check the method as well as the final answer. An alternative correct method is also valid.

1. A–B–C, length 7

The indirect route is shorter than the direct edge: $3+4<10$.

2. 7 units; for example four right, then three up

Every route needs net horizontal movement 4 and net vertical movement 3.

Curriculum reference: VC2M10ASP06

Independent original resource. Not published or endorsed by VCAA. This focused set supports the listed skills; it is not a complete course or an official assessment.

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