

## Air Miles Teacher Information Sheet

This activity can be run with KS4 or KS5 students and takes around 30-40 minutes. It reinforces curriculum topics from some GCSE schedules and from Decision Maths modules in KS5.

We recommend that students work in groups of 3 to 5 people, and that the activity is run as a competition with small prizes for the winning team.

Suggested timings:

- 5 minutes Discussion about how maths is used in the transport business (Some slides are available in this resource kit.)
- 5 minutes Hand out worksheets and make sure everyone understands the aim.
- 15 minutes Students work on the activity in small groups. It's important to stress that there is no right way of doing this activity, and they should experiment.
- 5 minutes Go round the class and ask for the cost of their cheapest route.
- 10 minutes Check the winner's route (another group could do this). Award prizes. Whole class discussion about some of the ideas raised. (Slides are available in this resource kit to add some context.)

**Air Miles** is based on the travelling salesman problem (TSP). More background/resources on this:

<http://www.tsp.gatech.edu/>

<http://www.tsp.gatech.edu/games/tspOnePlayer.html>

<http://www.heatonresearch.com/articles/64/page1.html>

<http://web.telia.com/~u85905224/tsp/TSP.htm>

history, applications, current research  
two Flash games based on the TSP  
simulated annealing applet for the TSP  
some more Java applet animations

The above sites are good for able maths students and have some good pictures and animations for putting up on a whiteboard. However they focus on the purely mathematical abstract problem and as such will probably not engage every student. Some other perspectives on it come from looking at specific "solutions" to the travelling salesman problem such as genetic algorithms. In these you take good solutions and try to make them better by putting them through a kind of digital evolution. Banks, transport and logistics companies use these daily to solve scheduling problems. Engineering and telecoms companies also use them to design everything from turbines to mobile phone networks.

<http://cs.felk.cvut.cz/~xobitko/ga/>

<http://www.cs4fn.org/biology/evolutionsolution.php>

<http://sodarace.net/>

<http://www.newscientist.com/article/dn1437-genetic-algorithms-evolve-optimum-satellite-orbits.html>

background on genetic algorithms  
computers, evolution and the TSP  
design racing robots, related to the TSP  
sample news article from New Scientist

These provide ways to links maths to biology, physics, engineering, computer science and design.

[www.moremathsgrads.org.uk](http://www.moremathsgrads.org.uk)