Discrete Mathematics:
Modelling with Networks

Aim	To develop students' understanding of modelling with networks and their ability to select the correct algorithm for a particular problem.
Resources required	A projector and computer Modelling with Networks problem cards A3 paper

Activity		Key questions
Teacher presentation and discussion	Mathematical Modelling: recap of network algorithms: Show the students the problems on slides 2 and 4. Discuss how they would model the problem and what the solution should achieve. Then go on to discuss which algorithm they would use to find a solution.	What algorithms use networks models? What is a good starting point? What are we trying to find out? Why have you chosen to use this particular algorithm? Are there alternative algorithms you could use?
Student group task	Modelling with Networks activity: Students work in groups of 2 or 3. Each group is given a set of cards with problem statements and a large piece of paper which they divide into four, with the following headings: Minimum spanning tree; Shortest path; Route inspection; Travelling salesperson. Students discuss the best method for finding a solution to the problem and place each card in the most appropriate section. They should be able to justify why they have made each decision. During the activity the teacher should move around the class asking key questions. Extension: Students use blank cards to think up one example of their own for each algorithm Groups can then be paired up to compare and discuss their results, or can feedback to the whole class.	What type of problem is this? Which algorithm do you think would give the most efficient solution? Why have you chosen to use this particular algorithm? What simplifying assumptions have you made?

Whole group discussion	Go through each of the headings in turn and invite groups to share which cards they placed under that heading. Discuss any discrepancies. If time invite students to share their own ideas and see whether the class can agree on where they should be placed.	Which cards were easy to place? What made them so identifiable? Could any of the cards link to more than one algorithm? Are there any problems that cannot be solved using the algorithms we have covered? If so, what would the new algorithm need to do?

Teaching Discrete Mathematics

Activity: Modelling with Networks - Identifying which algorithm to use

This activity is for students who have learnt the topics of Minimum Spanning Trees, Route Inspection Problems, Travelling Salesperson Problems and Shortest Path Problems, to practise matching a real-life context with the appropriate algorithm.

Resources needed: Set of problem cards, large piece of paper (e.g. A3 paper or sugar paper)

Students work in groups of 2 to 4. Each group is given a set of cards with problem statements and a large piece of paper which is divided into four and headed as shown (or 4 pieces of A4 with a heading on each piece).

Students discuss the best method for finding a solution to the problem in their groups and place the cards in the most appropriate section. They should be able to justify why they have made each decision.

Extension: Students use blank cards to think up one example of their own for each algorithm.
Groups can then be paired up to compare and discuss their results, or can feedback to the whole class.

Minimum Spanning Tree	Shortest Path
Route Inspection	**Travelling Salesperson**

A satellite navigation system in a car	Supermarket home delivery service	Snowplough clearing all the major roads in an area	Water pipelines being laid to connect pumping stations as economically as possible
A courier with one urgent delivery to make	A milk tanker collecting milk from several farms	A broadband provider linking properties using as little fibre optic cable as possible	A person planning the route to their holiday destination
An ambulance travelling to an emergency	The local council re-painting the lines in the middle of the roads in a district	Constructing roads joining several places as economically as possible	A parking official patrolling all the streets in an area
Constructing a pedestrian walking route to connect places of interest in a town centre	The Highways Authority inspecting roads for fallen trees after a storm	A courier with several deliveries to make	A family on a shopping trip with several shops to visit before they can return to their car