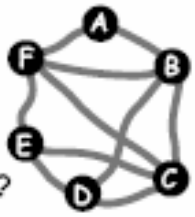
Diagram Problems and Visual Puzzles
Level Guidance

Appropriate Strategies for Diagram problems and Visual Puzzles
• Identify the given information and represent it in another way
• Use a systematic approach to solve the problem and a way of recording if necessary
• Use drawings or annotations to help visualise the problem using familiar shapes or patterns
• Try other possibilities to check the solution

The context for this problem is bus routes between 6 towns. By adapting the rules of the problem, children are able to show evidence of levels 1-5 problem solving skills.

Bus routes

Six towns are connected by bus routes.
The bus goes from A back to A.
It visits each of the other towns once.
How many different bus routes are there?



This table shows the bus fare for each direct route.
B to A costs the same as A to B, and so on.

A to B	B to C	C to D	D to E	E to F	F to A	B to D	B to F	C to E	C to F
£4	£3	£4	£4	£3	£4	£5	£3	£2	£2

Which round trip from A to A is the cheapest?

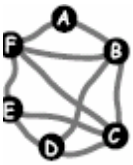
Linked problems

- Red Riding Hood choosing paths through the woods
- Santa / postman delivering presents to a number of houses
- Routes round the zoo to visit various animals
- Routes round the school fete
- Routes to and from home to school

This guidance also covers visual puzzles where children are asked to find shapes within a shape e.g. Nos. 25 and 58 from the Mathematical Challenges for Able Pupils in KS1 and 2

Level Guidance

Bus routes



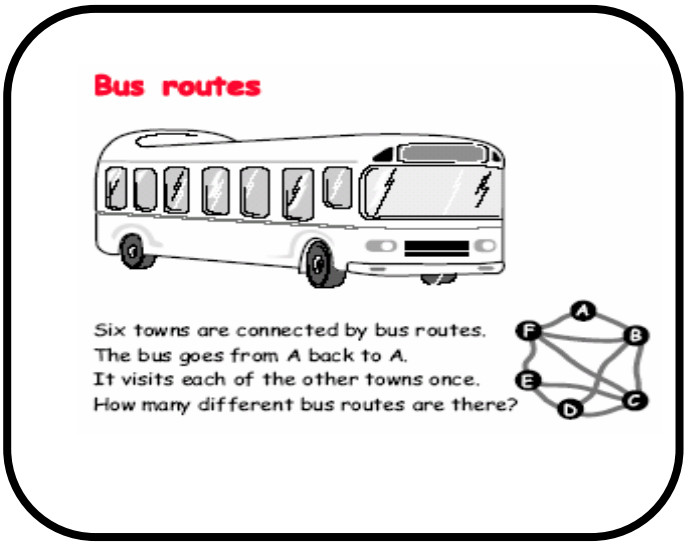
Six towns are connected by bus routes.
The bus starts and finishes at town A.
It does not visit a town more than once on a route.
It does not have to visit every town on a route.
Find some routes it could take.

Level 1

- Use practical resources to represent towns and linking roads at adult suggestion.
- Able to describe verbally or with resources routes which satisfy rules of the problem
- Be able to explain why some routes are not possible

Level 2

- Use practical resources to represent towns and linking roads reflecting accurately the given diagram
- Able to organise routes into groups with similar characteristics e.g. all the routes which start AB or all the routes which visit 5 towns
- Record routes found through annotating or sketching another diagram
- Able to persevere and consider wider range of routes than Level 1



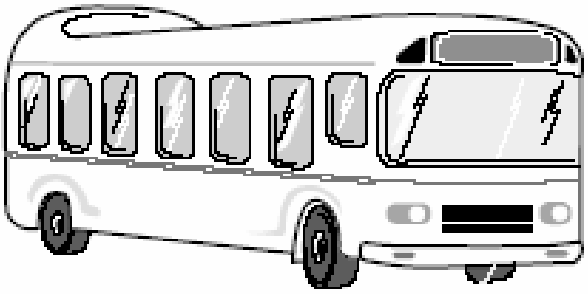
Level 3

- Able to suggest different ways of representing the given information i.e interpret diagram with resources, draw own route map, give codes for each route.
- Begin to tackle the problem systematically (after initial attempt) by grouping some routes with similar characteristics i.e those routes which start ABC
- Record routes found through annotating/sketching another diagram or using coding i.e AFC……
- Begin to look for missing routes by referring to systematic working and checking for repeats

Level 4

- Be able to interpret the diagram in relation to constraints of the problem i.e. understand that you cannot travel directly from A to D or B to E
- Aware that problem should be tackled in a systematic way (initial attempts may not be systematic, but approach should change once problem is understood)
- Record routes in an organised and clear way using a suitable shorthand system.
- Use mathematical reasoning to justify final solution

Bus routes



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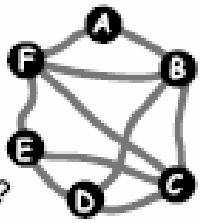

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Which round trip from A to A is the cheapest?

Level 5

- Be able to combine information given in different formats and represent it in an appropriate manner
- Use a system for finding all possible routes which uses mathematical reasoning to justify final solution.
- Apply reasoning to discover the cheapest route.
- Communicate findings in an appropriate way, with sufficient detail to enable others to interpret their work.

Solution

There are 6 different routes from A back to A
ABCDEFA
ABDCEFA
ABDECFA
And the 3 reversals of these:
AFEDCBA
AFECDBA
AFCEDBA
The cheapest routes are ABDECFA and its reversal, which each cost £21.