6 Notes on the problems

Estimating and interpreting: Schoolteachers and dentists

Links to Case Studies

This task offers an unstructured estimation problem. Such problems are intended to create confidence in pupils' own ability to use knowledge that they already have.
This problem is similar to other problems within the Case Studies, most notably those that are contained within the Case Study "**You reckon?"**

Sample solutions

How many schoolteachers are there in the UK?

The solution will be dependent on the assumptions made and the line of reasoning taken. The solutions below illustrate just one approach.

We can make the following assumptions:

- About one fifth of the total population is at school. (If life span is approx 75 years and 14 of these are at school).
- Assume an average of 25 children per class.
- Assume all teachers are working full-time

Then there will be about $\frac{60{,}000{,}000}{5 \times 25} = 480{,}000$ teachers.

Answer: about half a million teachers are required. In fact there are about 441,000 full time teachers in mainstream education (Source: www.statistics.gov.uk)

How many dentists are there in the UK?

We can make the following assumptions:

- Each member of population sees dentist on average twice per year.
- Each consultation lasts about 20 minutes
- Dentist sees patients for about 6 hours per day
- Dentist works for 45 weeks per year.

Then, dentist can have 45 x 5 x 6 x 3 = 4,050 consultations per year.
Number of consultations required = 120 million per year
120 million / 4,050 = 30 thousand dentists

Answer: about 30 thousand dentists are required. In fact there are about 31,000 registered dentists in the UK (Source BBC.co.uk)

6 Notes on the problems (continued)

Modelling and explaining: Sharing office space

Links to Case Studies

This is similar to other problems within the Case Studies, where pupils are expected to model a situation (e.g. by creating a measure for something). Those most closely related are:

- **Water availability**: Create a fair way to distribute water.
- **My music**: Create a measure of tempo.
- **Keeping the pizza hot**: Model the cooling of a pizza

Sample solution

We first need to explain what is meant by 'more crowded'. One possible measure is the number of people per unit area.

At present:

- Office A has 7 people in 27 square units
- Office B has 6 people in 21 square units
- Office C has 9 people in 24 square units
- Office D has 6 people in 12 square units.

This is a total of 28 people in 84 square units.

If the space was shared equally, each office worker would get 3 square units of space. We could do this if we allocated people to offices so that:

- Office A has 9 people
- Office B has 7 people
- Office C has 8 people
- Office D has 4 people

One way of achieving this with least fuss would be to move 2 people from office D to office A and one person from office C to office B.

Of course this solution does not take into account the space needed for the doors!

6 Notes on the problems (continued)

Solving logic puzzles: Treasure hint

Links to Case Studies

There are a number of Case Studies that contain logic problems that are quite abstract in nature. These are often situated in the context of computer games.

Examples are:

- **Alien invasion**
- **PointZero**
- **Explorers**

Sample solution

The treasure may be hidden in 100x100 = 10,000 different places, so it will seem surprising to many pupils that it can always be located in no more than seven digs, provided that each dig is located in the centre (or very near to the centre) of the remaining region. In this way, the number of possible remaining hiding places is reduced by about one quarter each time. This strategy is shown in the following example:

Coordinates of dig	Resulting clue
(50, 50)	"Go East and go South"
(75, 25)	"Go East and go South"
(88, 12)	"Go West and go South"
(82, 6)	"Go East and go North"
(85, 9)	"Go West and go South"
(84, 8)	"Go West and go South"
(83, 7)	Arrh! Ye have found the treasure!

This strategy is, however, by no means obvious to many pupils and it will be interesting to see which strategies they can come up with unaided!