PRIMARY ROUND 2 solutions

P2.1.

Three ladies and three gentlemen are seated alternately at a round table.

1. Miss Adams is two places to the left of Mrs Stewart, and is not the graphic designer.
2. Mrs Stewart is not sitting opposite her husband, but the accountant is facing the web-designer.
3. Mr McGregor has the graphic designer on his right.
4. The banker is on the left of Mr Greenwell our local artist, and opposite the doctor.
5. Miss Brodie and the web-designer have their heads close together over some sketches.

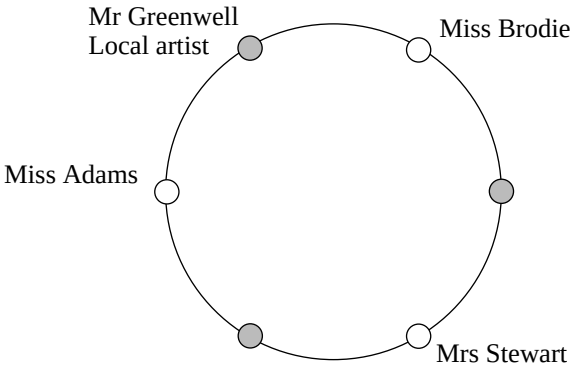
Who is sitting opposite Mrs Stewart?

Solution

Note that the ladies and gentlemen are seated alternately.

Using statements 1 and 5: Place Miss Adams two places to the left of Mrs Stewart, and Miss Brodie in the remaining alternate space**.**

From statement 1 Miss Adams is not the graphic designer and statement 3 states that Mr McGregor has the graphic designer on his right so Miss Adams cannot be on his right. This position is also opposite Mrs Stewart and therefore cannot be her husband Mr Stewart (statement 2) which means it must be Mr Greenwell the local artist (by statement 4).



Mr Greenwell is sitting opposite Mrs Stewart.

Although this is not required, to check that this answer is correct it helps to complete the diagram with all the placings and professions:

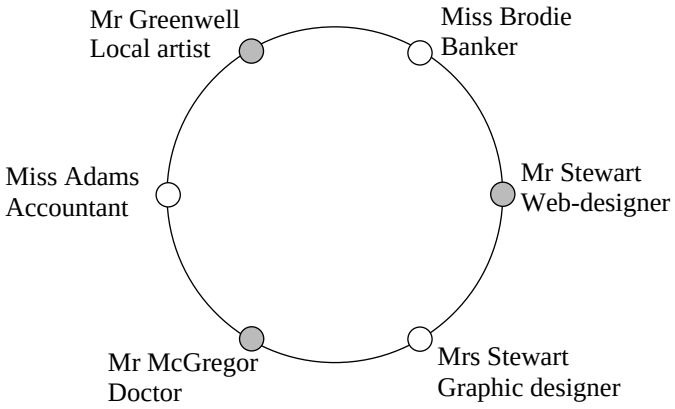
Statement 4 says that the person on Mr Greenwell's left, Miss Brodie, must be the banker and the person opposite her must be the doctor.

Statement 5 says that the web designer is sitting next to Miss Brodie, and so must be to her left.

Statement 3 says that Mr McGregor has the graphic designer on his right. Miss Brodie is the banker, so Mr McGregor must sit in the other space, and Mrs Stewart on his right must be the graphic designer.

The remaining man, Mr Stewart is therefore the web designer. Opposite him, Miss Adams is the accountant (statement 2).

The completed layout is as follows and we can check that all the conditions are satisfied.



P2.2.

Louise and her dog share the same birthday, but are different ages. When Louise's aunt asked how old her dog was, Louise replied as follows:

'Next birthday she will be half of my age but on my birthday two years ago she was one third of my age.'

How old is Louise now and how old is her dog now?

Solution 1

On a birthday both ages are whole numbers.

Let Louise's age now be x.

$x - 2$ must be divisible by 3, so x is 2 or 5 or 8 or 11 or . . .

$x + 1$ is even, so x must be odd which means x is 5 or 11 or . . .

Try $x = 5$:

Dog's age next birthday is $\frac{1}{2}(5 + 1) = 3$, so dog's age now is 2.

Dog's age two years ago is $\frac{1}{3}(5 - 2) = 1$, so dog's age now is 3.

These do not match so Louise's age now is *not* 5.

Try $x = 11$:

Dog's age next birthday is $\frac{1}{2}(11 + 1) = 6$, so dog's age now is 5.

Dog's age two years ago is $\frac{1}{3}(11 - 2) = 3$, so dog's age now is 5.

These *do* match so Louise's age now is 11, and her dog's age now is 5.

Solution 2

On the birthday both ages are whole numbers.

Let Louise's age now be x and her dog's age now be y, so

$$\frac{x + 1}{2} = y + 1 \text{ and } \frac{x - 2}{3} = y - 2.$$

and therefore

$$x + 1 = 2y + 2 \text{ and } x - 2 = 3y - 6.$$

Subtract the second from the first:

$$3 = 8 - y$$

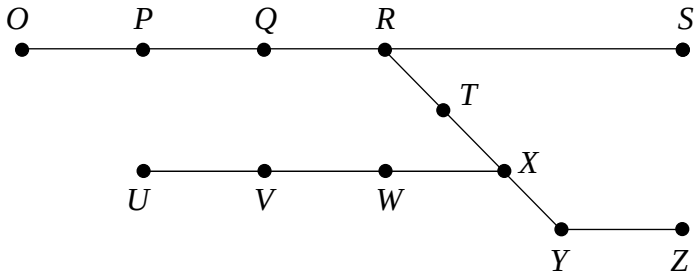
$$y = 5$$

which gives

$$x = 11.$$

So Louise's age now is 11, and her dog's age now is 5.

P2.3.



The diagram shows a map of Callum's local rail network, where the dots represent stations and the lines are routes. Callum wants to visit all the stations, travelling only by train, starting at any station and ending at any station, with no restriction on which routes are taken.

What is the smallest number of stations he must visit more than once?

Solution

Callum should start and end on the spurs with the largest number of stations - otherwise he will have to pass through the intermediate stations on the spur more than once.

He should also visit each spur as he first reaches it.

So a possible route is

O P Q R S R T X Y Z Y X W V U

or its reverse.

R, *X* and *Y* are visited more than once.

So the smallest number of stations he must visit more than once is 3.