Fermi Challenge

(by Thilo Gross)

Here are three quick questions. Try to use Fermi estimates to find answers.

I want to build a classical redbrick house in Bristol. It will be a 2 bedroom property. How many bricks do I need?

$$A =$$

A plumber in London cleans out the drains of a laundrette. This yields enough small change to fill a 5l bucket. Estimate the value of the change (in pound), assuming a typical mixture of coins.

$$B =$$

Consider a city with about 1 million residents, e.g. greater Manchester. How many playgrounds could we build on an area that is as large as the combined area taken up by parking spaces in the city?

$$C =$$

Now multiply your answers

$$A \cdot B \cdot C =$$

Solution

This worksheet is intended as a competition between groups of students. It assumes that the students are already familiar with Fermi estimates, e.g. they may have previously done our worksheet "Moving Mount Fuji".

The first question can be answered by first estimating the total length of wall (perhaps 80 m for a 6 m by 8 m house, including some meters of double wall on the front and back and interior walls), then the total area of walls (we could assume 3 m average height of walls), and then dividing by the area of the side of a brick (about 180 cm^2).

The second question is more tricky. Here it can be useful to just take whatever coins you have in your pocket. Count their value and estimate their volume.

For the third question, you can estimate the number of cars (it's more than 1 car per 2 people in the UK.) Most of the time these cars sit around parked (about 23.5h per day) so we need at least as many parking spaces as cars, perhaps a bit more. Multiply by the area of typical parking space (ca. 15 m^2) and divide by the size of a typical playground (ca. 400 m^2).

Obviously there are no definitive answers and alternative paths to solutions are possible. The multiplication of results in the last step is done to determine the winner of the competition. If you have an odd number of groups then the group which the result of $A \cdot B \cdot C$ is the median has almost certainly the best estimate. For an even number of groups the group for which the result is closest to the geometric mean of results has almost certainly the best estimates (unless one group is particularly far off the mark, in such a case ignore that group).