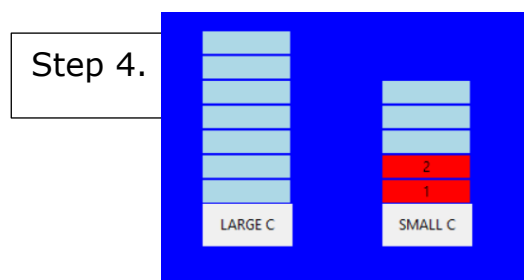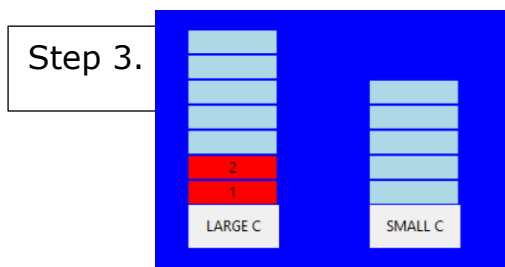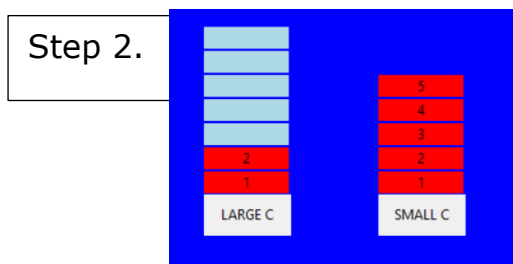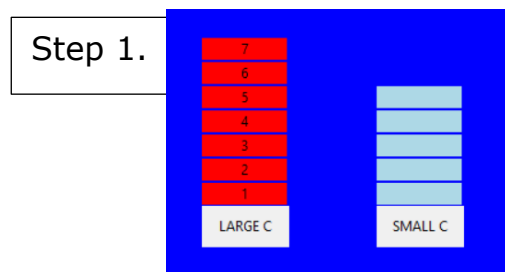## The Problem

To measure out 4 litres from containers of 7l and 5l.

The 4 litres must be contained in the smaller container at the end of the process, and the larger one empty.
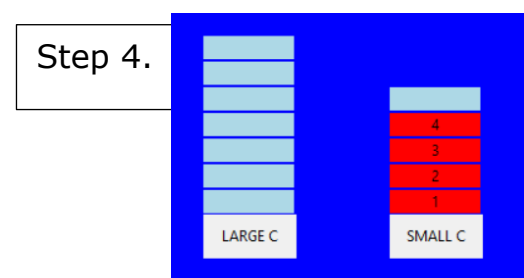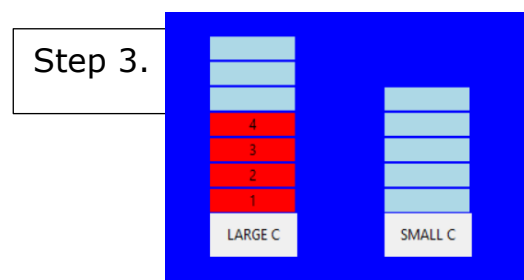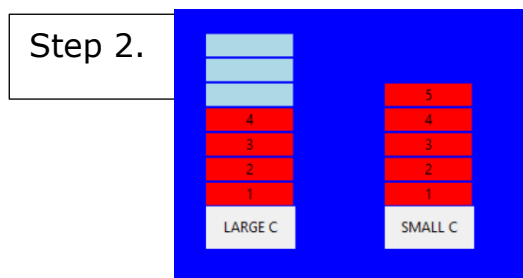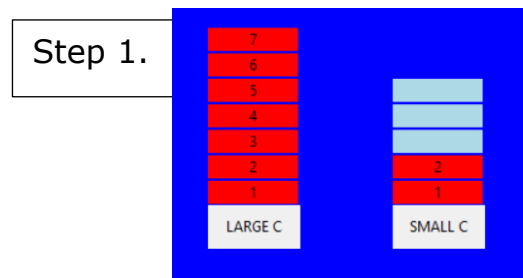
A Visual Solution

There are 4 steps involved to have 2 litres in the small container and an empty large container. The steps can be just repeated for a 4 litre solution.

First Iteration

Step 1.

Step 2.

Step 3.

Step 4.

Second Iteration

Step 1.

Step 2.

Step 3.

Step 4.

Solution in Words (very algorithmic)

The four steps can be described as follows :

1. Fill the larger container.

2. Pour the larger one into the smaller one, until the smaller container is full.

3. Empty the small one into a sink

4. Pour the difference from the larger into the smaller

Repeat steps 1-4. The larger container will be empty and the smaller one will contain 4 litres.

A more abstracted Mathematical Solution

If the equation $7x + 5y = 4$ has two integer solutions, then it is possible to measure out 4 litres.

Let's look at the volume of water in and out of the containers.

Briefly, let's say f is the number of fills of the large container and e is the number of empties into the sink (not pours into another container).

In the visual solution, $f = 2$ and $e = 0$ $\therefore x = 2$.

Let's say for the small container f' is the numbers of fills and e' the number of empties into the sink.

In the visual solution, $f' = 0$ and $e' = 2$ $\therefore y = -2$.

Substituting: $7(2) + 5(-2) = 4$ which means there must a solution for measuring 4 litres into a container.

Try these ones ....

Will the solution hold for 9 litre and 7 litre containers?

Will the steps work for any two containers as long the difference in their capacities is 2 litres?