

## A City Of Towers

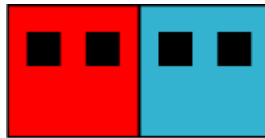
<http://nrich.maths.org/183>

In a certain city houses had to be built in a particular way.

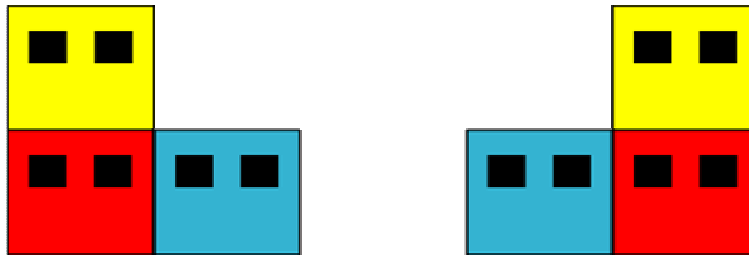
There had to be two rooms on the ground floor and all other rooms had to be built on top of these.

Families were allowed to build just one room for each person living in the house.

So a house for two people would look like this:



but a house for three people could look like one of these:



There are some families of seven people living in the town.

In how many different ways can they build their houses?

### You Will Need:

- 7 Square Tiles/Cubes

### **Why do this problem?**

This problem is an investigation into combinations of a number of cubes. It is a practical activity which involves visualising and relating 3D shapes to their representation on paper. Young children are often introduced to sets of regular polyhedra and similar sorts of shapes, less often do they systematically explore shapes made up from cubes.

### **Possible approach**

Ideally, it would be good to supply interlocking cubes or other cube bricks and 2 cm squared paper or plain paper for recording. It might help to begin the challenge all together before asking children to work in pairs on the problem so that they are able to talk through their ideas and compare their results with a partner.

Some children may need help recording their models and you could demonstrate this on the interactive whiteboard. If 2 cm cubes have been used then they can lay their shape on the paper and see how it fits into the squares. Alternatively, children might just sketch their models on plain paper or, if you have enough cubes, they can keep each model.

In the plenary, as well as comparing results, it would be good to spend time talking about how the children approached the problem. Some might have started straight away with seven cubes, others might have tried four cubes, then five, etc. Some children might have made the models, some might have been able to picture the houses and draw them without using cubes. It can be useful to discuss the advantages and disadvantages of each different method. Depending on the children's experience, you can also draw attention to those that have used a systematic way of finding all the houses. If most of the children have not developed a system, you could line up models in a particular order for all to see so that they notice the system themselves. This way, they may be able to spot any that are missing.

### **Key questions**

How many cubes are there in this one? Would it be a good idea to count them?  
Are all your houses different from each other?  
Could you put this cube in a different place?  
How will you draw your houses?

### **Possible extension**

Children who do this problem quickly could investigate other numbers of cubes or create their own rules for building houses.

### **Possible support**

You may like to suggest that some children start by finding all the houses for four people, then five etc