

## Un-Babushka Squares

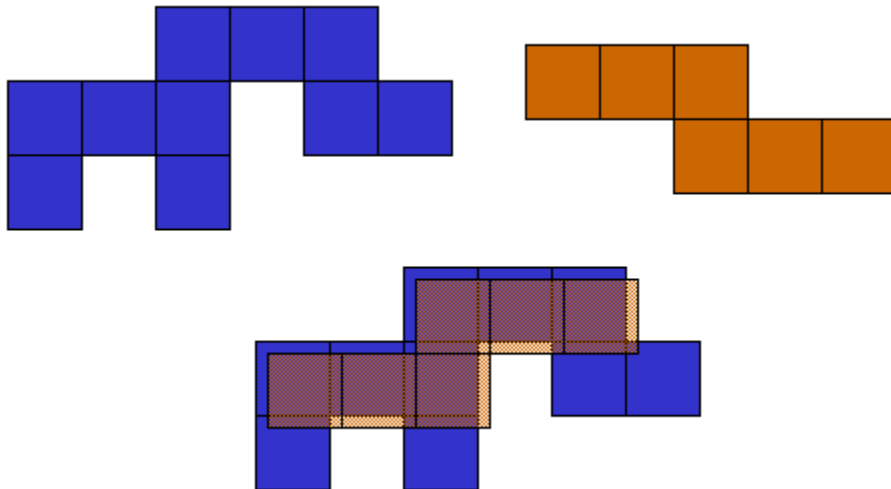
When, *Polyo*, wants to rebel from her claustrophobic family, she seeks out solitude to work on very Un-Babushka-like puzzles. That means she wants puzzles where the pieces DO NOT FIT INTO EACH OTHER!!! She feels rather strongly about this.



Polyomino, Polyomina, Polyo, Poly, and little Oly.

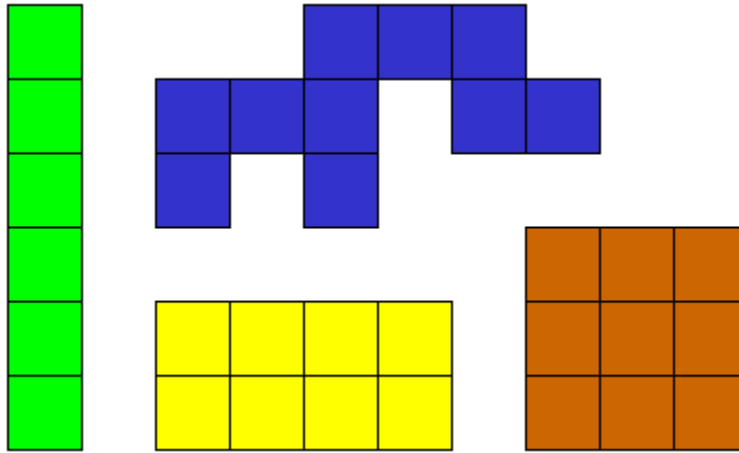
Polyo (in the centre) sometimes wants to just get away from her family.

Her favourite puzzle is to try to find animals which don't EAT each other. An animal eats another animal if it fits inside. For example, the blue elephant can eat the orange snake because the snake can be flipped over so that it fits into the elephant:



On the other hand, the four animals below could live happily together because they can't eat each other. For example, the size 10 blue elephant (made of 10 squares) cannot eat the green bamboo (size 6) or the orange blossom tree (size 9).





Polyo's three animals are of sizes 3, 4 and 5.

What do they look like?

### Extensions:

- Polyo next made a zoo with seven animals of sizes 4, 5, 6, 7, 8, 9, and 10. Of course, no animal may eat another animal.
- Find seven animals of sizes 4, 5, 6, 7, 8, 9, and 10 that fit into a 7 by 7 cage. [Hint](#)
- Find a zoo with 14 animals of sizes 4, 4, 5, 5, 6, 6, 7, 7, 8, 8, 9, 9, 10, and 10.
- Show that no zoo exists that has animals of sizes: 3, 4, 5, 6, 7, 8, 9 and 10.
- Imagine that Polyo decides to recruit animals to her zoo starting with the smallest animals. What is the most animals she can recruit at each size so that her zoo can continue growing indefinitely? For example, if she gets greedy and recruits three animals of size 4, her zoo will be very small.

**Warning:** This is an unsolved problem.

### The Math in This Problem:

A polyomino is a geometric shape, made from any number of squares joined by their edges. In this puzzle, students experiment with polyominoes of all different sizes. The goal of Un-Babushka Squares is to construct the sizes so that a smaller polyomino cannot fit perfectly inside of another one.

