

Square in the Bag and Other Puzzles for Classroom

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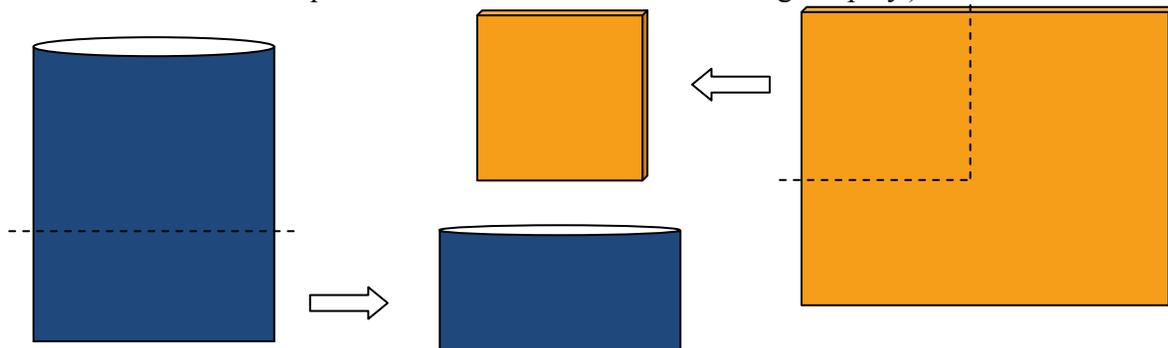
1. Square in the Bag

Square in the Bag is a mechanical puzzle I designed. Happily, it won the Puzzlers' Award in the 2012 Puzzle Design Competition. It consists of only a square board and a bag. The bag is of a 2 by 1 rectangle where the length of a diagonal of the square is 1. The goal is to place the square completely inside the bag. (No undue force is required.)

So the goal is easy to understand, the parts are simple geometrical figures, and the puzzle is not easy to solve. Such a puzzle must be very good not only for puzzle collectors but also for classroom. In fact, I really want teachers to use this puzzle in their classroom. So anybody can copy it for educational purposes (or for personal use) without my permission.

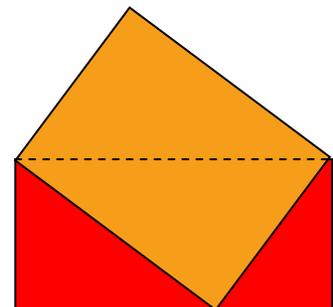
As the design is so simple, it may be easy to make. Especially if you are good at sewing, the only note is that you must use some soft but unstretchable fabric. On the other hand, it is not easy for general people to sew a bag with precise dimensions. An alternative idea might be to make a paper bag. But, unfortunately, as paper is too hard for this puzzle, the finished work will be an almost unsolvable puzzle.

My recommendation is to use a strong plastic bag and a corrugated board. They are cheap and it is very easy for everyone to make the puzzle using them. First, cut a 2 by 1 rectangle from the bottom part of the bag. Second, cut an appropriate sized square from the board. That's it. (If you use a cardboard, you need to note that the square board must never be bent during the play.)



2. Correctly in the Bag

You can make a similar puzzle using a rectangular board instead of a square. It is another design of mine named Correctly in the Bag. For the rectangle, any dimensions will do. But, of course, the dimensions of the bag depend on the rectangle. The diagram to the right shows the correspondence between their dimensions. Playing this puzzle would be very good for geometrical thinking.



3. Relevant mathematical puzzles

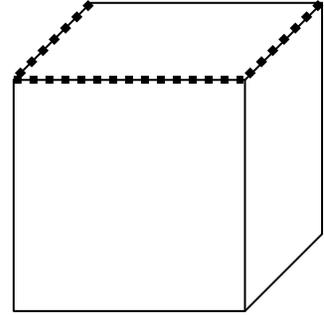
After solving the mechanical puzzles above, the following mathematical puzzles would be nice exercises.

Cube Cover

Imagine a cover that perfectly fits a specified cube without any overlap or excess. It is removable as it has a zipper. An example is shown in the diagram to the right.

The cube is rigid and the cover is made of some fabric that is sufficiently soft and thin but absolutely unstretchable. The zipper has only two endpoints, that is, it has no branches.

What is the shortest possible length of the zipper?



Tetrahedron Cover and Octahedron Cover

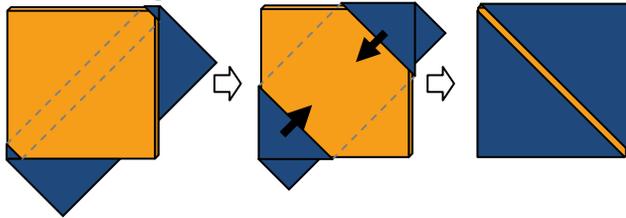
How about the corresponding problem for a regular tetrahedron?

How about for a regular octahedron?

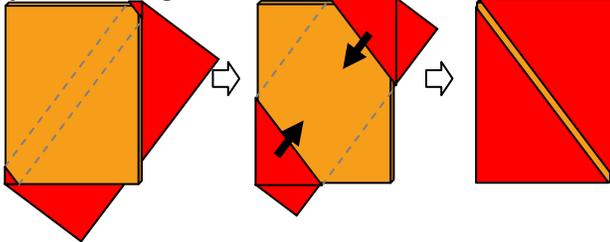


Solutions without words

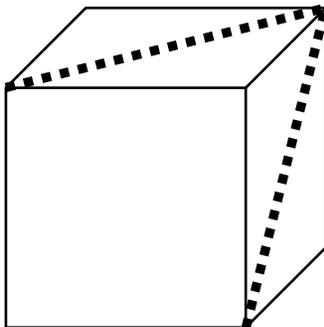
Square in the Bag



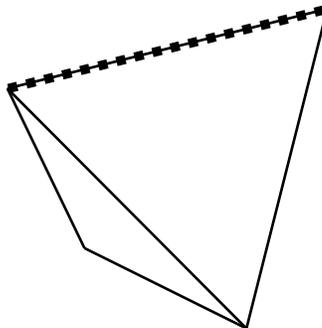
Correctly in the Bag



Cube Cover



Tetrahedron Cover



Octahedron Cover

