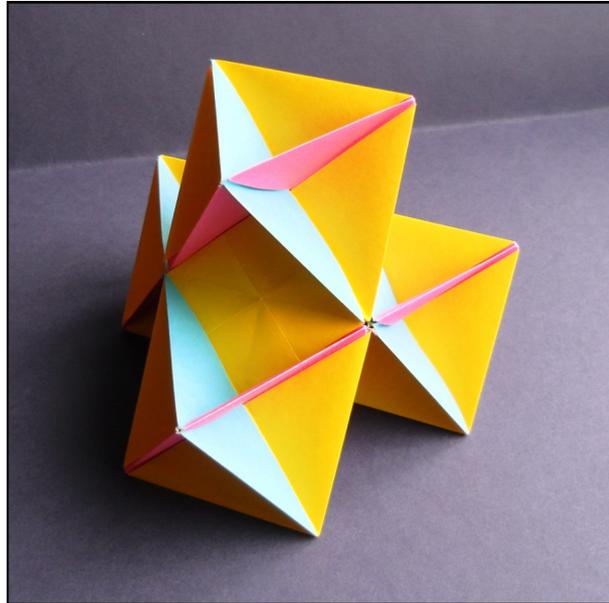


# Four Octahedra

Designed by David Mitchell

Four Octahedra is an interesting macromodular form which appears to be made from six interpenetrating 2x1 rectangles, but is in fact made by linking together four separate nolid octahedra with very simple joining pieces.



The nolid octahedra are a design by Robert E Neale dating back to the mid 1960s. I call this design Robert Neale 's Octahedron but it has many other names. I first linked four together to make the Four Octahedra form in 1995 but simplified the design of the joining pieces in 2016.

Apart from the mathematical elegance of the form there is no reason to stop at joining just four nolid octahedra together. Larger structures are easily built.

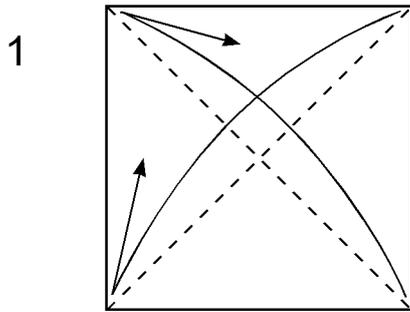
Another method of linking these octahedra together to make Octahedral Pyramids is given in the second edition of my book Building with Butterflies. This alternative method will not, however, allow the rectangles to be coloured independently.

Somewhat surprisingly, I have not come across the four octahedra, six interpenetrating 2x1 rectangle, form in any other context.

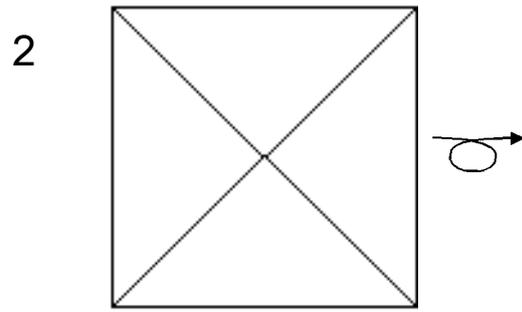
Diagrams for the nolid octahedron are included by permission of Robert E Neale.

## Making the octahedra

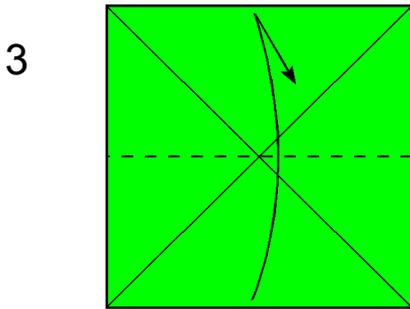
You will need six squares of paper for each octahedron, two in each of three contrasting but complementary colours. If you are using irogami begin with your paper arranged white side up.



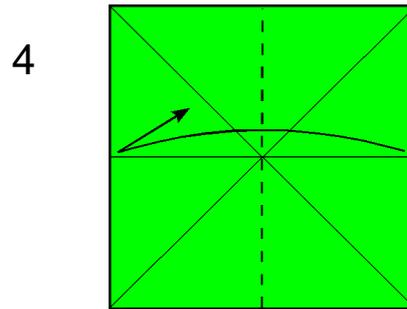
1. Fold in half diagonally, then unfold, in both directions.



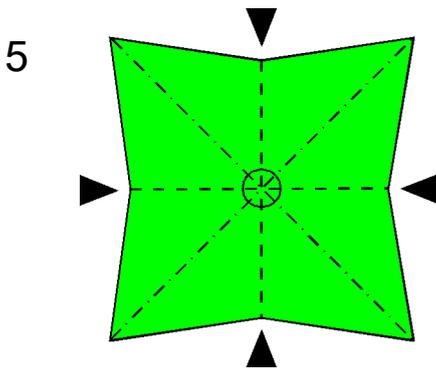
2. Turn over sideways.



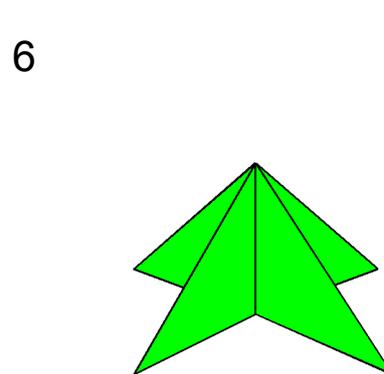
3. Fold in half edge to edge downwards, then unfold.



4. Fold in half edge to edge sideways, then unfold.

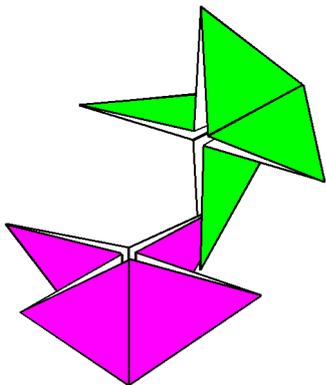


5. Collapse into a Waterbomb Base.



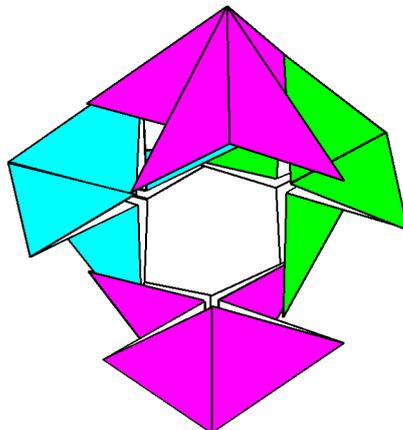
6. You will need six modules like this for each octahedron.

7



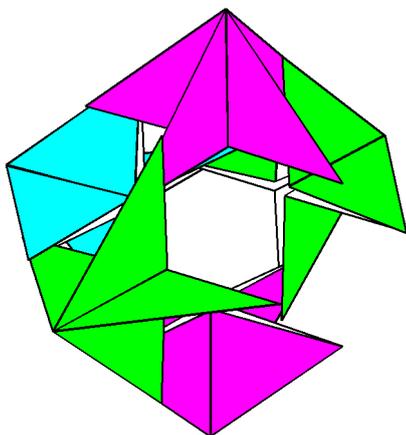
7. The first two modules slot together like this.

8



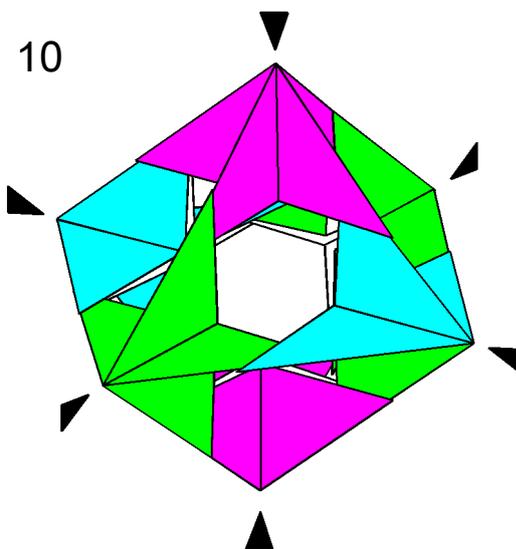
8. You will see that the arms of each module go outside those of one colour and inside those of the other.

9



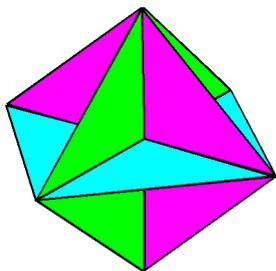
9. Five modules assembled!

10



10. Add the sixth module, keeping to the inside / outside weave pattern, then gently nudge the modules together. They will eventually settle into a tight position where the centre of all the modules are locked together.

11

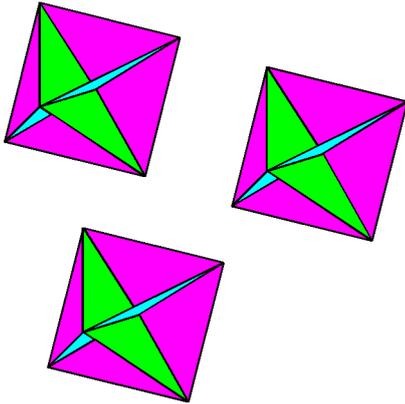


11. The finished octahedron should look like this. Make four. Make sure all your octahedra are identical. There are two ways to put three colours together. Unless you use the same method each time you will be unable to insert the joining pieces.

## How the structure works

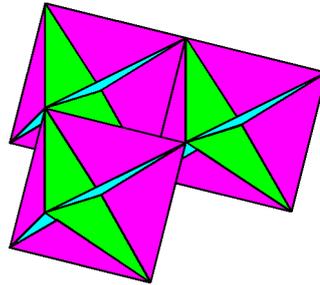
It will help you understand how the structure works if you stack the four octahedra to form a second level octahedral pyramid in the way shown below without incorporating the joining pieces.

12



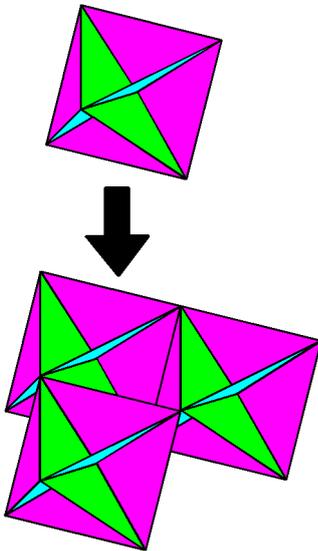
12. Arrange three octahedra on a flat surface like this ...

13



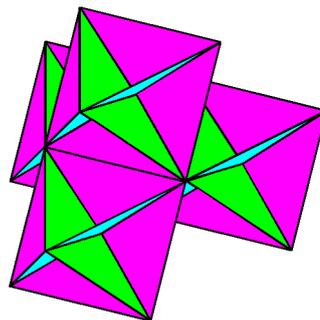
13. ... then slide them together to form the first layer of the pyramid.

14



14. Place the last octahedron gently on top of the others.

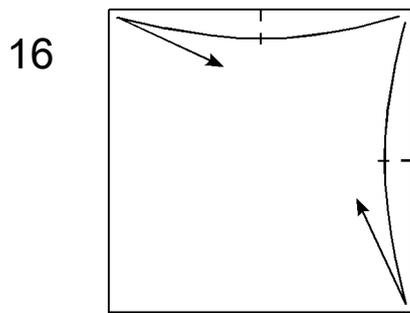
15



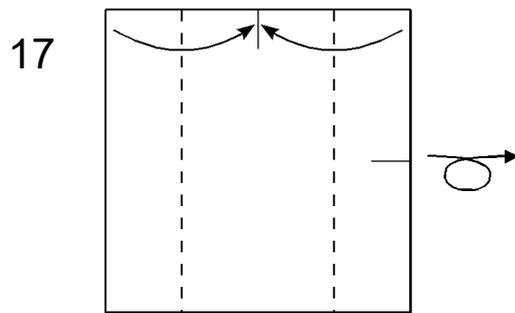
15. The result should look like this. The octahedra are arranged in the same way in the finished design.

## Folding the joining modules

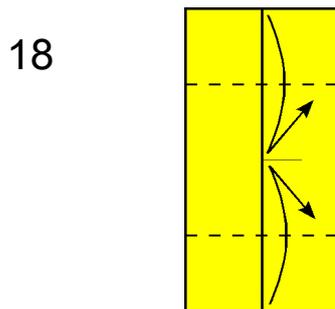
You will need six more squares of paper for the joining pieces, two in each of the same three colours you used for the octahedra. If you are using irogami begin with your paper arranged white side up.



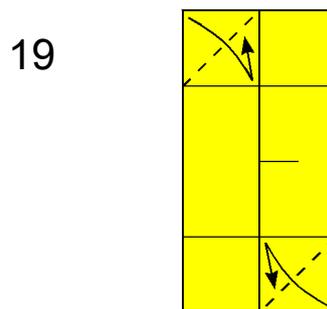
16. Make two tiny creases to mark the centres of the top and right edges.



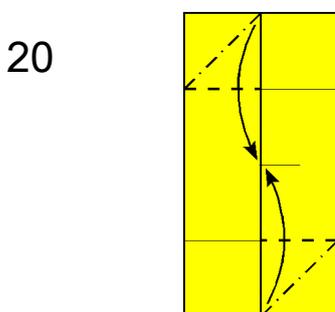
17. Fold both outside edges into the centre using the tiny crease as a guide.



18. Fold the top and bottom edges into the centre, using the second tiny crease as a guide, then unfold.

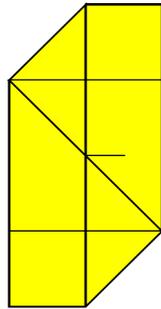


19. Fold the top left and bottom right corners inwards as shown, then unfold.

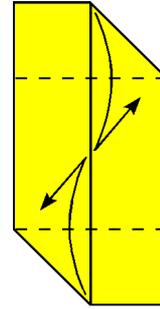


21. Fold the top left corner of the left front layer downwards using the crease made in step 18 and squash symmetrically.. Repeat at the bottom.

21



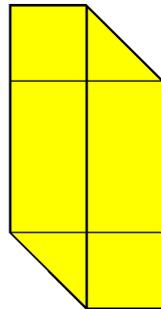
22



22. This is what the result should look like. Turn over sideways.

22. Reverse the direction of the folds made in step 18.

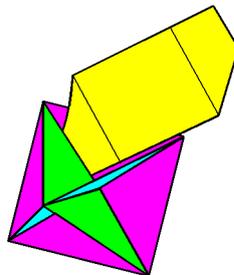
23



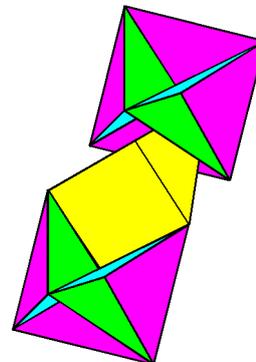
23. The joining module is finished. Make all six.

### Linking the octahedra together

24



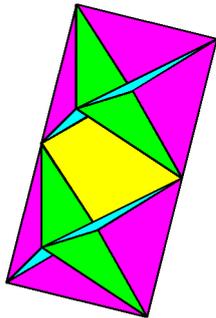
25



24. One tab of the joining module will slide up inside one of the arms of the octahedron as shown. If you can't do this it is probably because you have put your octahedrons together in the second of the two possible ways. Ease the octahedron gently apart, reconstruct it the correct way round and try again!

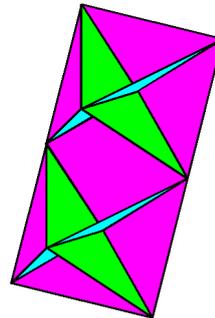
25. The second tab of the joining module slides into the corresponding pocket on a second octahedron.

26



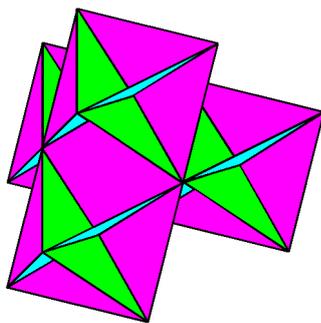
26. One of the joining pieces is in place. In these diagrams the joining piece has been shaded a fourth colour for clarity, but it should, of course be the same colour as the rest of the 2x1 rectangle it is competing.

27



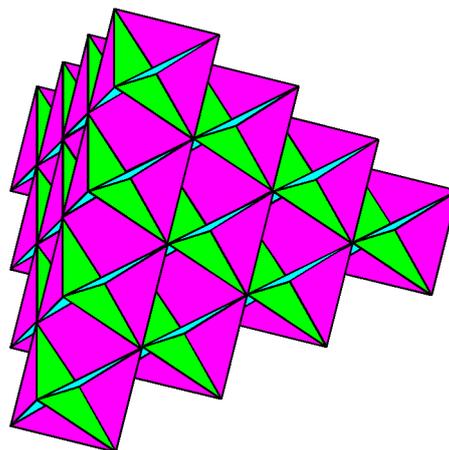
27. Link the third and fourth octahedra into the design in the same way. Gently add all the remaining joining pieces to complete the linkages.

28



28. When you have finished Four Octahedra will look like this.

29



29. If you wish, you can use the same technique to build larger octahedral pyramids. This is what a fourth level pyramid would look like.

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