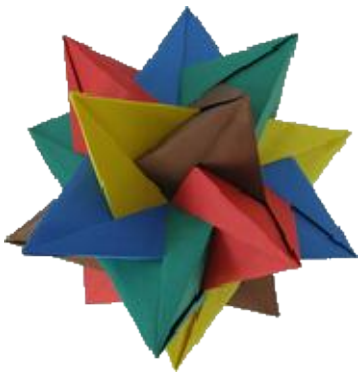

FIT CS

Five Intersecting Tetrahedra – Closed Surface Diagrams and Instructions

Original FIT model
by Thomas Hull
(http://mars.wnec.edu/~th297133/fit.html)

Save Date: 2008-12-17
Version: 1.1

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Contents:

Prerequisites

Corner modules

- The model consists of 20 corners. Each corner is made from a single sheet of paper.
- There are five tetrahedra. To give each tetrahedron a distinct color, 4 sheets per color are required.
- The folding of the corner module starts with a hexagon. It is possible to fold the hexagon from a square sheet. The author prefers to cut out the hexagon. Not only that this saves time (all 20 sheets can be cut at once) it also increases precision.

Lock modules

- The corner modules are not self locking. Instead, helper modules are used to hold the corner modules from inside the model. 12 of them are required, each made from a single sheet of paper.
- Since the lock modules are not visible, color doesn't matter.
- Again, the folding starts with a hexagon. So the same applies as written above.

Paper quality

- Any cheap standard origami paper does it.
- The larger the model, the more stiff the paper should be in order to prevent the finished model from collapsing.

Paper size

- In general, there are no restrictions regarding the paper size.
- The ratio between the paper sizes used to build the corner modules and the lock modules is more important. Given the diameter D_{corner} of the hexagon used for the corner module, the diameter D_{lock} of the hexagon used for the lock module should be:

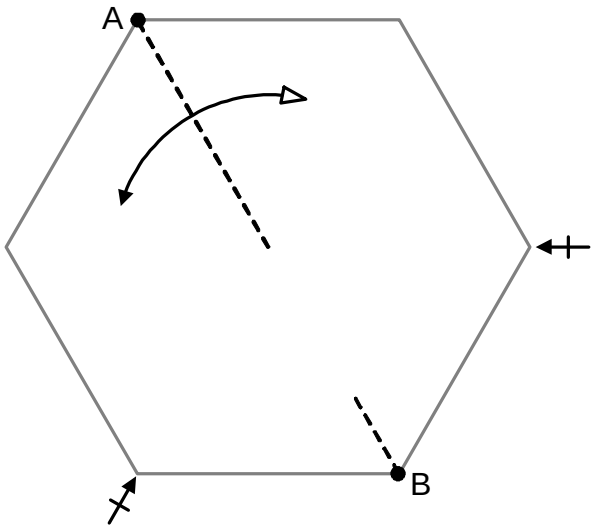
$$D_{lock} \approx 0.764 D_{corner}$$

Recommendation for the first model

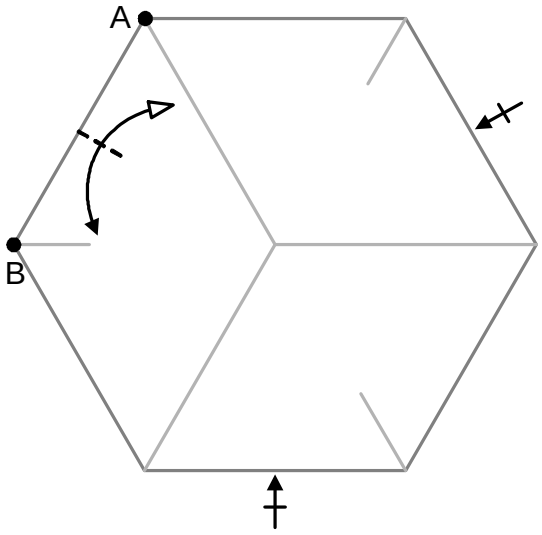
- Select five different colors, for example: red, green, blue, yellow and dark brown. For each color, take 4 sheets of square origami paper, 20 x 20 cm, 65 g / m², colored on one side. Cut these sheets into hexagons with a diameter of 200 mm.
- Take 12 sheets of square origami paper, 17 x 17 cm, 65 g / m². Cut them to 152 x 152 mm. Then cut out hexagons with a diameter of 152 mm.
- This will result in a model with a great circle diameter of about 28 cm.

Part I – Corner Module

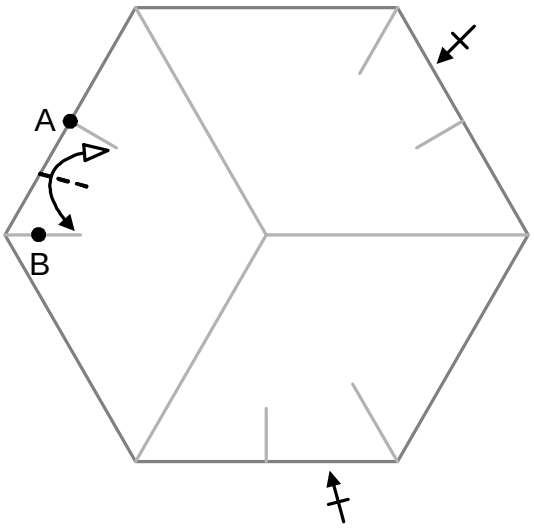
Step 1) Fold an angle of 22½ °.
Step 1a) Start with a sheet of paper with regular hexagon shape. The colored side is back, the blank side is up. Start at point A and fold towards the center. At the opposite point B, make a marking fold. Unfold and repeat this step at the next point but one.



Step 1b) Place point A over point B and make a marking fold. Unfold and repeat at the other two points.

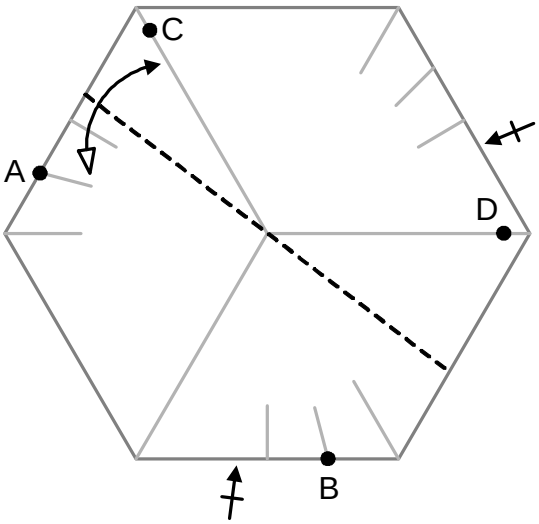


Step 1c) Place point A over point B and make another marking fold. Unfold and repeat at the other two points.

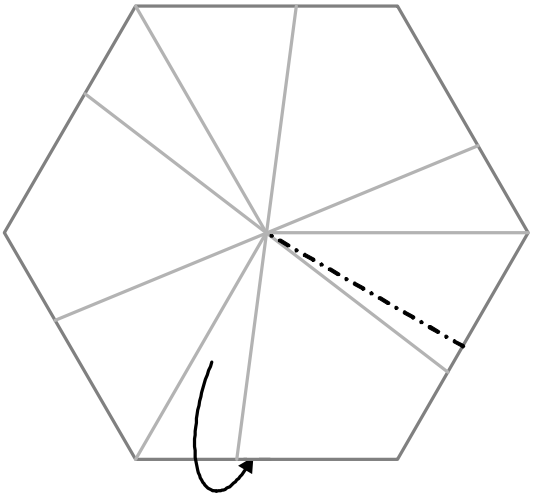


Step 1d) Place point A over point C and point B over point D so that the marking folds from the previous step come to lie over the crease from Step 1a). Fold from edge to edge. Unfold and repeat twice in the other sections.

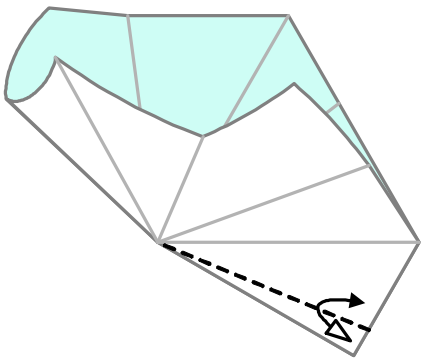
Note: Now that the angle of 22.5 ° has been folded the marking folds are no longer required. They don't appear in the remaining steps.



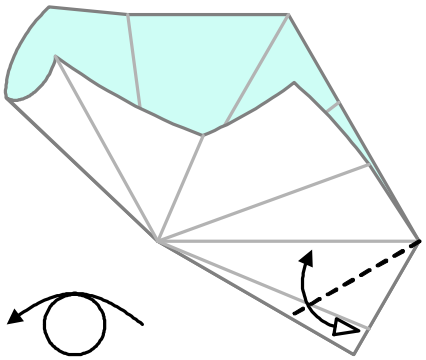
Step 2) Fold the flaps.
Step 2a) Fold the lower part of the sheet back making a mountain fold at the indicated line. Do not fold through to the opposite edge. Let loose that part of the sheet and focus on the folded side.



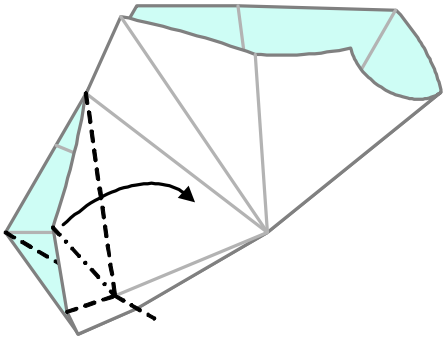
Step 2b) Fold the crease from the bottom layer through to the top layer and unfold.



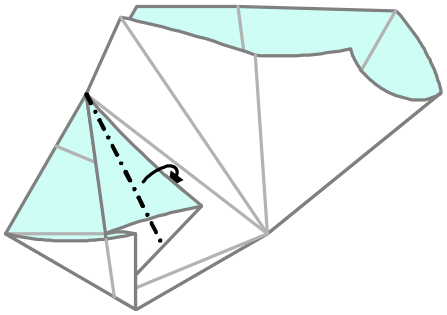
Step 2c) Fold both layers so that the edge of the paper matches the horizontal crease. Unfold. Grab the paper where the fold has been made and flip the paper over to the left side. Leave the open part as it is.



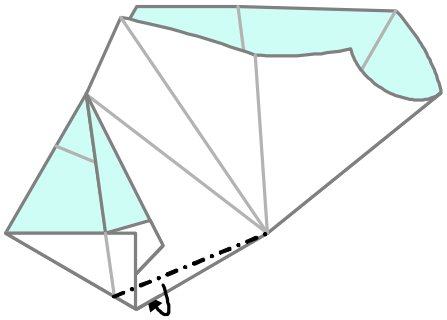
Step 2d) Fold the top layer towards the center. Use the creases from the previous step on both layers to form the flaps. See the next diagram for the result.



Step 2e) Fold half of the large flap behind the other half.

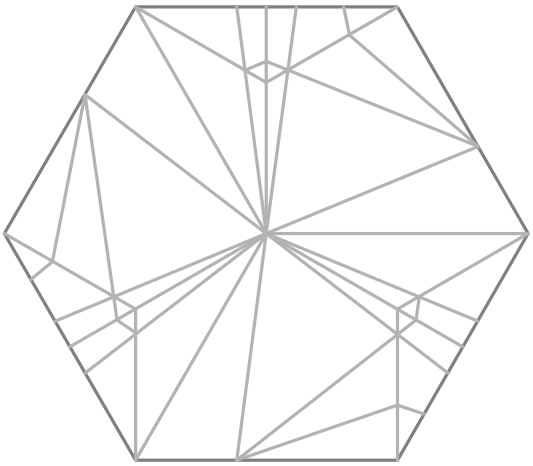


Step 2f) Fold the lower edge to the back along the crease from the fold in Step 2b).

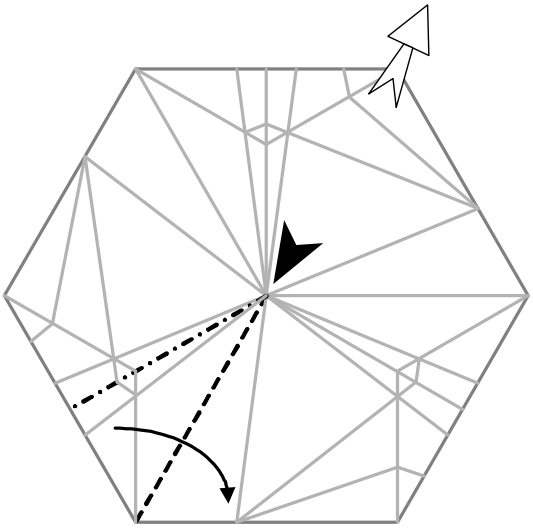


Unfold everything and repeat Step 2a) to Step 2f) in the other two sections.

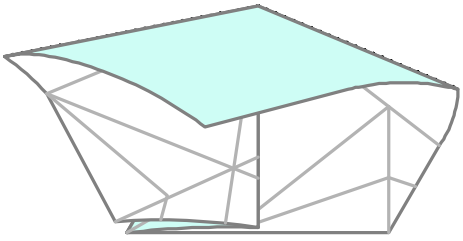
Step 2g) Pre-folding done and ready for 3D. The diagram shows the complete crease pattern of the corner module.



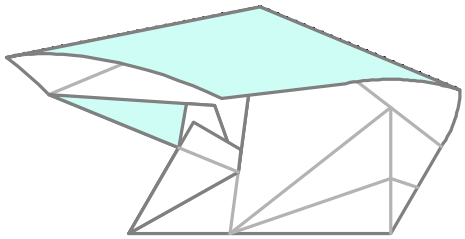
Step 3) Build the corner module.
Step 3a) Make the indicated folds using existing creases. Pushing the center downwards ensures that the opposite part of the paper flips up.



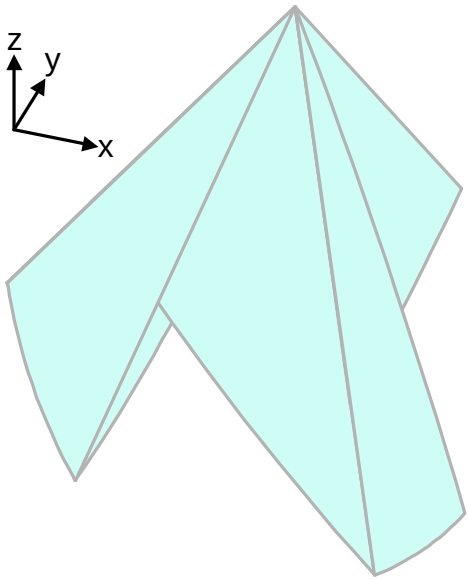
Step 3b) Repeat the folds from Step 2d) to Step 2f) to complete the first section.



Step 3c) The first section finished. Repeat Step 3a) and Step 3b) twice using only existing creases.



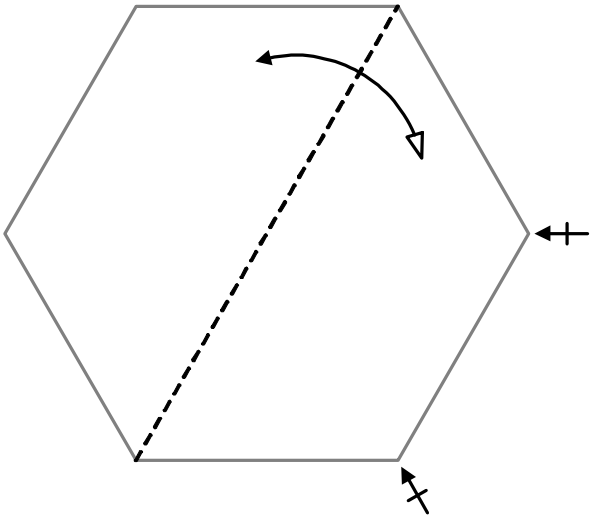
Step 3d) The completed corner module.



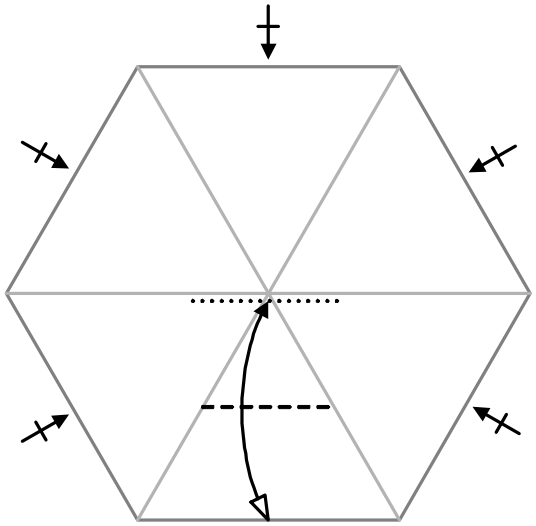
Repeat Step 1) to Step 3) with the other 19 sheets of paper to obtain 20 corner modules.

Part II – Lock Module

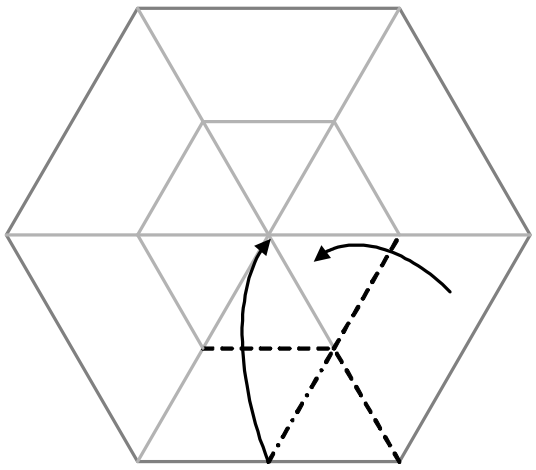
Step 1) Pre-fold.
Step 1a) Start with a sheet of paper with regular hexagon shape. Fold from one tip to the opposite tip. Repeat this two times.



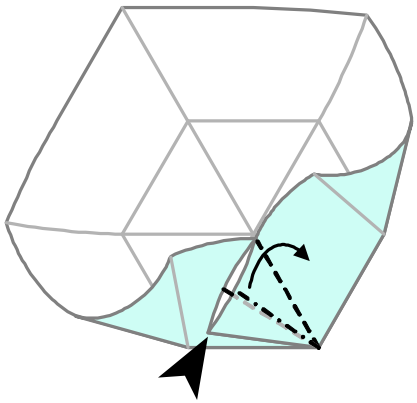
Step 1b) Place the edge of a section nearly over the parallel crease and make a fold between the other two creases. “Nearly” means to leave a small gap between the edge and the parallel crease. For a hexagon with a diameter of 152 mm this can be as large as 1 mm. The gap is vital for assembling the whole model because a lot of tips and flaps meet each other in the center. Repeat this in the other five sections.



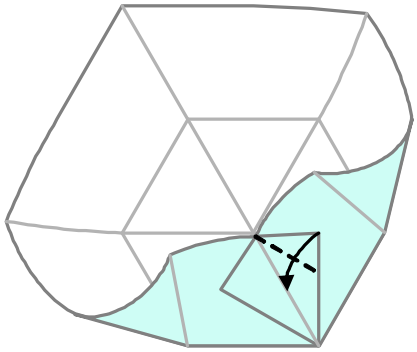
Step 1c) Grab the edges of two adjacent sections and fold them along the creases from the previous step.



Step 1d) Flip up the upper flap and flatten it so that the tip points to the center of the sheet.

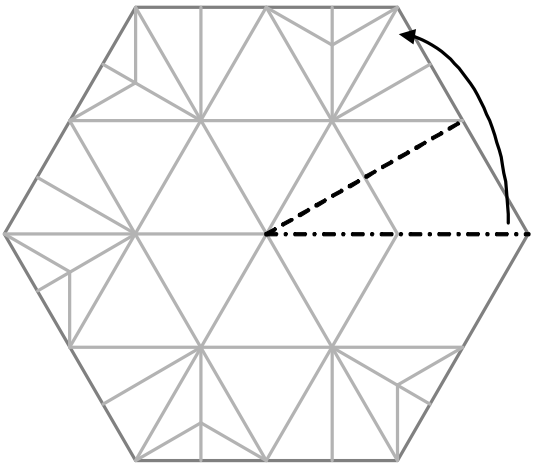


Step 1e) Fold the two topmost layers at the right side of the upper flap towards the diagonal crease.

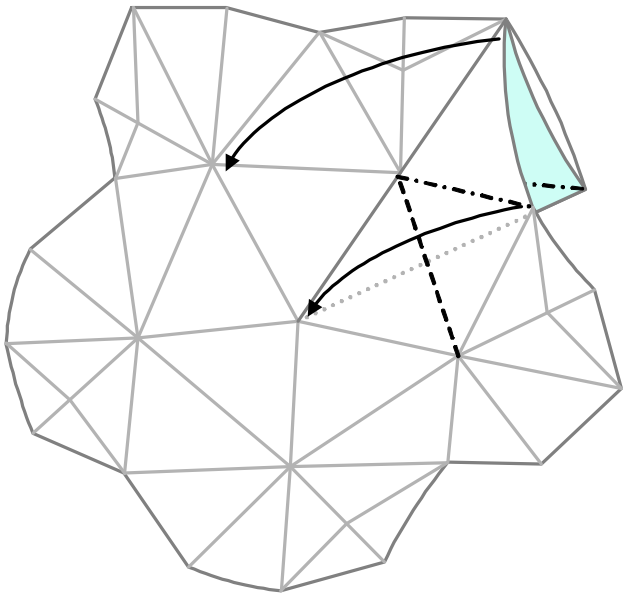


Unfold everything and repeat Step 1d) to Step 1e) at four other tips. Leave one tip unchanged.

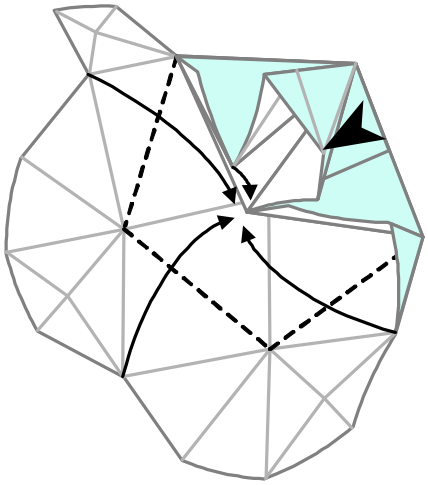
Step 2) Build the lock module.
Step 2a) Identify the tip which has been left out in the last steps. Fold it towards the next tip to the left in counter clockwise direction. This “hides” one section of the hexagon resulting in a 3D pentagon shape with a section angle of 30 °.



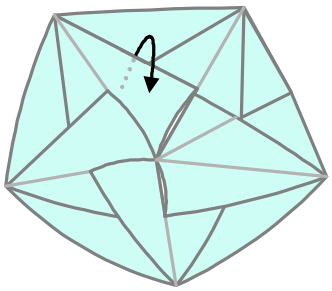
Step 2b) Fold the part with the three layers into the model. This is where it gets important to have a little space in the center. All the tips will now meet there.



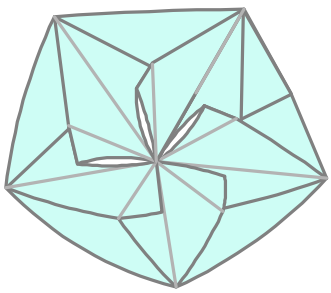
Step 2c) Flatten the flap which is on top of the previously folded layers. Then fold the next part to the left in counter clockwise direction. Use only existing creases. Continue to fold inwards and flatten in this direction until all tips meet in the center and the layers lie flat on each other.



Step 2d) Reorder the flaps so that the ones with an additional crease are the on top.



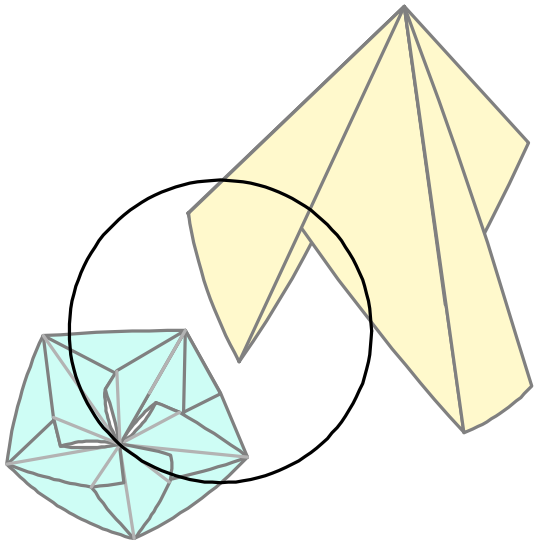
Step 2e) The completed lock module.



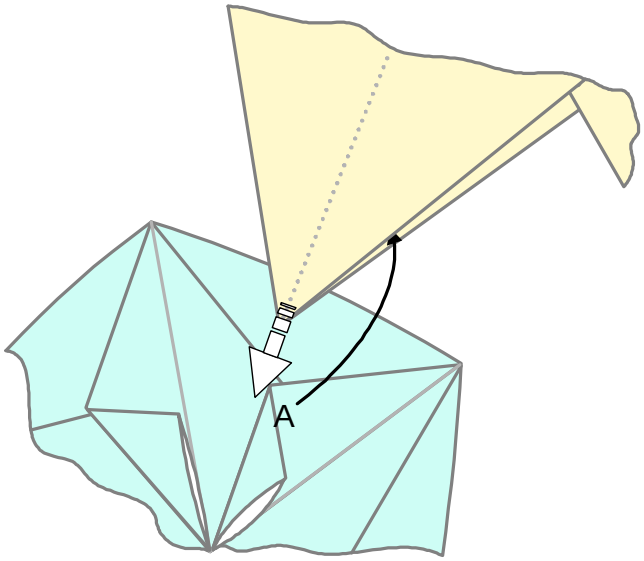
Repeat Step 1) to Step 2) with the other 11 sheets of paper in order to obtain 12 lock modules.

Part III – Assembling the Model

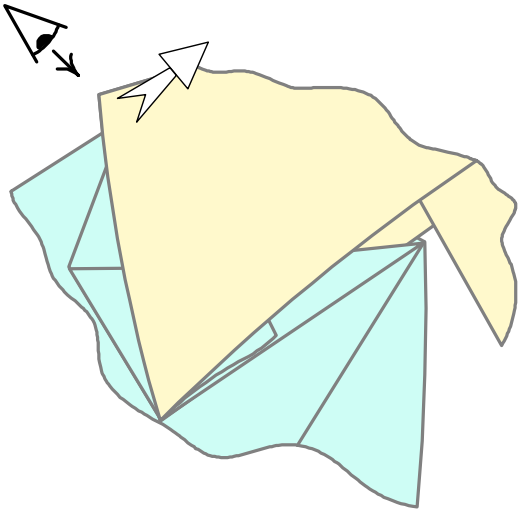
Step 1) Take a corner module and a lock module. Focus on one of the corner modules tips. It will be placed and secured on the lock module in the next few steps.



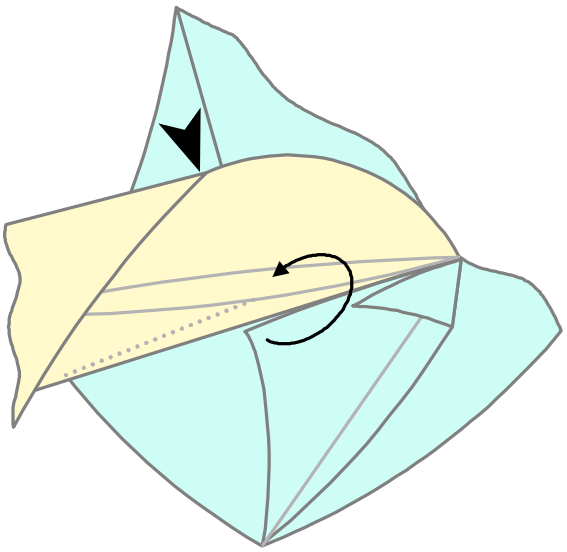
Step 2) Move the corner module into the lock modules so that the tip of the corner module hits the center of the lock module. The right side of the tip has three layers of paper. Flap A of the lock module is placed between the second and the third layer.



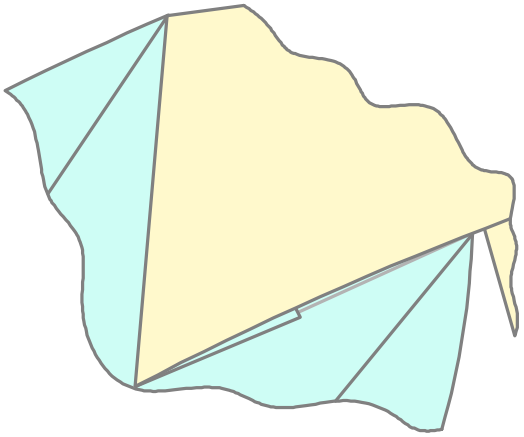
Step 3) While being careful not to destroy the new combination, lift a bit the top layer of the corner module to get behind it.



Step 4) Pull out the flap of the lock module from under the corner module and let it snap into the space between the two topmost layers of the corner module. Then flatten the corner module.

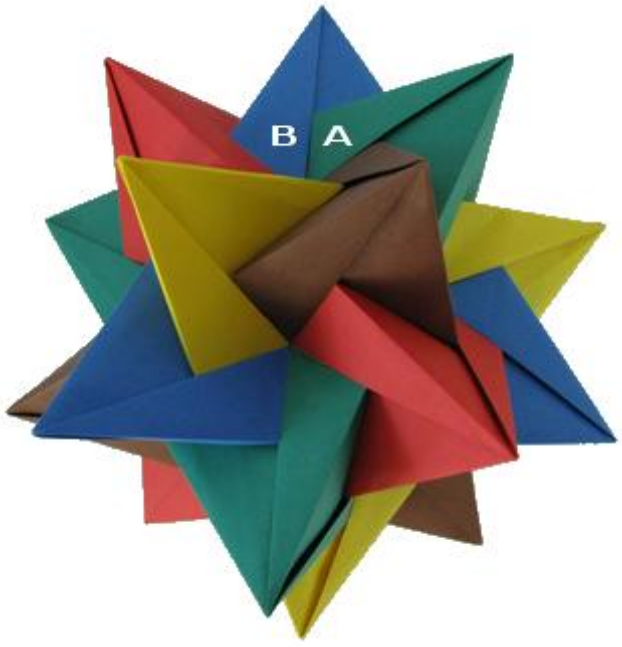


Step 5) The corner module is no tied to the lock module.



Note: The corner module may also be combined with the lock module by starting with the other flap of the lock module (the one pulled out in Step 4). It is a matter of personal preference.

Repeat Step 1) to Step 5) with four other corner modules on the same lock module. When using different colors for each tetrahedron make sure to arrange the corner modules accordingly. Add other lock modules to the free tips of the corner modules. Repeat this until all modules are in place.



Step 6) Rearrange all edges in the same way so that one flap (marked as A in the picture) lies completely under the other flap (marked as B in the picture). This increases the structural stress which stabilizes the whole model while keeping the modules safely in place.

Finished.