Workshop: XColony – Globefish


Globefish Model: Close and Open Views

Objectives

Solve 2D puzzles related to domain decomposition, partitioning and pattern detection. Build kinetic structures and investigate their properties. Understand tension and elasticity.

Experiment with stability, symmetry, rotation, locking, pressure and centrifuge force. Use the kit elements and follow the video and printed instructions to achieve the goals of this project.

Materials

Movies from the XColony channel on YouTube
Elements and documents from the construction kit

Organization

The workshop is organized in teams of 4-6 participants.

Activities

1. Presentation of the theme and objectives (10 min)

- watch the introductory and step-by-step video instructions
- brainstorming on the content of the movies: how many items have been identified, what kind of description could be associated with them, what other names should be given to these items in order to better designate them? Find associations with objects from reality and life, science (flowers, animals, crystals, molecules) and art (films, tilings, architecture, origami).

2. Distribution of materials (5 min)

- identification/designation of the elements,
- generate hypothesis on their use and foresee the final construction to be made

3. Playing and Learning Activities. Construction, Puzzle solving, Discovery (40 min)

- each team will inspect the materials and investigate through puzzle solving the 2D properties of the available elements
- visualize the way to construct the basic modules and construct all of them
- formulate the strategy to be applied to construct the final object: schedule tasks, assign tasks to members of the team equitably
- investigate geometric, kinetic and combinatorial properties of the final construction; visit other teams and discuss your findings; ask questions, challenge the others to pose problems and puzzles, ask for new solutions

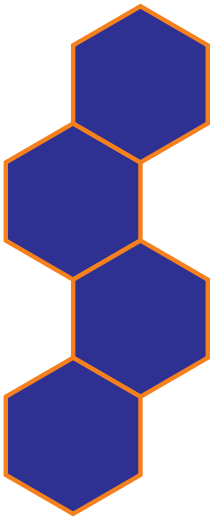
4. Concluding the workshop (5 min):

- recall the most interesting part of the workshop (each team identify one)
- pack and store or distribute the final constructions made. If the constructions are distributed there should be a fair system for that (e.g., a number of credits is assigned for every participant, each construction costs a number of credits, the student with a highest number of credits in the team will pick first and his/her number of credits is adjusted by the cost of the object). Students should be encouraged to design their own system of credits). After several sessions all students would have taken home at least one object.

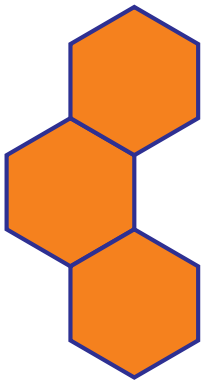
Appendix

Activity 1

Inspect the 5 Hs4 and the 15 Hc3 elements having different colors.



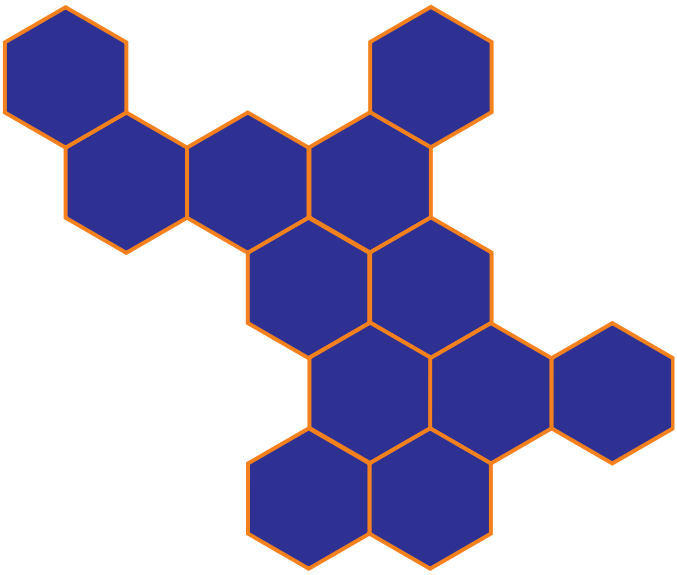
Hs4



Hc3

Arrange 3Hs4 elements and 4hc3 elements to create the same domain. Overlapping is not allowed.

For example, choose this common domain:



Create 2 more problems of like this one, based on different domains. Find the pattern that allows you to create more problems. Did you investigate the linear domain?

Activity 2

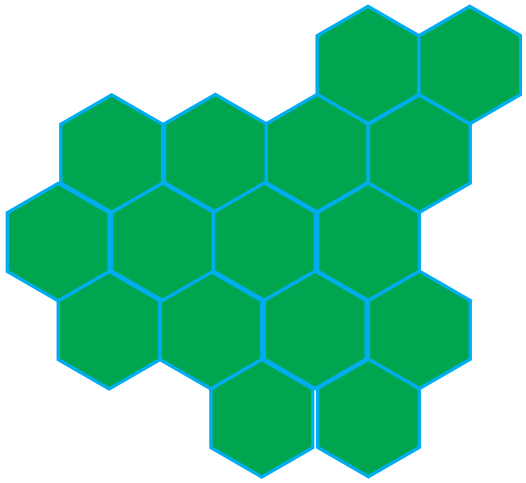
For any arrangement of connected elements that are not overlapping you can determine the distance between two hexagons as the minimum numbers of steps (moves to an adjacent location) needed to move from one hexagon to the other. Two adjacent hexagons are at distance 1. Identify in Hs4 pairs of hexagons at distance 2 and 3. The maximum distance between any two hexagons belonging to a domain will be the diameter of the domain. The diameter of the Hs element is 3. The diameter of the domain shown in Activity 1 is 6.

Find an arrangement of 4 Hs4 having the smallest diameter. Can the diameter be 5?

Find an arrangement of 4 Hs4 having the largest diameter. What is the structure of this solution?

Activity 3

Construct this domain using hs3 elements. Create a border using a minimum number of Hs3 elements. How many do you need? If any adjacent Hc3 elements on this border must have different colors, how many colors do you need? How many Hc3 elements would you need to create a border with only colors? Explain why only one extra element will suffice.

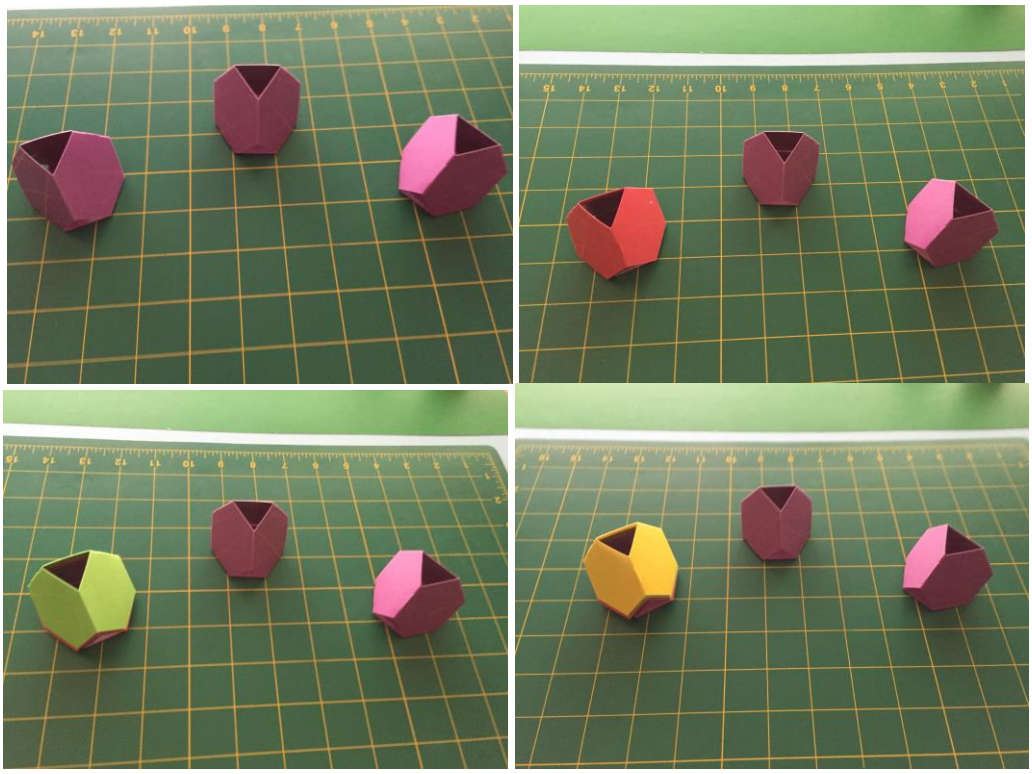


Activity 4

Using the instruction in the manual construct the Scale and the Fin modules. Arrange 5 Scale modules (but not just a stack) so that you can lift the whole ensemble with 2 fingers.

Activity 5

Put 3 Fin modules as towers in the Hanoi Tower puzzle. Select 3 Scale modules of different colors and stack them on the first tower from the darkest to the lightest color. You have to move the 3 Scale modules from the first tower to the second. You can move one Scale at a time from one tower to another. At any stage darker color Scales cannot be place on top of lighter color ones.



Modify the game to work with more than 3 Scale modules. Allow some modules to be of the same color.

Activity 6

Using the Scales modules construct the Puff modules. You need 3 Scales for each Puff. Each puff modules can be Open or Close (Puffed or Deflated).

Can you arrange the 3 Puff modules inside each other in open positions? Is that possible with close positions?

Activity 7

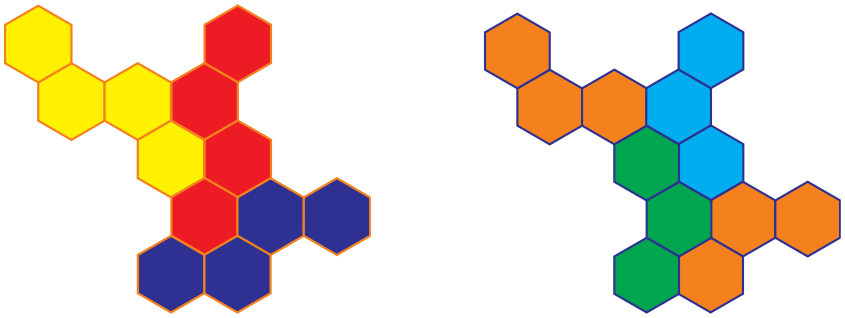
Can you arrange 3 Puff modules inside each other but not all three in the same position? Is that possible in both states: open and close?

Activity 8

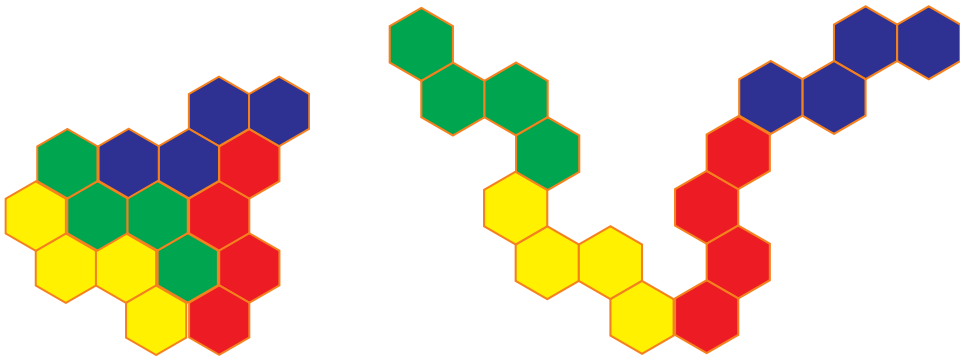
Finish the construction of the Globefish model. Analyze all states and find ways to transform one state into another. Can you use pressure on the top fin? Can you use centrifuge force and rotate the bottom fin? Could you stack 2 Globefish models?

Solutions

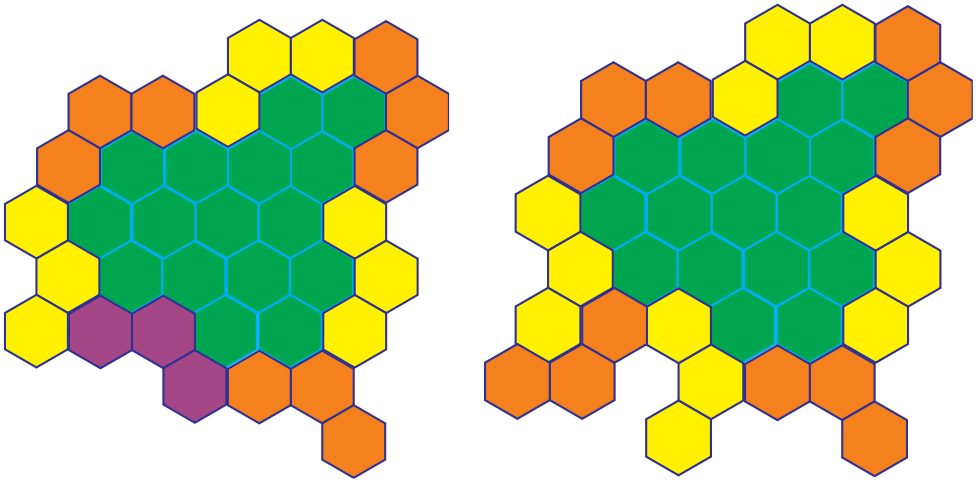
Activity 1



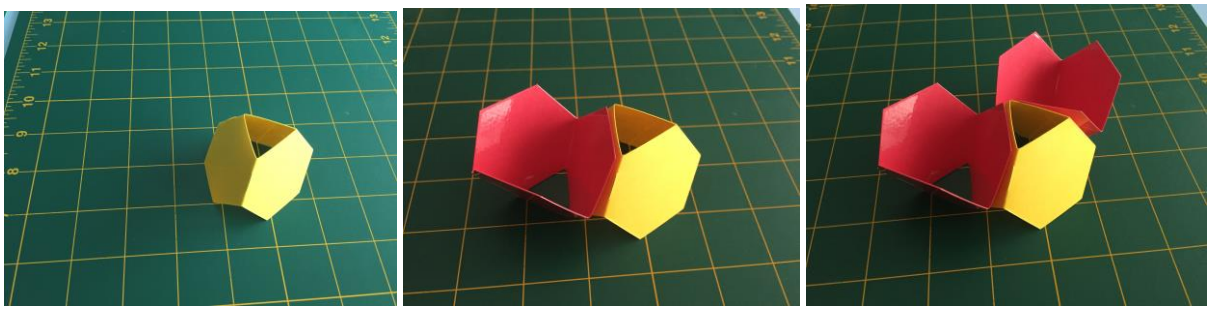
Activity 2

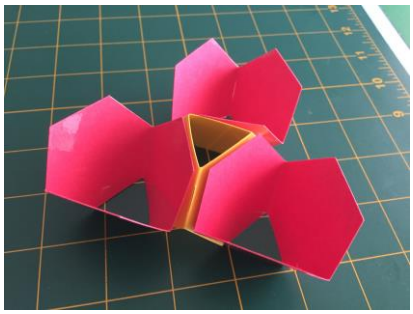


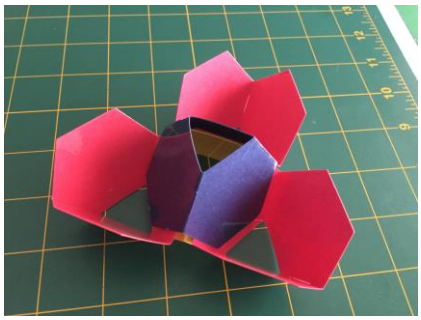
Activity 3



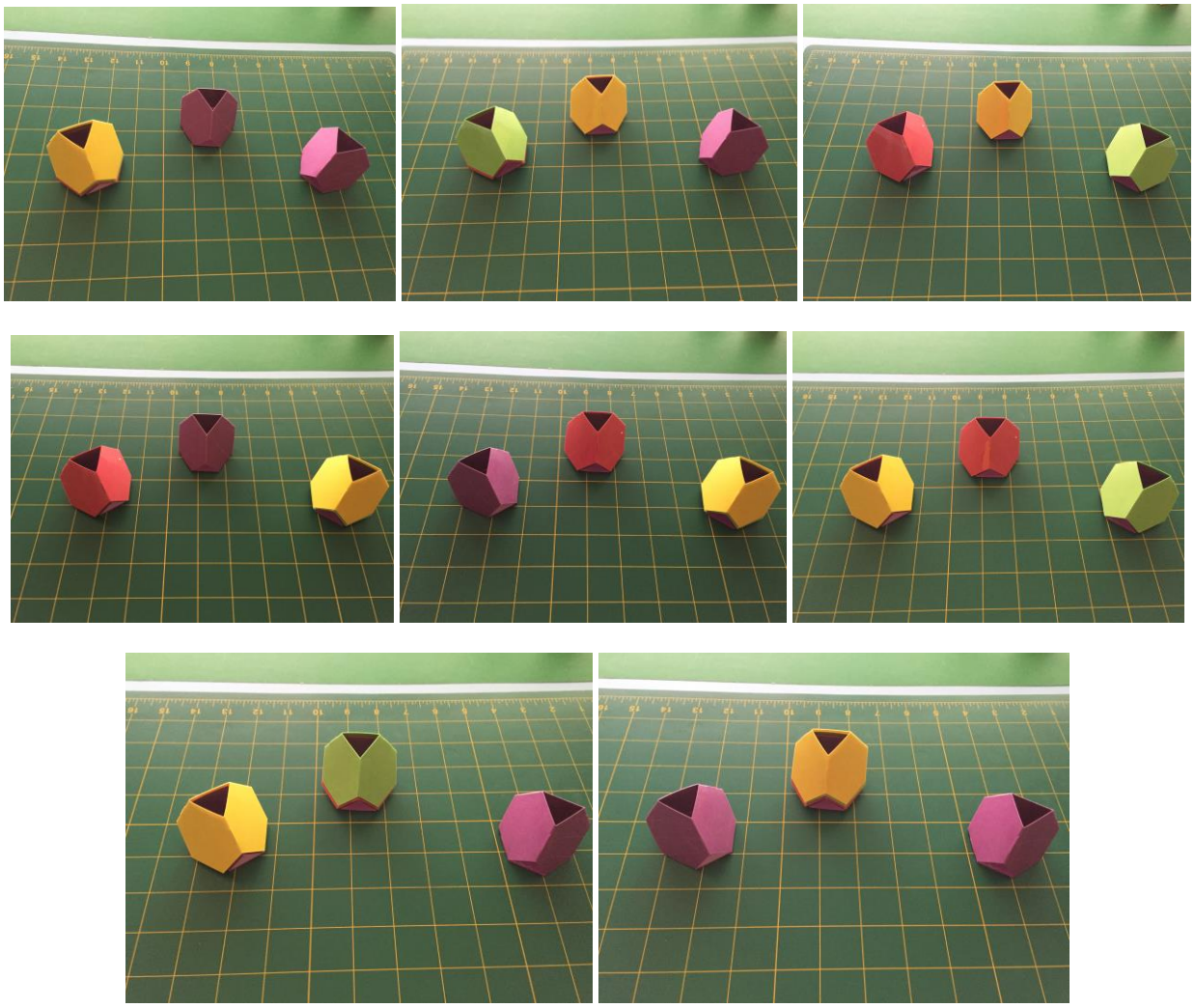
Activity 4



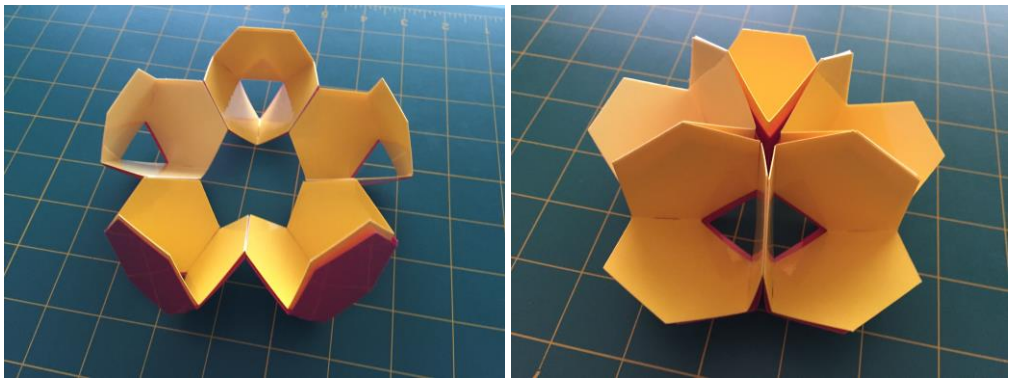




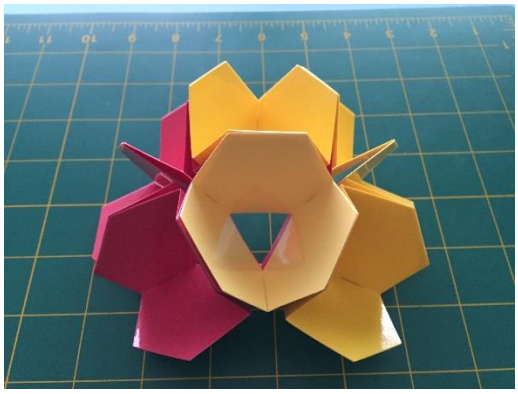
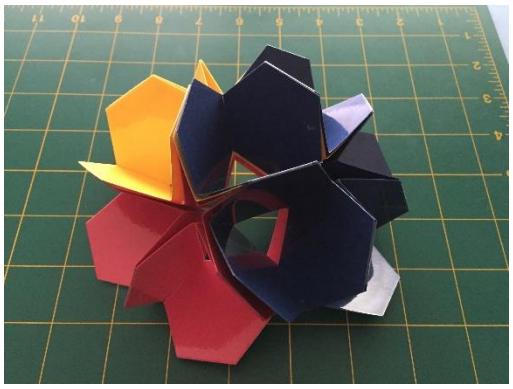
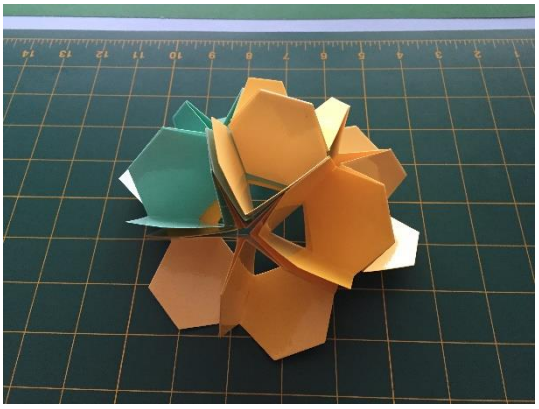
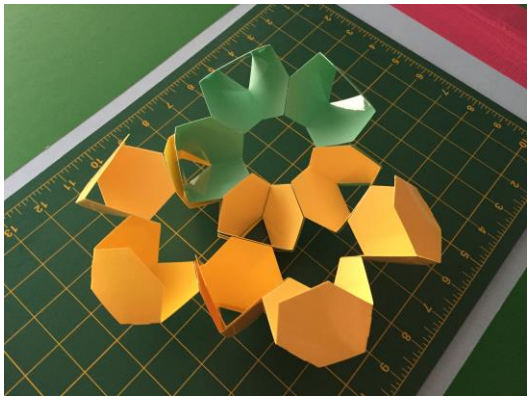
Activity 5



Activity 6



Activity 7

Activity 8