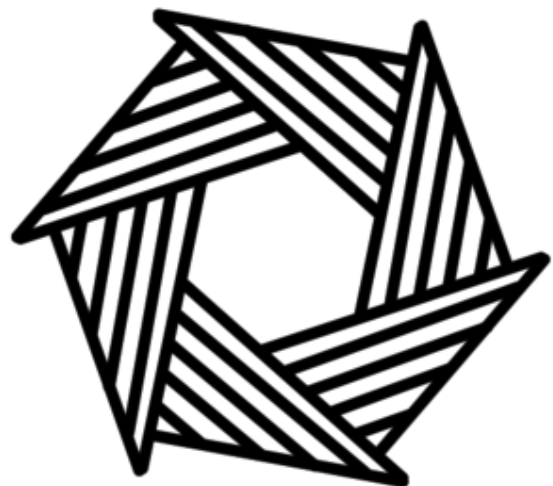
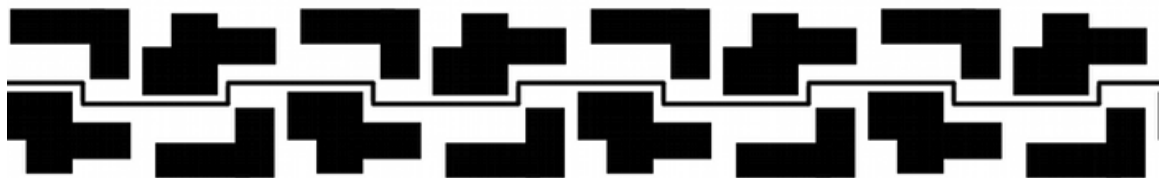


Instructions: This is a “low-stakes” assignment, to be graded on a check/check+/check-basis. You will start working on it in class in a group and can finish it outside of class.

Exercise 1. A few pairs of mirrors will be available to be passed around during class. You should experiment with them to help you understand reflection symmetries. Use **one** mirror to see some reflection symmetries. Two patterns that you’ve seen before are shown below. Try placing a mirror on the line down the middle of the glide-reflection pattern. What do you see when you observe the pattern in the mirror along with the part of the original pattern that is still visible? Do the same thing with the rotation pattern, placing the mirror along a line that runs through the center of the pattern. What do you observe? Then try two mirrors held together at an angle to form a “dihedral” pattern as demonstrated in class. Can you use two mirrors to turn the rotation pattern into a six-fold dihedral pattern? Try placing an asymmetrical pattern between two mirrors. Can you make a dihedral pattern that has both rotation and reflection symmetries? Write a paragraph or two about your observations.



Exercise 2. What are all the symmetries of a perfect circle?

Exercise 3. Suppose that you take a long walk in a straight line over new-fallen snow. What is the symmetry pattern of your boot prints in the snow? Draw a picture and state what symmetries it has. (To get a true symmetry, you have to imagine that your path is extended in both directions to infinity.)

Exercise 4. Consider the 26 letters of the English alphabet written as block upper-case letters. Each letter has its own type of symmetry. Some letters, such as A, have a reflection symmetry through a vertical line. Some have other symmetries. And some have no symmetry at all. Put the 26 letters into groups, where all the letters in a group have the same symmetry pattern. For example, F and R will be in the group containing letters that have no symmetry, and A will be in a group with other letters that have reflection symmetry through a vertical line but no other symmetries. State the symmetries for each group. For a few letters, the answer can depend on exactly how you draw the letter.