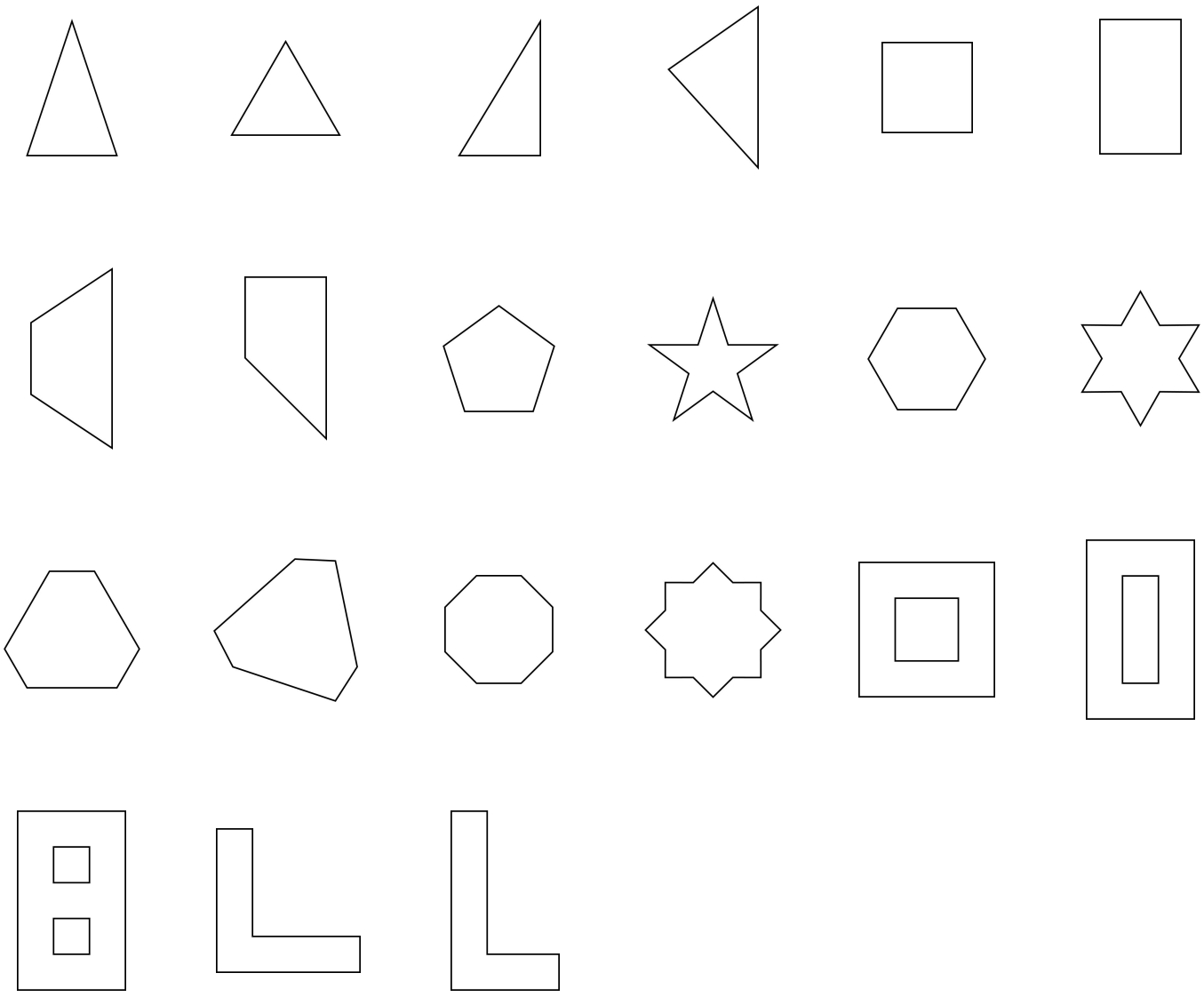
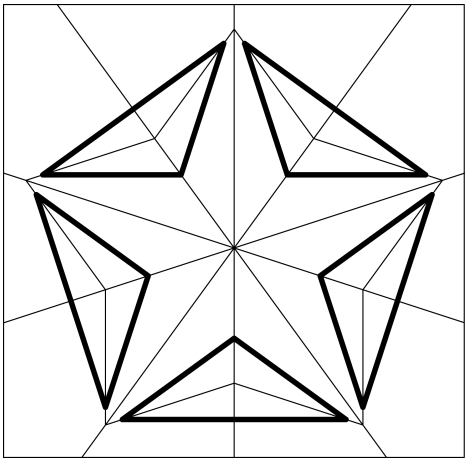
Fold and Cut

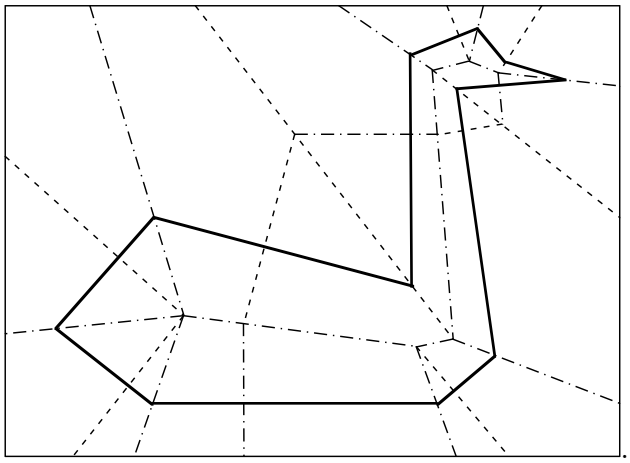
1. Try to make the following shapes by folding and making as few cuts as possible. Which ones can you make with one cut?

   Hint: if you want two lines to lie on top of each other, where should you put the fold line?



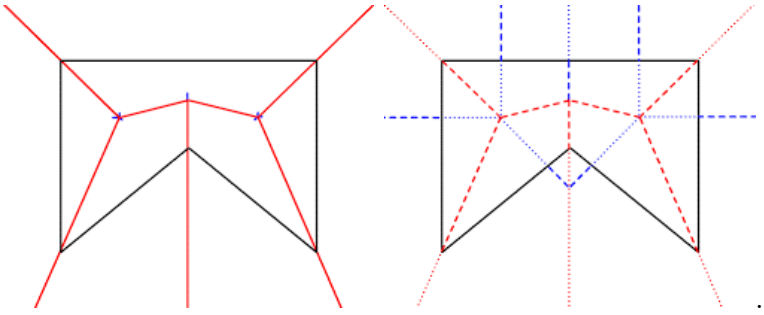
2. Use the fold lines drawn to make the pentagram or swan.





3. How could you generate these fold lines if you only knew the "cut-lines", that is, the outline of the pentagram and the swan?

4. Explain the lines below.



1 Only One Cut

In fact, it is always possible to cut out a polygon shape – even one with holes – with one cut. A good lecture explaining an algorithm for folding is here: Erik Demaine's Lecture 8: Fold & One Cut, Aug 26, 2014

`https://www.youtube.com/watch?v=K0GuKDSX1FA`

Here are the main ideas of one algorithm: the "straight skeleton algorithm".

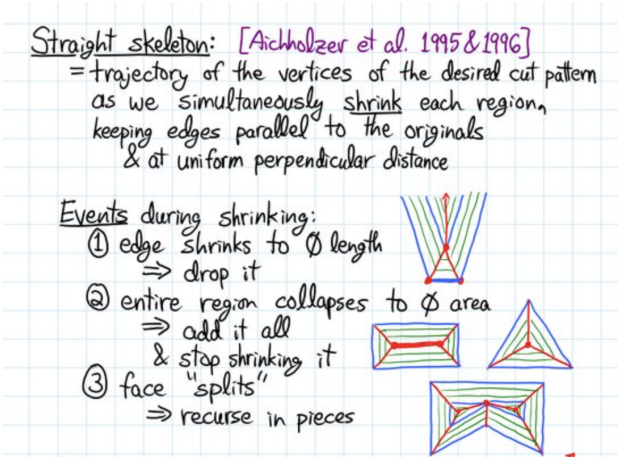
Idea 1: Use angle bisectors to align edges

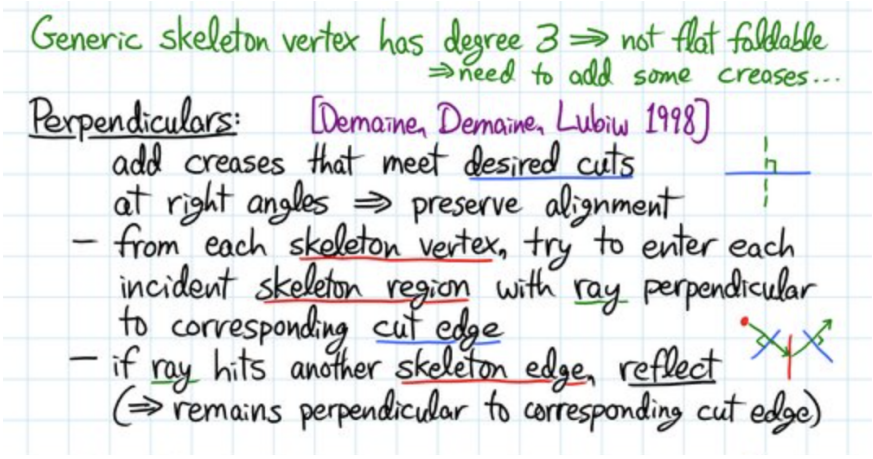
Idea 2: use perp bisector of line to get it to fold flat

Idea 3: Shrink in the cut lines little by little in perpendicular directions. Do the same on the outside of the shape. The trajectories of the vertices form the "straight skeleton" drawn in red for the pentagram, and in dot-dash lines for the swan.

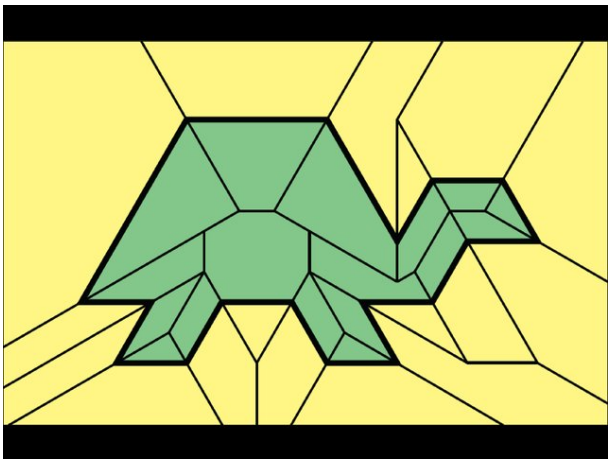
Idea 4: Each region of the straight skeleton will have one cut line (line you want to cut on) inside it.

Idea 5: From each vertex of the straight skeleton, enter each adjacent region of of the straight skeleton in a direction that is perpendicular to its cut line. These lines form the perpendicular-to-cut-line fold lines that are drawn in blue on the pentagram and as dashed lines on the swan.





5. Draw the perpendicular lines on this turtle, where the straight skeleton has already been drawn.



6. Draw the straight skeleton AND the perpendicular lines on some of the shapes from the first page, or on a shape that you have drawn yourself that you want to fold and cut.