6.849: Geometric Folding Algorithms, Spring 2017

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Problem Set 1 Solutions

Due: Wednesday, February 15, 2017

Solve Problem 1.1 and *either* Problem 1.2 or 1.3.

Problem 1.1 [Mandatory, Collaboration OK]. On each problem set, we will ask you to write a problem (solved or unsolved) related to the material covered in class. The problem should be original to the best of your knowledge, so be creative and diverse! Folding can be applied to mathematics, computation, engineering, architecture, biology, and beyond, so write a problem that is related to a field that interests you. If you write a problem whose solution can be solved from the material covered in class, then we may adapt your problem for future problem sets. If you pose a problem whose solution is not yet known, we may try to solve it in class during our open problem sessions, or it may become inspiration for a class project. Feel free to include solutions or commentary for your problem. While writing a problem is required, your submission will be graded generously, so have fun and share with us your exploration of the course material.

Solution: There were many interesting questions asked. Some of the ones more directly related to the material will show up on Coauthor or be used as future in-class problems.

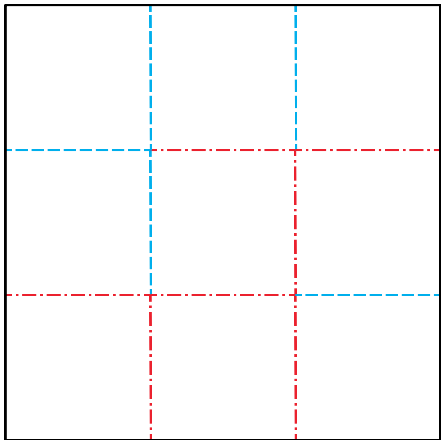
Solve ONE of the two problems below.

Problem 1.2 [Collaboration Forbidden]. For each of the two 3×3 maps linked below,[1] fold along all the creases to obtain a flat packet of 1×1 squares that satisfy the following restrictions. Submit your folded solutions.

(a) Respect the specified mountain-valley pattern.

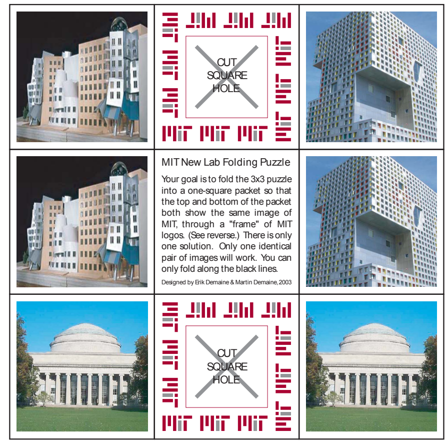
(b) The top and bottom of the packet should both show the same image of an MIT building, through a “frame” of MIT logos. (Only one identical pair of images will work.)

[1] The puzzle in Problem 1.2(b) was handed out in class. If you missed it, follow the link and print the two-sided PDF on a duplex printer. Note that the puzzle has two sides; only the front side is shown here.



(a)

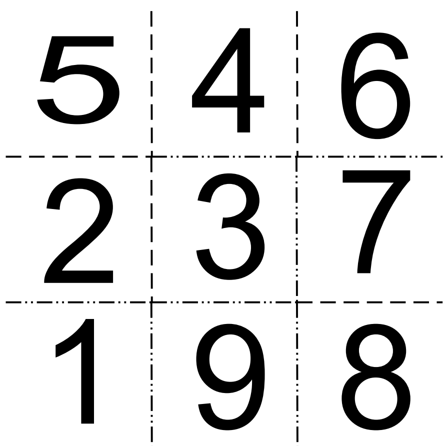
http://courses.csail.mit.edu/6.849/spring17/psets/map_crease_2.pdf



(b)

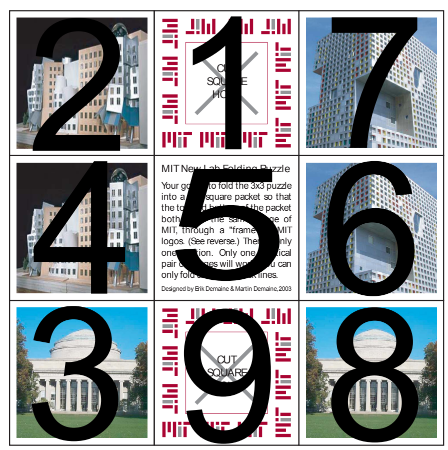
http://erikdemaine.org/puzzles/LCS2003/

Solution: Layering given below. Stata appears in the windows.



(a)

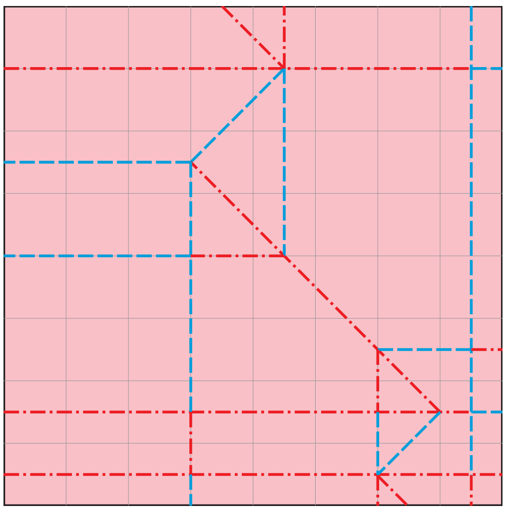
http://courses.csail.mit.edu/6.849/fall12/psets/map_crease_2.pdf



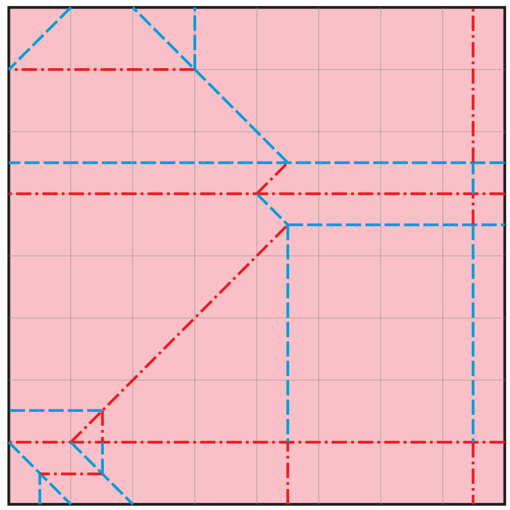
(b)

http://erikdemaine.org/puzzles/LCS2003/

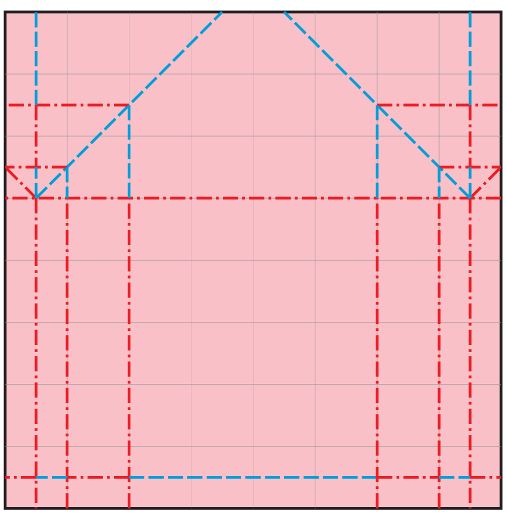
Problem 1.3 [Collaboration Forbidden]. Fold all three red crease patterns below, *or* fold the grey crease pattern (lower right). Submit your folding(s) with your problem set. The red crease patterns increase slowly in complexity and are related to each other. Valley folds are marked with blue, dashed lines, while Mountain folds are marked with red, dash-dot lines. Valley folds will fold the printing to the inside, while Mountain folds will fold the printing to the outside. The gray crease pattern is substantially harder than the others and may provide a challenge to interested students. On the gray crease pattern, Mountain folds are marked with a thick line, while Valley folds are marked with a thin line.



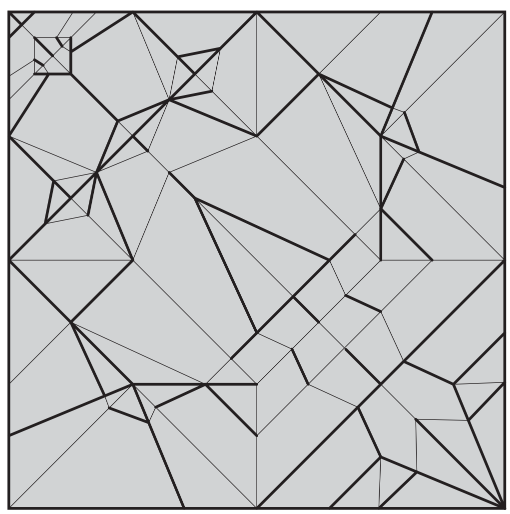
http://courses.csail.mit.edu/6.849/spring17/psets/cp1.pdf



http://courses.csail.mit.edu/6.849/spring17/psets/cp2.pdf

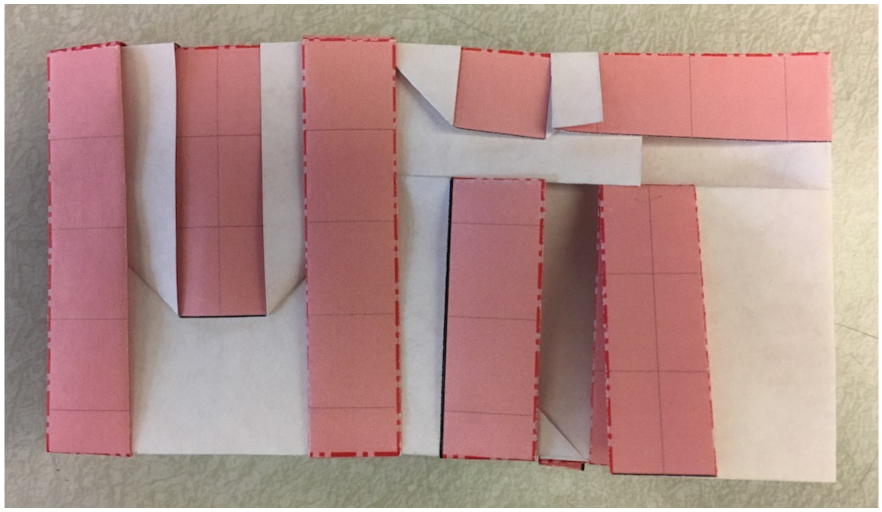


http://courses.csail.mit.edu/6.849/spring17/psets/cp3.pdf

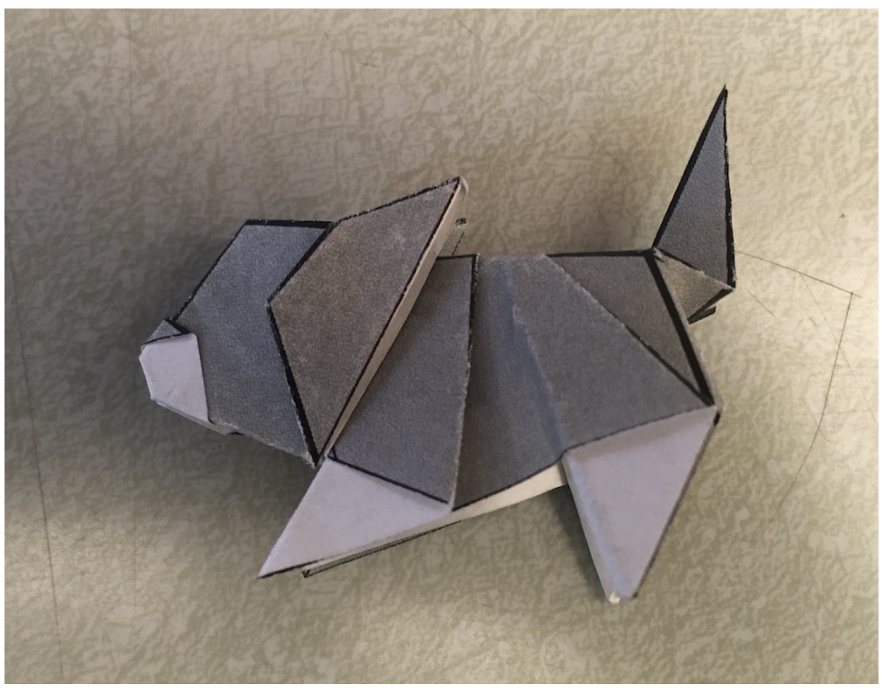


http://courses.csail.mit.edu/6.849/spring17/psets/cp4.pdf

Solution: Below are pictures of the folded crease patterns. The first three fold into the letters 'M', 'I', and 'T' respectively. The last crease pattern folds into a kitten.



http://courses.csail.mit.edu/6.849/spring17/psets/MIT_cp.jpg



http://courses.csail.mit.edu/6.849/spring17/psets/Kitten_cp.jpg