MA 323 **3/26/01**

Combinatorial Geometry
Sexy Problem Set Number Six
do any two

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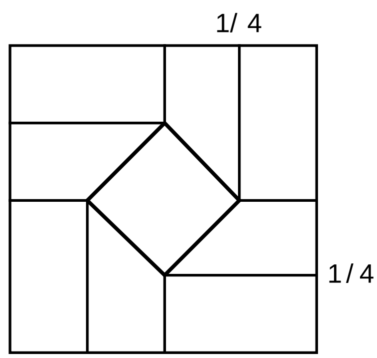
(1) Prove, without using Maekawa's Theorem, that if a collection of creases meeting at a vertex can fold flat, then there must be an even number of creases. (Hint: pretend you're an ant.)

(2) We've seen Kawasaki's Theorem. How about the converse? That is, suppose you're given a single-vertex crease pattern, and the Kawasaki equation for the angles holds. Are we guaranteed that it is flat foldable?

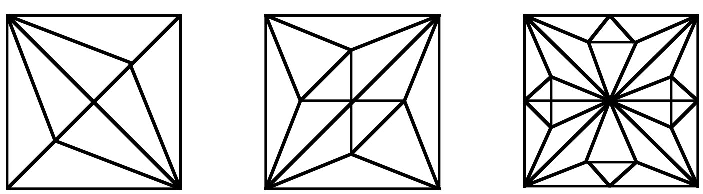
(3) Consider the configuration of creases shown below. Can they fold flat? How many different ways can you collapse it? (I.e., how many different ways can the creases be made mountain or valley?)



(4) Below are shown the crease patterns for the fish base, bird base, and frog base.

(a) Is there a relationship between these bases? Can you see a pattern in their progression?

(b) What base should come "next" in this progression? Draw what the crease pattern would look like. (You can try to fold one too, but that might be hard.)



(5) How many ways are there to assign the mountain and valley creases to make the following vertex fold flat? State your reasoning. (You might want to photocopy the below picture, cut it out, and try folding that.)