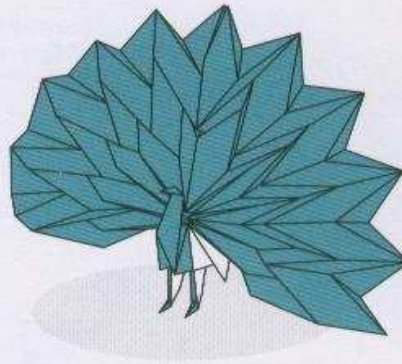


Peacock

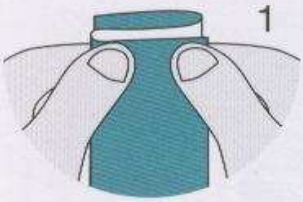
Theme: Miura-ori; Tessellation

Fold using 6" (15 cm) or preferably larger origami paper.



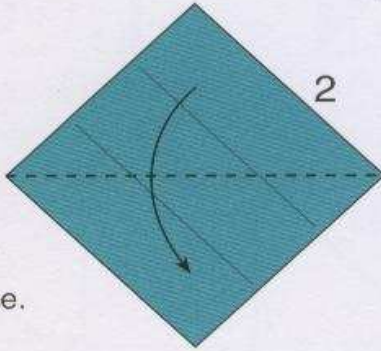
I present you two types of this model. First fold *Peacock 1*, with fewer pleats, as a warm-up, then proceed to *Peacock 2*, which is a more advanced model with twice as many pleats.

Peacock 1

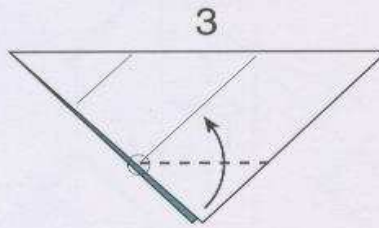


1

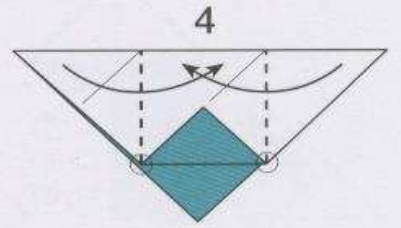
Divide the side into three.



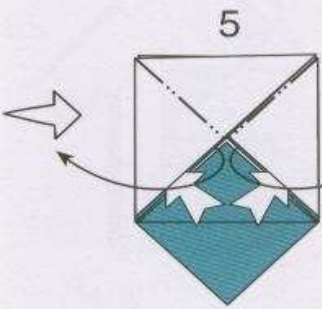
2



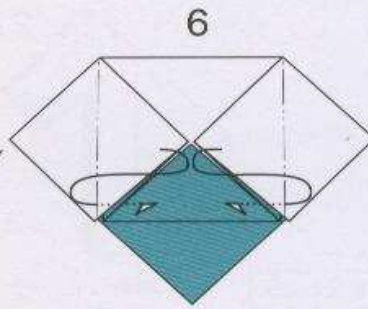
3



4

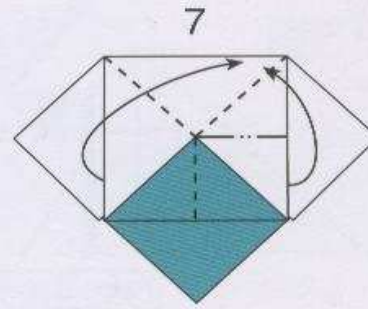


5



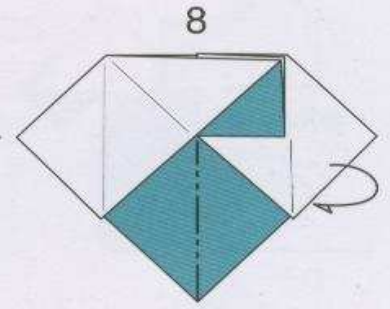
6

Reverse the mountain and valley creases.

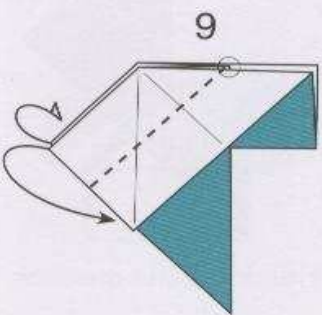


7

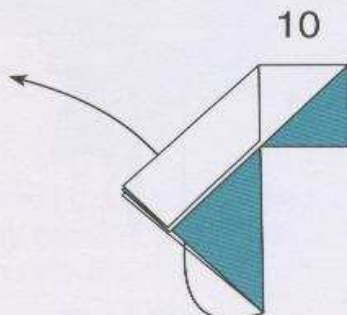
Rabbit-ear-fold



8

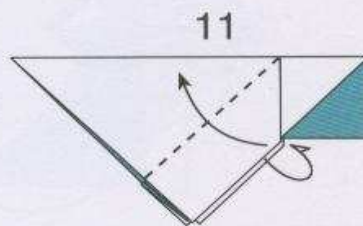


9

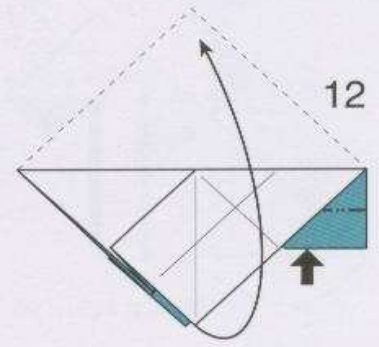


10

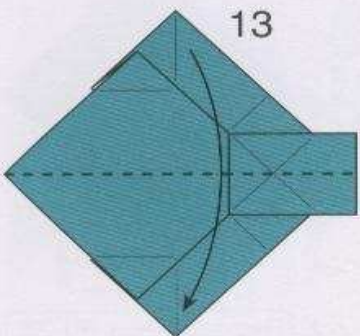
Inside reverse-fold



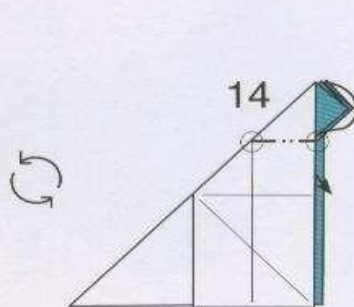
11



12

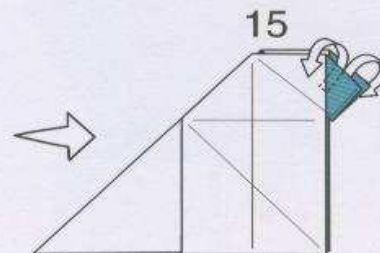


13



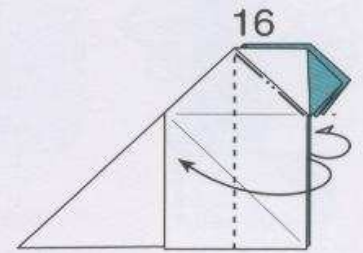
14

Inside reverse-fold

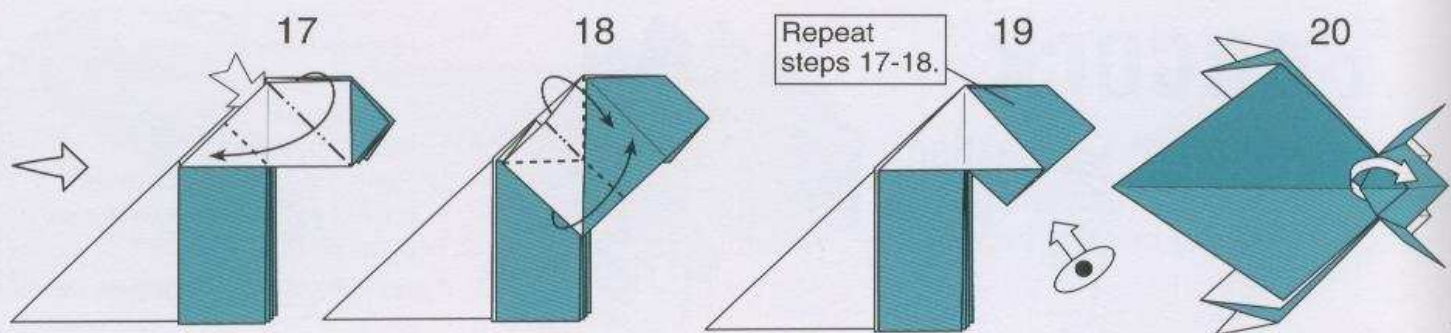


15

Reverse like an outside reverse fold.

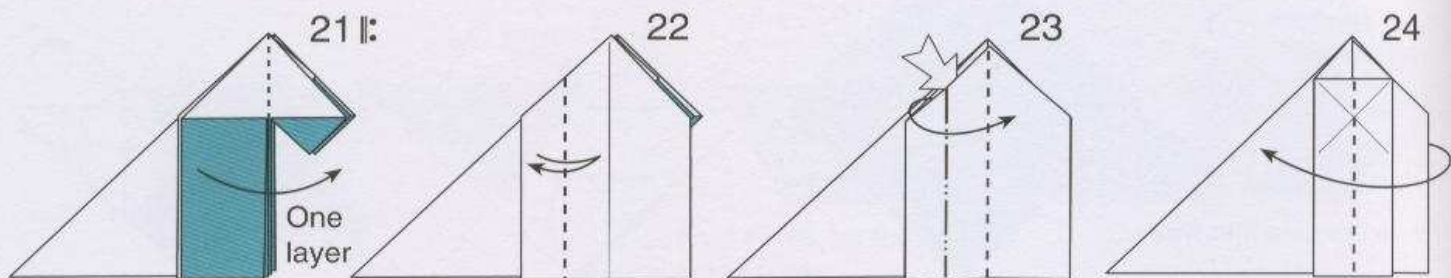


16



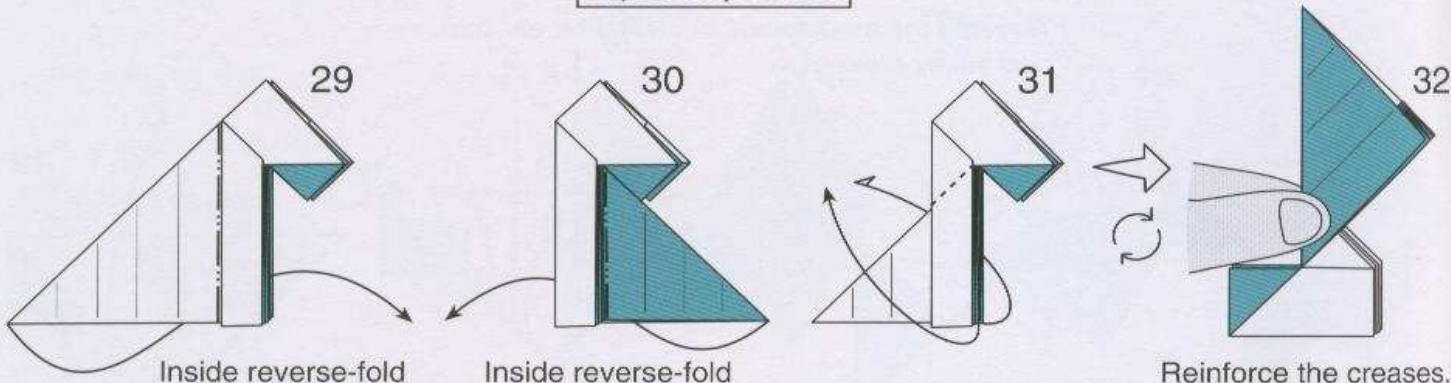
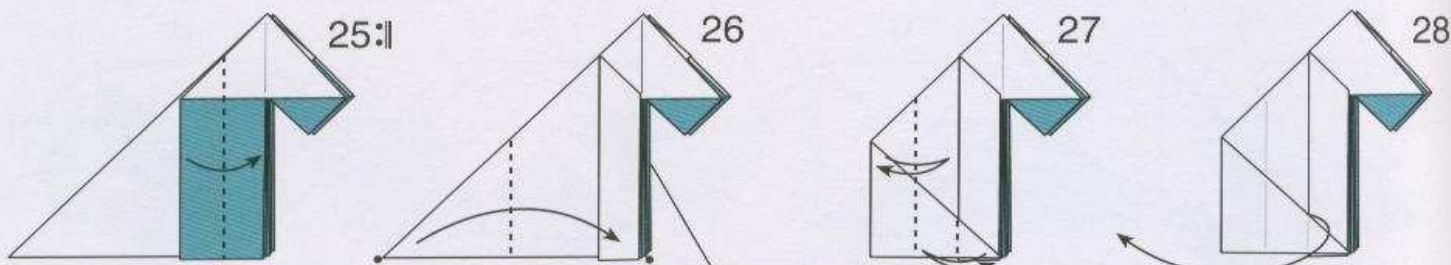
Repeat steps 17-18.

Flip the flap to the other side.



One layer

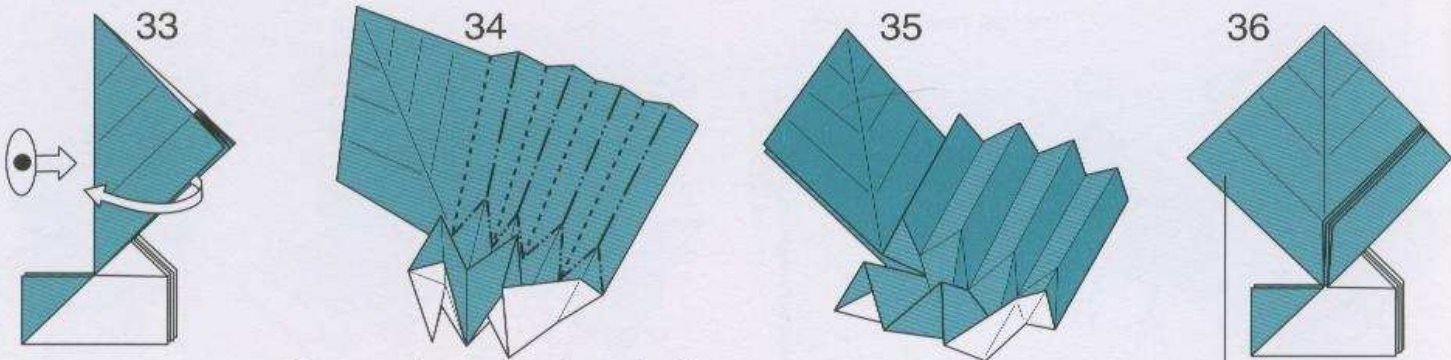
Repeat steps 21-25.



Inside reverse-fold

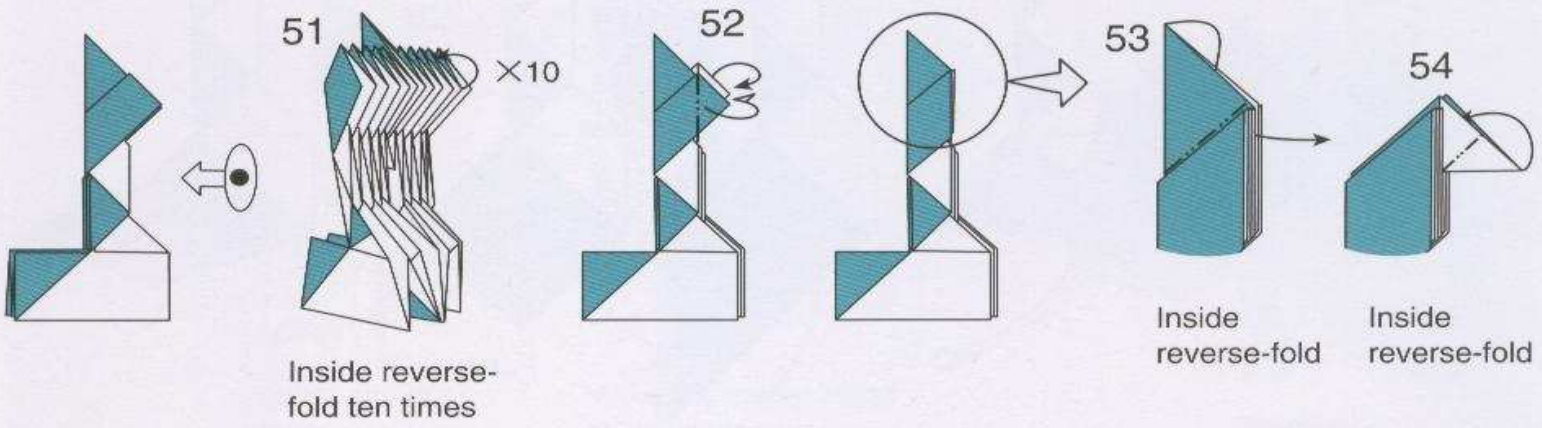
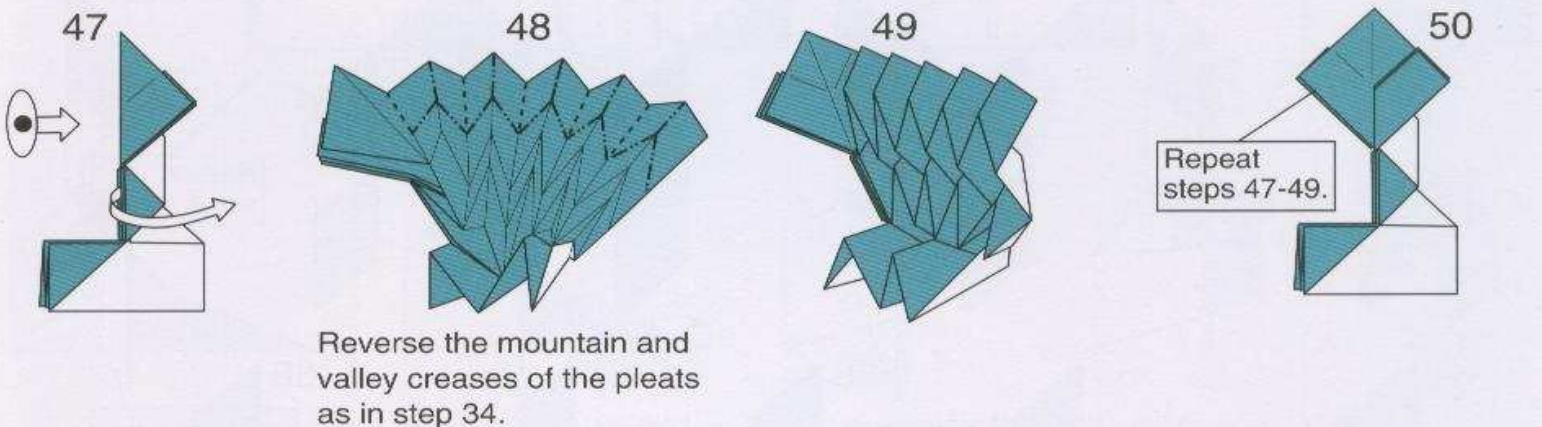
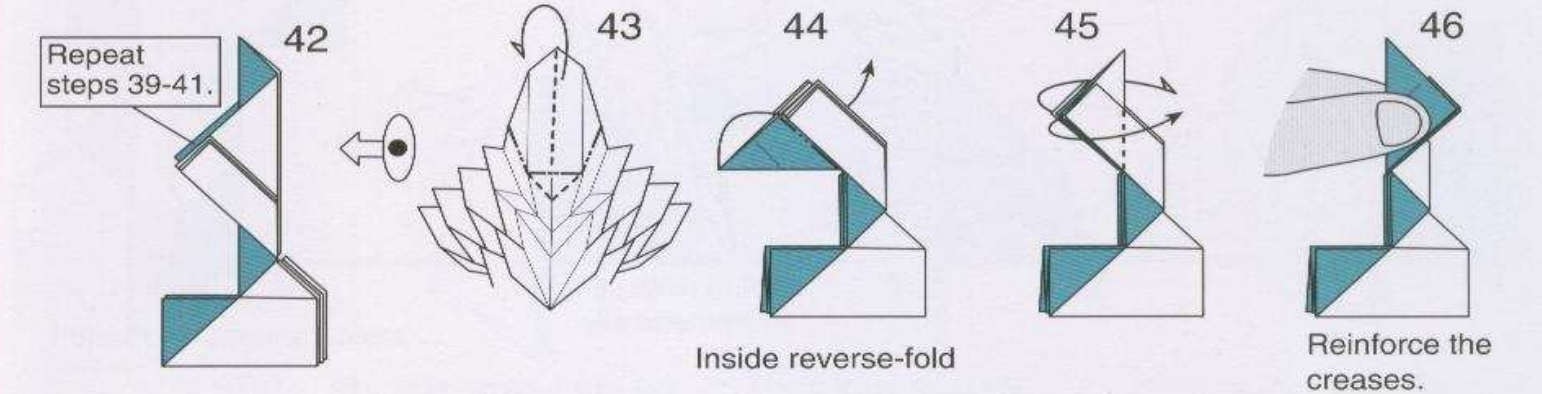
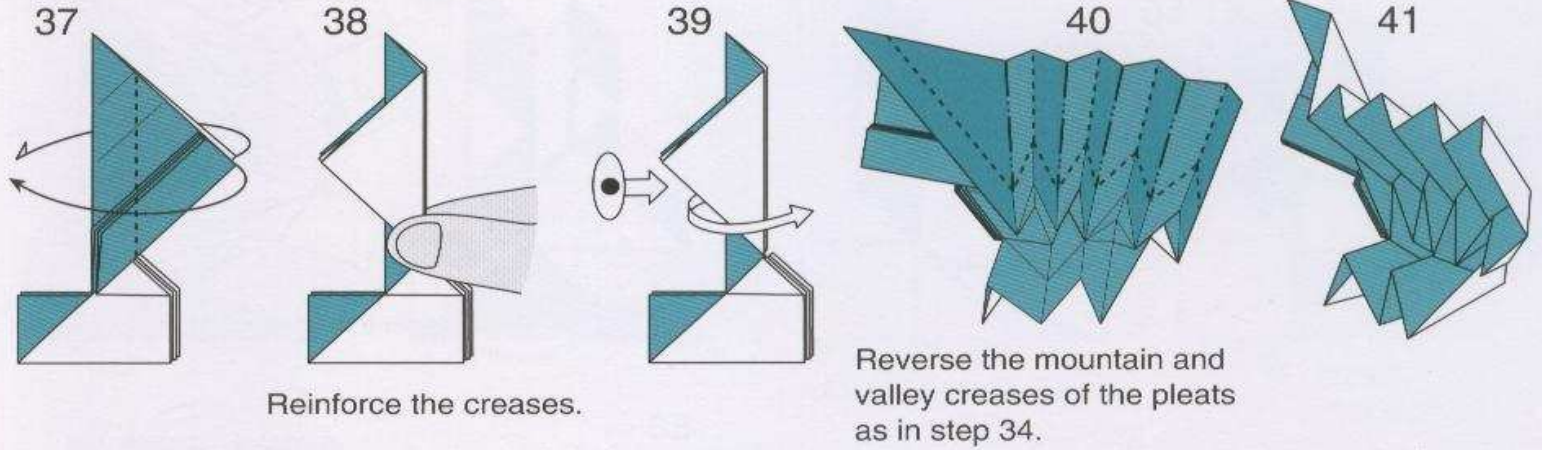
Inside reverse-fold

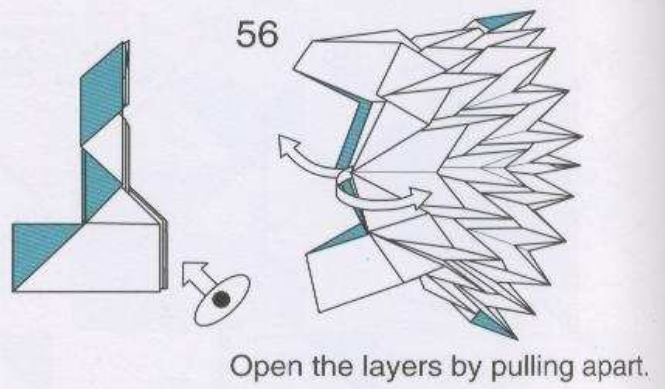
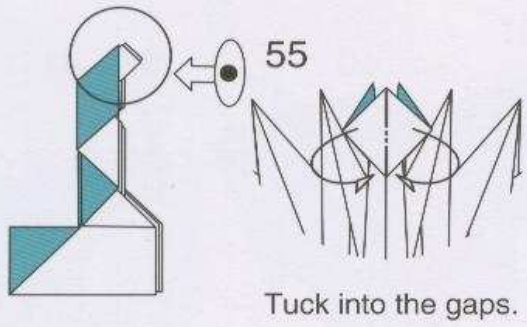
Reinforce the creases.



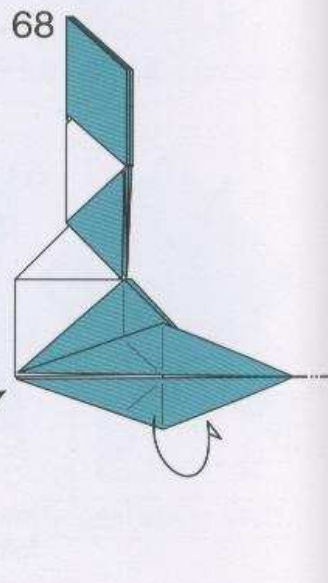
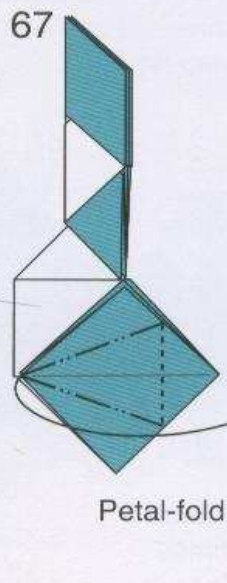
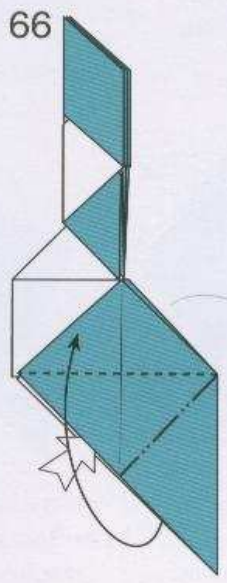
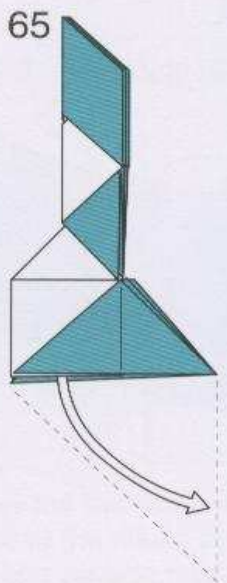
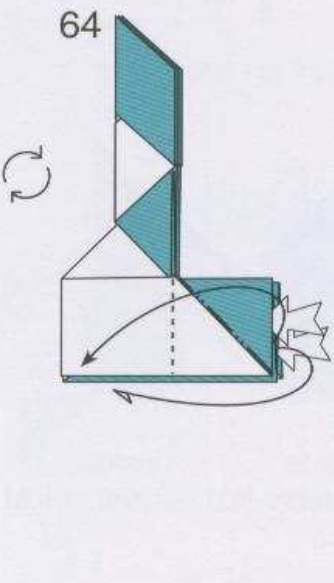
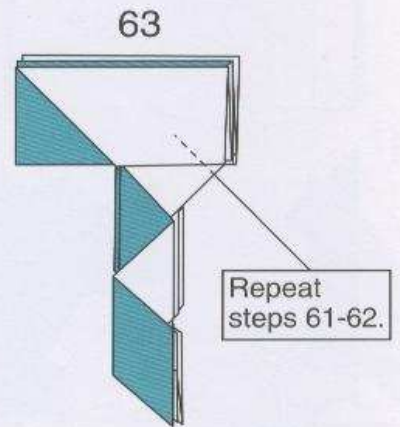
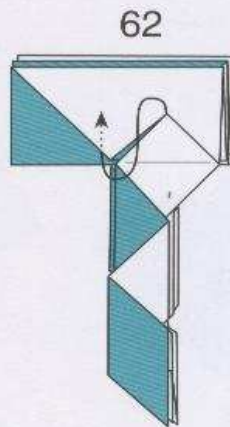
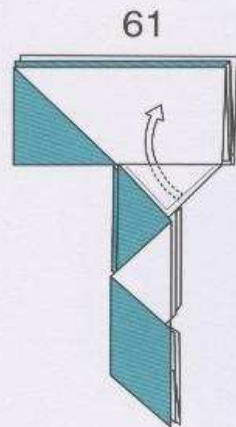
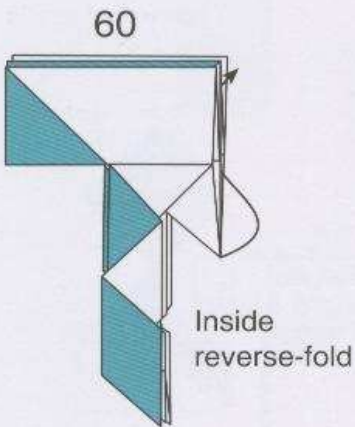
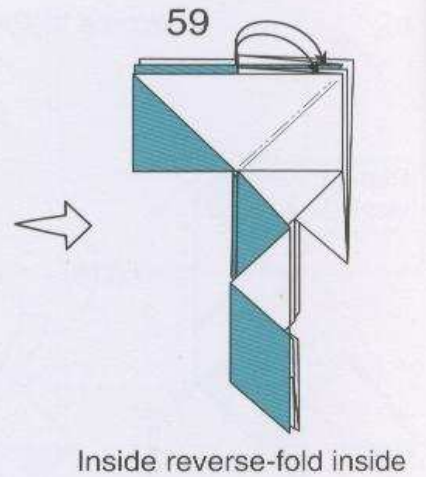
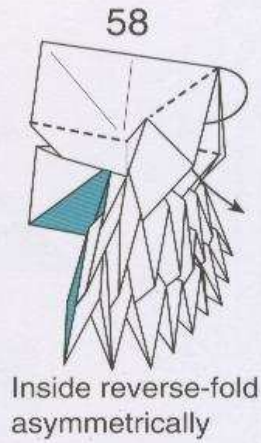
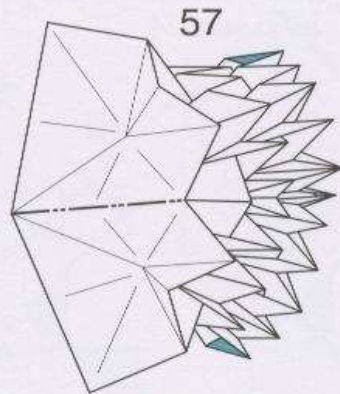
Reverse the mountain and valley creases of the pleats by a series of inside and outside reverse folds.

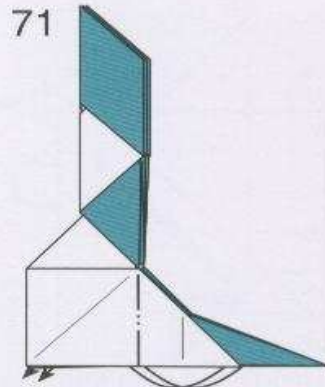
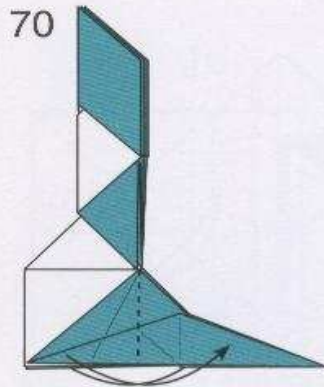
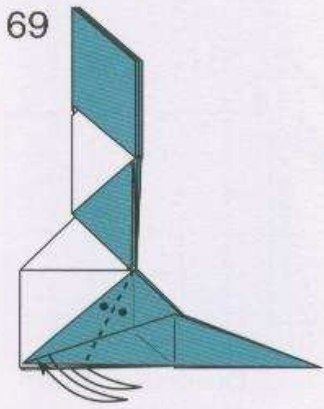
Repeat steps 33-35.



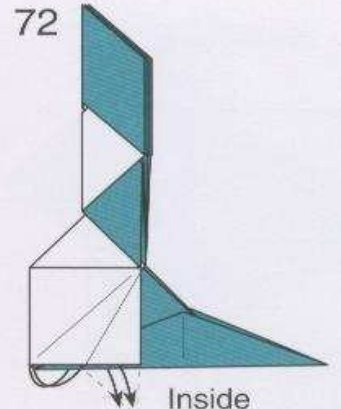


Lock the root of the fan in steps 56-58.

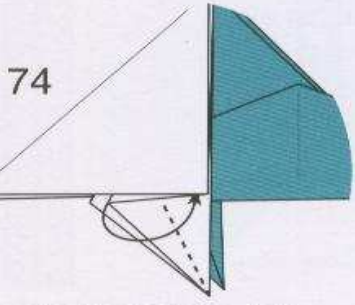
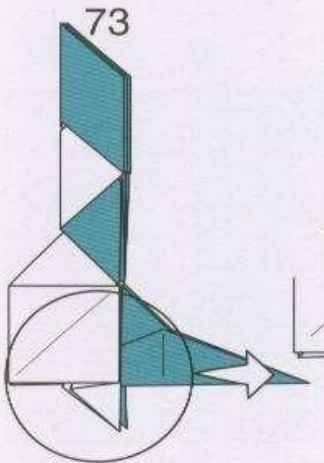




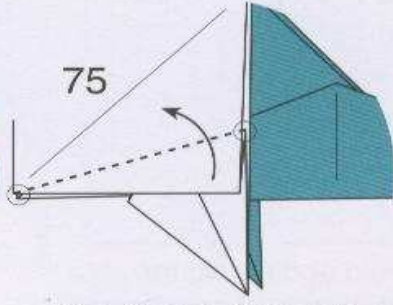
Inside reverse-fold



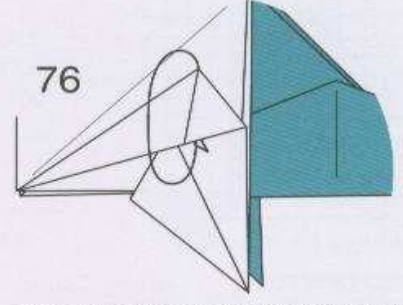
Inside reverse-fold



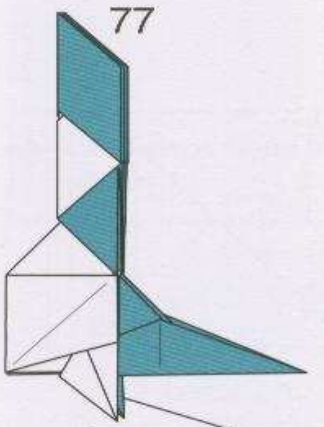
Inside reverse-fold



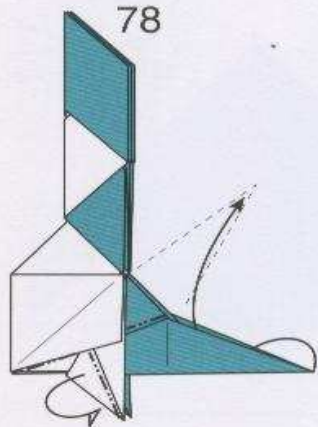
The crease does not bisect the angle.



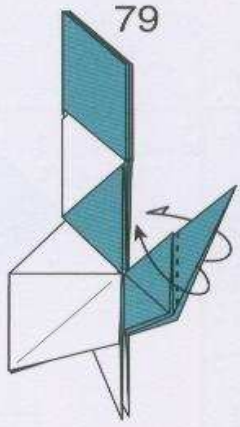
Reverse the valley fold made in step 75 to mountain.



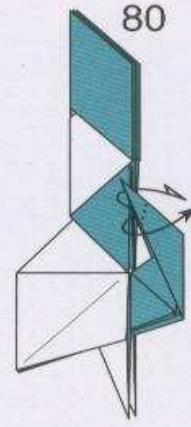
Repeat steps 74-76.



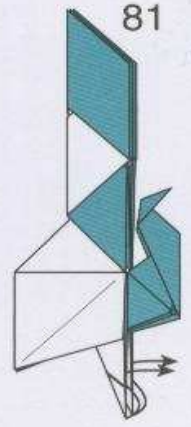
Inside reverse-fold



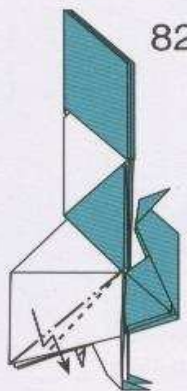
Outside reverse-fold



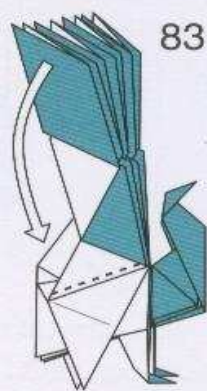
Outside reverse-fold



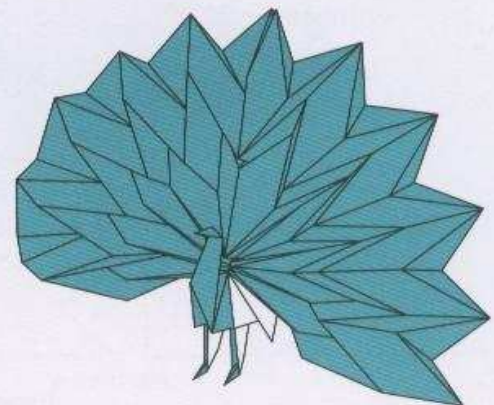
Inside reverse-fold



Crimp the outer layers only.

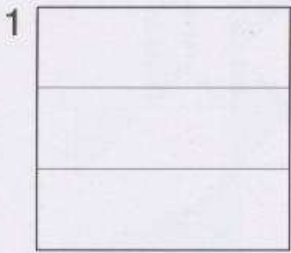


Make the model stand on its wings and legs.

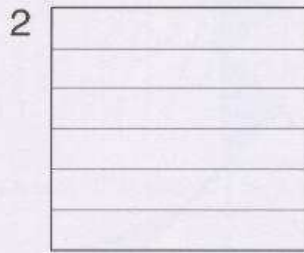


Finished.

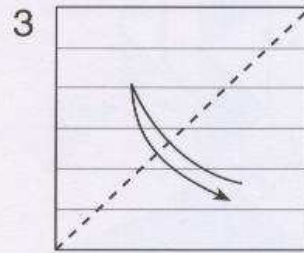
Peacock 2



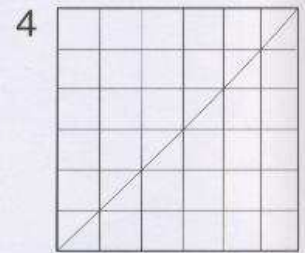
1 Divide the side into three.



2 Divide the side into six.

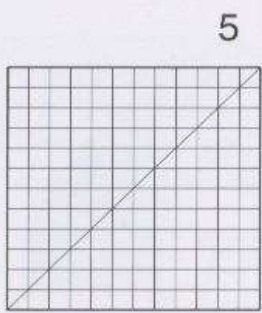


3



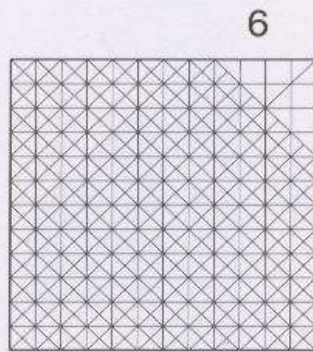
4

Divide the other side into six.



5

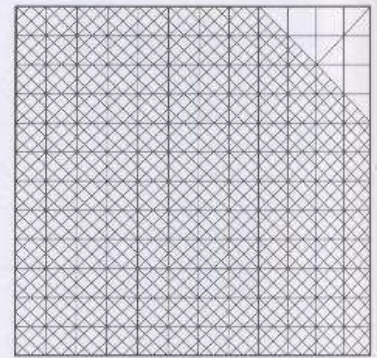
Divide both sides into twelve.



6

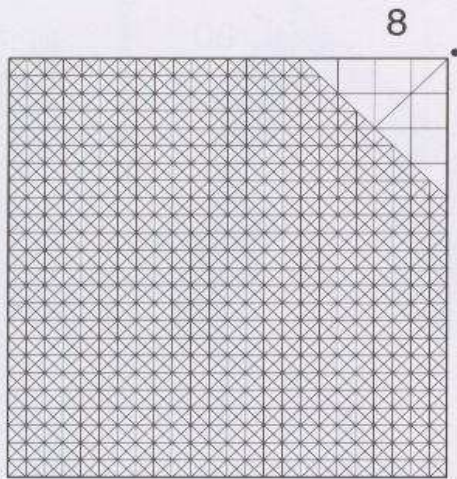
Fold and unfold the diagonals of small squares.

Don't crease in this area.



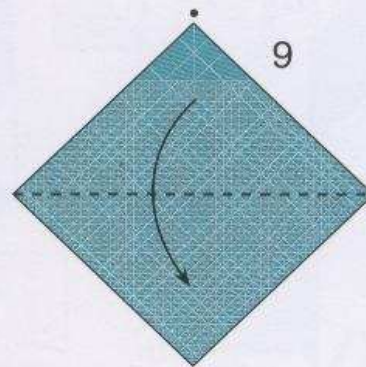
7

Fold and unfold more diagonals in half.



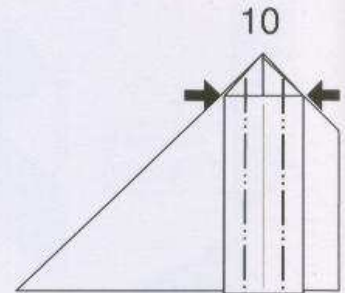
8

Fold and unfold horizontally and vertically in half.



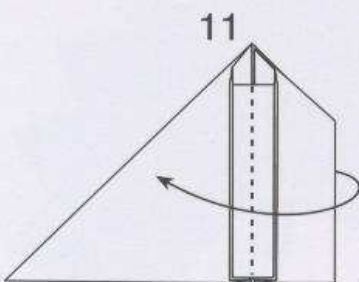
9

Repeat steps 2-24 of Peacock 1.

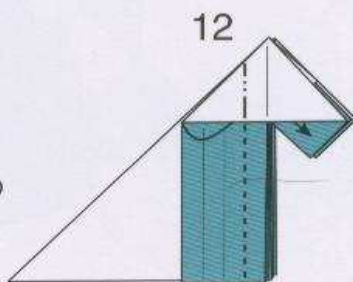


10

Closed-sink

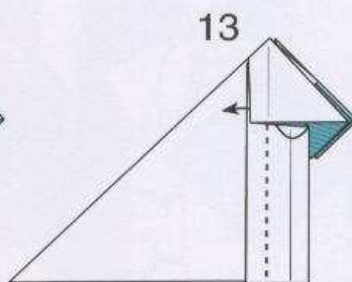


11



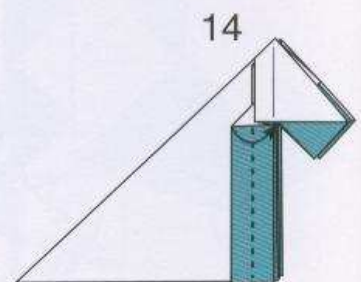
12

Inside reverse-fold



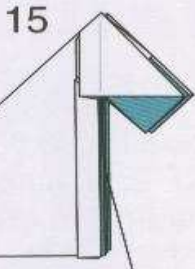
13

Inside reverse-fold

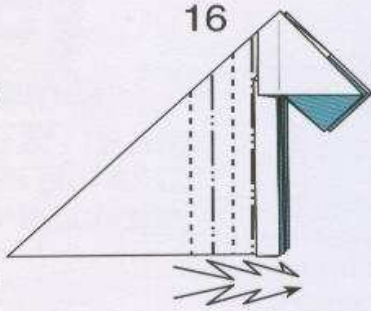


14

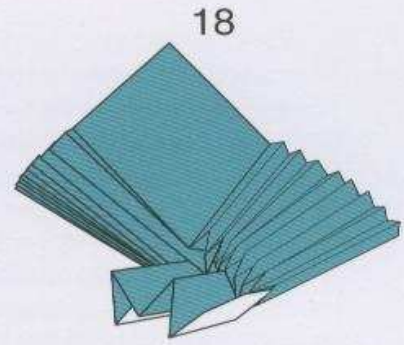
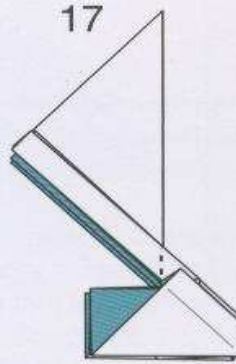
Inside reverse-fold



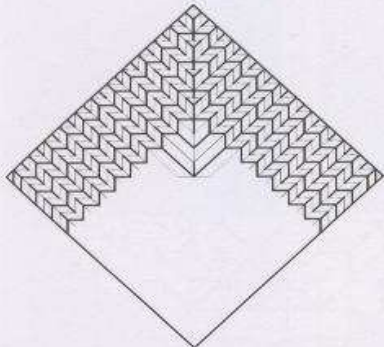
Repeat steps 10-14.



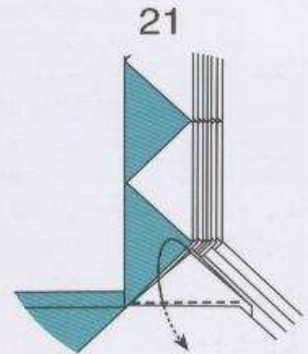
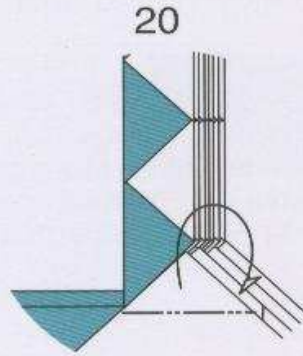
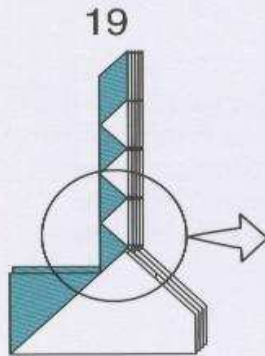
Inside reverse-fold four times



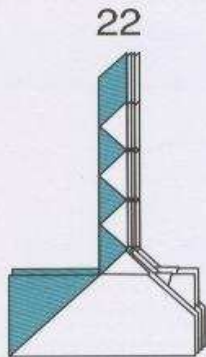
Repeat steps 34-55 of Peacock 1.



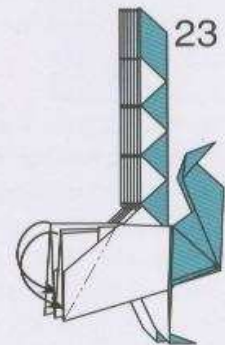
The crease pattern for steps 18-19



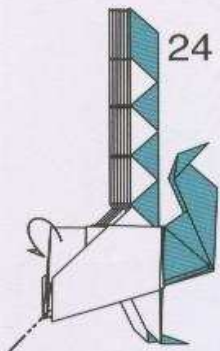
Repeat steps 56-60 of Peacock 1.



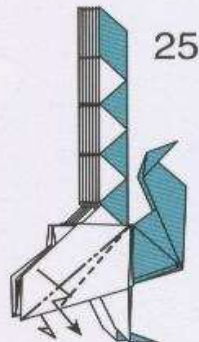
Repeat steps 64-81 of Peacock 1.



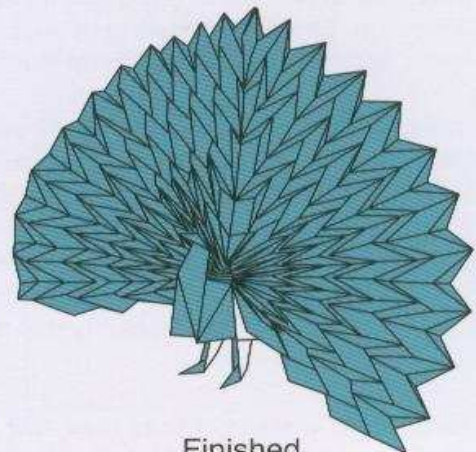
Inside reverse-fold the flaps on both sides



Tuck in the center layer.



Crimp the outer layers (wings) only, so that the model stands on its wings and legs.



Finished.

Miura-ori and tessellation

The tail of *Peacock* has the same structure as **Miura-ori**, a crease pattern devised by Koryo Miura. Though the angles are different, compositions of mountain and valley creases are the same.

Although well known for map folding, Miura-ori was originally invented in space engineering technology to transport a large flat structure (such as an antenna, a solar panel, or a solar sail that receive the pressure of particles emitted from the Sun) into outer space. This structure is technically called **developable double corrugation surface** because it can be easily developed onto a plane.

This crease pattern itself had been used in lampshades and other designs before Miura started studying it and revealed its significance in engineering technology.

I designed, without the knowledge of Miura-ori, an earlier version of *Peacock* that has a similar crease pattern in its tail. It was folded from a rectangle. After learning and analyzing the Miura-ori, I came up with the idea of placing two sets of Miura-ori in different orientations within the square and connecting them at the right angle, thus resulting into this model.



As I discussed about the use of cuts in origami at the end of **Varieties of Origami**, models that use crease patterns that can be repeated infinitely, as with Miura-ori, are the ones that we can call true origami "with no cuts."

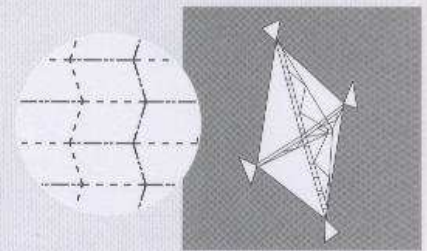
So, what will happen if we fold an infinitely large sheet in Miura-ori? The structure is called "double corrugation" because of the combination of horizontal and vertical pleats. But those two types of pleats are different. As you can see in the tail of *Peacock*, the sheet will be narrowed in one direction but become only slightly shorter in the other. When applied in engineering, it will be packed more compactly because the angles are closer to the right angle than 45° and 135° of *Peacock*. Still, because of the difference between the directions, the sheet becomes oblong when folded.

The difference also appears on the crease pattern. That can be eliminated by using two types of parallelograms, instead of one as in original Miura-ori. The first modeling of such extended Miura-ori is, as far as I know, **MARS** by Paulo Taborda Barreto.

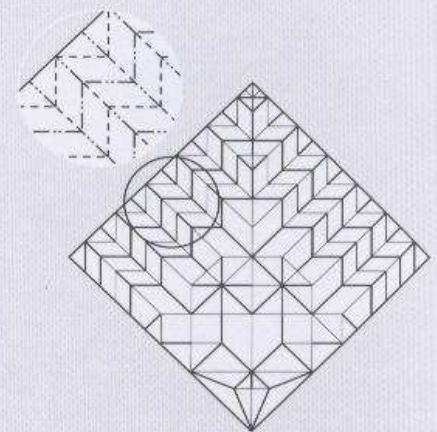
For example, we can use squares and parallelograms whose angles are 60° and 120° . Then the folded pattern extends in all directions, though there is still a little difference between directions.

A pioneer of such tiling crease pattern, or **origami tessellation**, is Shuzo Fujimoto. He calls it "hira-ori", or flat-weaving, because folded patterns look as if it is woven. Recently it is also applied to the design of scales and other patterns.

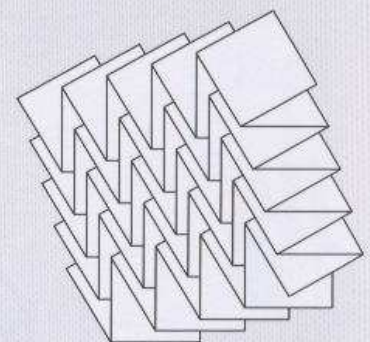
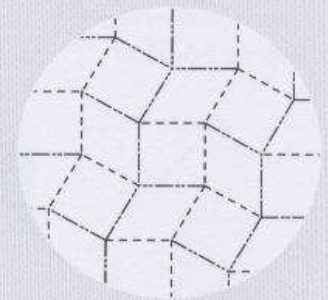
Note that Miura-ori is also iso-area (see *Gift Box*).



Miura-ori by Koryo Miura



Peacock



Extended Miura-ori: MARS by Paulo Taborda Barreto