Silver Fir

Designed by David Mitchell

Silver Fir is a very simple, but fun to make, multiple sheet design. It is made in layers from units folded from a series of successively smaller squares - each one half the size of the one before - which are all cut from a single silver rectangle.

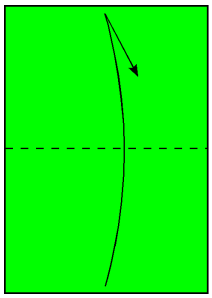
The picture shows a tree with eight layers folded from a single sheet of A4 paper.

The design also has some interesting mathematical properties.

Silver Fir was designed in 2019. It qualifies as a semi-naïve design.

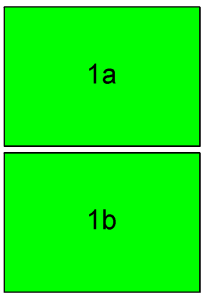
You will need a single silver rectangle of paper, preferably the same colour on both sides. A4 is a sufficiently good approximation of a silver rectangle to be used for this purpose.

1



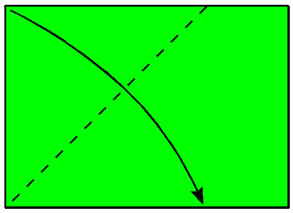
1. Fold in half downwards, then unfold

2



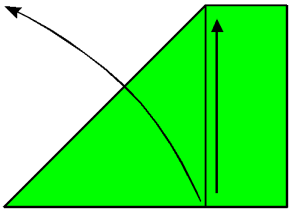
2. Cut along the horizontal crease to separate the two halves,1a and 1b. Both of these halves are also silver rectangles. Set aside rectangle 1b for now.

3



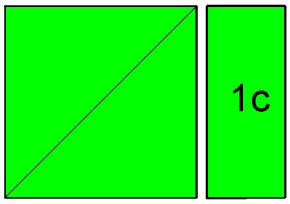
3. Fold the left edge of rectangle 1a onto the bottom edge as shown.

4



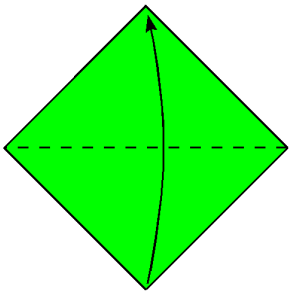
4. Cut upwards alongside the right edge of the front layer to separate the right hand portion of the paper from the rest. When you have done this open out the fold you made in step 3.

5



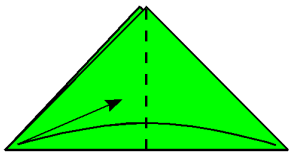
5. Discard portion 1c （which is a leftover rectangle ）.

6



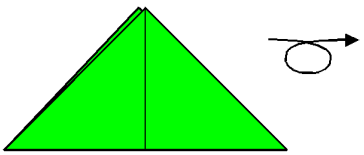
6. Arrange the square like this and remake fold 3 in an upward direction.

7



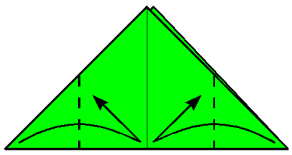
7. Fold in half sideways, then unfold.

8



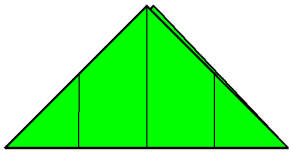
8. Turn over sideways.

9



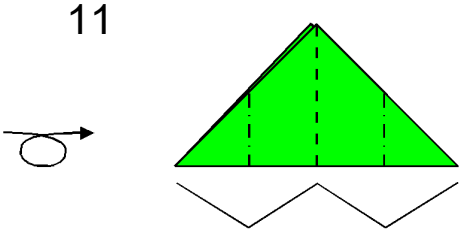
9. Fold both outside bottom points into the centre, then unfold.

10



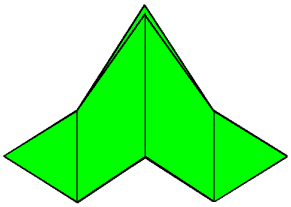
10. Turn over sideways.

11



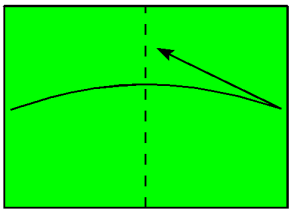
11. Use the existing creases to fold the paper into a zigzag form.

12



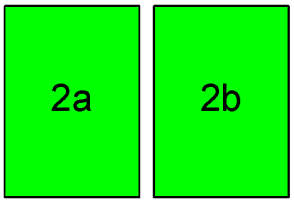
12. The bottom layer of the Silver Fir is finished.

13



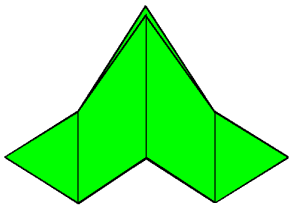
13. Now take rectangle 1b, that you set aside earlier, fold it in half sideways, then open out.

14



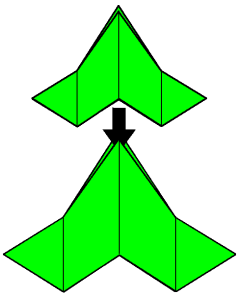
14. Cut along the vertical crease to separate the two halves,2a and 2b. Both of these halves are also silver rectangles. Set aside rectangle 2b for now. Take rectangle 2a and follow steps 3 to 12 to create the second layer. Continue the process of using the piece set aside to create another layer until the pieces become too tiny to handle.

15



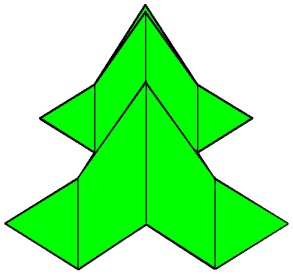
15. The first unit you made will form the base of the tree.

16



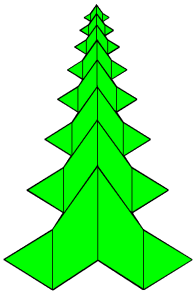
15. Open the layers at the top of the unit and insert the second unit in between the layers of the first as far as it will go.

17



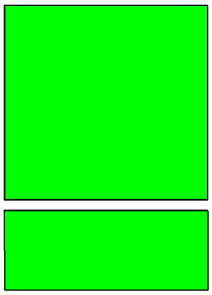
17. The result will look like this. Continue adding units / layers in the same way until your Silver Fir is complete.

18



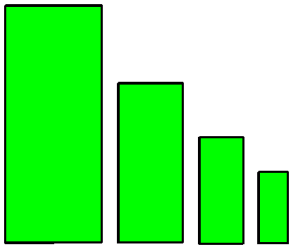
18. This picture show what an eight layer Silver Fir will look like. You should be able to achieve at least eight layers from an A4 sheet of paper.

19



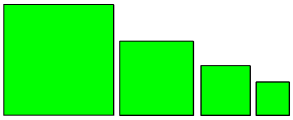
19. If you had divided the silver rectangle you started with into the largest possible square and a leftover rectangle, the area of the square should be equal to the total area of all the squares used to make a Silver Fir with a never ending number of layers, while the leftover rectangle should be equal to the total area of all the paper cut away and discarded during the process of making it.

20



19. All the discarded pieces are leftover rectangles, each one being half the size of the one before. If you call the area of the first one 1/2, the next 1/4, the next 1/8 and so on and add their areas together you will end up with a sequence that goes 1/2, 3/4, 7/8, 15/16. 31/32, 63/64, 127/128 and so on. Each successive fraction in the sequence gets closer to 1 (which is the area of the leftover rectangle shown in picture 19) without ever, quite, getting there, however long the sequence is continued.

21



21. You can do exactly the same thing with the areas of the successively smaller squares used to make the tree itself. In this case, of course, 1 is the area of the large square shown in picture 19.