Sierpinski Triangle Algorithmic Knitting

Skills and Experience ●●●○○

This is a knitting project using double-sided knitting. Once you have learnt how to do double-sided knitting it's actually very easy!

How it relates to maths

A Sierpinski triangle is a type of fractal. It is an equilateral triangle where if you zoom in to the top quarter of the triangle you see exactly the same pattern as the original triangle. This sequence repeats forever, so it is impossible to draw it all, but we can draw something which gives the idea of the fractal.

An algorithm is a set of rules which, if followed exactly, generates a known outcome. There are various algorithms which can be used to create a Sierpinski triangle. The following is the one used for this knitted rectangle:

The middle square of the first row has been shaded in. In each subsequent row, each square touches two squares in the previous row. If these two squares are the same colour, leave the square unshaded. If the two squares in the previous row are different colours, shade the square in. Copy the grid and try it!

I learnt double-knitting from tutorials on YouTube and the best descriptions I came across were from my knitting hero, the Sockmatician. This chap is a practical knot theorist who really understands the underlying shapes of knitting. If you want to learn to cast on, knit, have tidy edges and cast off with double-knitting I can recommend you search YouTube for "Sockmatician double-knitting". If you haven't done any double-knitting before, I would suggest you find two balls of contrasting yarn and make a test rectangle before you try to make a Sierpinski triangle.
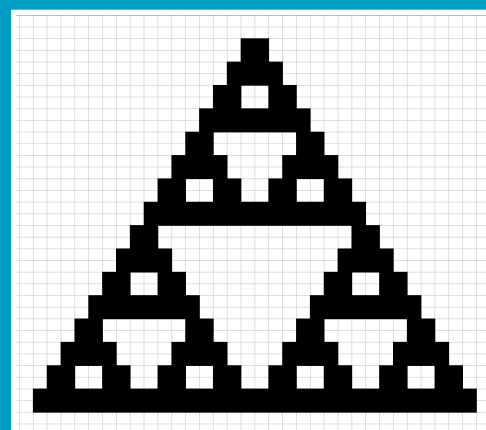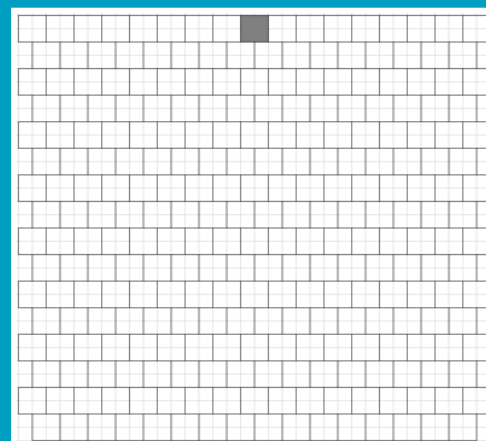
What you'll need

Two 50g balls of contrasting double knitting yarn

4mm knitting needles

Scissors

A tapestry, darning or wool needle

Step-by-step instructions

These instructions are written for red and green yarn

1 Cast on 72 stitches, 36 double stitches of red and green. Wind the yarn on as taught by Sockmatician (a popular YouTube knitter) and knit and purl alternately back to make those stitches wind round the needle securely.

2 Now make three more rows, keeping one side red and the other green. You are now set up to start the pattern. In my rectangle the red side was facing me at this stage, so I will call the red side the front and the green side the back.

3 The next row begins with red to the front, but make the middle two double stitches the other way round, to bring green to the front and red to the back. In other words, knit red, purl green for 34 of the 72 stitches, then knit green, purl red, knit green, purl red before doing knit red purl green for the rest of the row (34 more stitches).

4 Knit the fractal pattern using these two rules:

Rule 1

When the front is facing you (the mainly red side for me), look at the next four stitches to be worked on the left-hand needle.

If these stitches alternate red and green in either order, you knit red, purl green to set another red stich to the front.

If the next four stitches on the left-hand needle contain two stiches of the same colour side-by-side, you knit green, purl red, knit green, purl red to set two green stitches to the front.
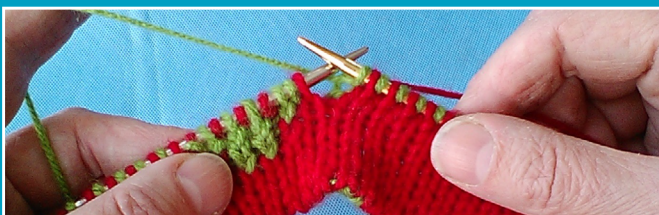
The next four pictures show the four possible situations when you are working on the front.

Here the next four stitches on the left-hand needle, in the order that they will be worked, are red, green, red, green. There is no double colour, so I knit red, purl green, then look at the next four stitches.

Here the next four stitches on the left-hand needle, in the order that they will be worked, are green, red, green, red. There is no double colour, so I knit red, purl green, then look at the next four stitches.

Here the next four stitches on the left-hand needle, in the order that they will be worked, are red, green, green, red. There is a double green, so I knit green, purl red, knit green, purl red, then look at the next four stitches.

Here the next four stitches on the left-hand needle, in the order that they will be worked, are green, red, red, green. There is a double red, so I knit green, purl red, knit green, purl red, then look at the next four stitches.

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Rule 2

When the back is facing you (the mainly green side for me) make a knit stitch followed by a purl stitch all the way along. Use the yarn that is the same colour as that on the left-hand needle next.

Here the next six stitches on the left-hand needle, in order that they will be worked, are green, red, red, green, red, green. So I knit green, purl red, knit red, purl green, knit red, purl green and so on. Always alternate knit and purl and use the colour of the next stick on the left needle.

5 You can tell when you are reaching the end of the fractal pattern when, working on the front of the piece, you knit two red stitches and then find you only knit green stitches until the last two stitches at the other end. When this happens, do the back as usual. Then knit and purl four rows to make some plain background.

6 Cast off.

Instructional Videos

To make these instructions clearer I have recorded ten videos where I make a smaller version, for you to dip into as needed:

DK0 **Introduction** (explaining what I am doing and showing what materials and tools you need.)

DK1 **Casting on** (how to cast on the stitches to start with using the technique learnt here.)

DK2 **First three rows and slip stitch** (plain double knitting before the pattern starts, showing how to keep the edges neat as I learnt to do here)

DK3 **Starting the pattern** (how to get the fractal pattern started before the algorithm kicks in.)

DK4 **First algorithmic row** (showing the basics of the algorithm for the front and the back of the work.)

DK5 **Second algorithmic row** (showing the algorithm when there is more happening.)

DK6 **When to stop the pattern** (how to recognise when you reach the row where the fractal pattern stops.)

DK7 **What it looks like when the pattern stops** (seeing when to stop using the algorithm.)

DK8 **Casting off** (the one-needle Kitchener bind-off as described in far better detail here.)

DK9 **How to undo a row** (how to undo a row or two. If things go more seriously wrong you can pull the whole thing off the needles and start again, or the Sockmatician shows you how to rescue some of your work here.)

Quick Tips

Using circular needles for this project makes it much easier to cast off at the end because you can slip stitches to the other end of the needles.

These instructions are for a rectangle about 20cm x 16cm. You can make bigger or smaller versions by starting by casting on $2^n + 4$ stitches of each colour for any positive integer $n \geq 3$.

Notice that if ever you see three stitches of the same colour next to each other on a needle, you have gone wrong and will have to undo some of your knitting!

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