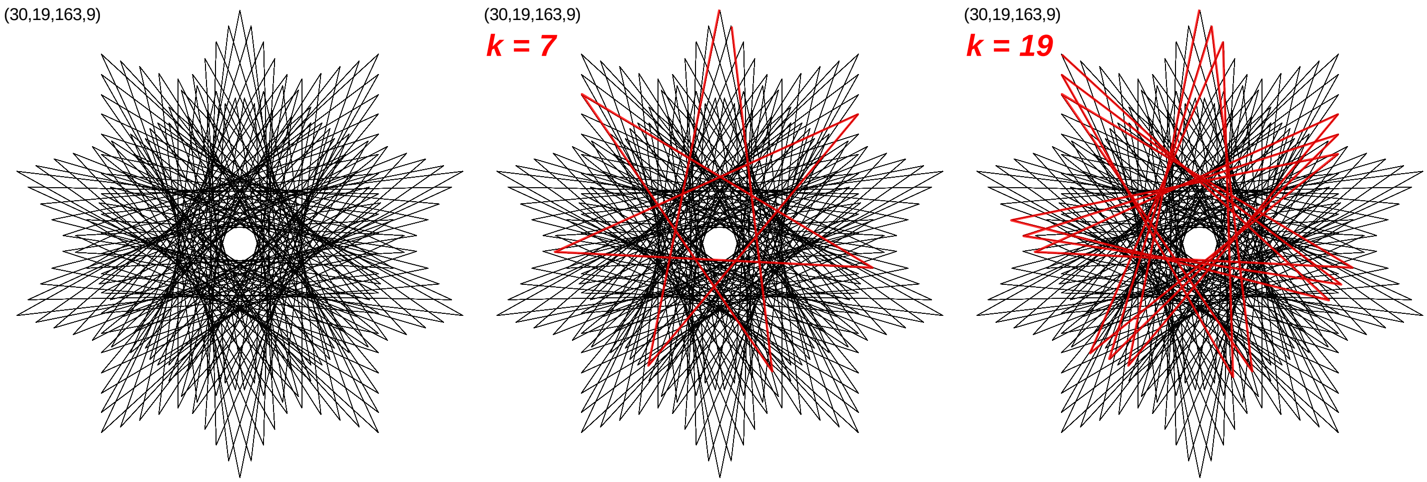
8.6. Kicking the Tires of *Three Shape-Shifting Triangles*

The *Three Shape-Shifting Triangles* image analyzed in Section 8.4, (***n***,***S***,***P***,***J***) = [(30,19,163,13)](), is one of a handful of images that has acted as a springboard to deeper understanding of the intricacies of ESA images. *The seminal attribute of this image is that it is single-step of length 7* as defined in Section 8.5.1. (Other attributes are highlighted in yellow below.)

This follows because ***n·S*** = 570 and 7·***P*** = 7·163 = 1141 = 2·570 + 1. [**MA.** Using Chapter 24, 7 and ***P*** are MMI MOD ***n·S***.]

The interesting thing to note about the above calculation is that it does NOT depend on ***J***. Each (***n***,***S***,***P***,***J***) = (30,19,163,***J***) image for 1 ≤ ***J*** < ***n***/2 will be single-step of length 7. The image will not remain 570 lines long as ***J*** varies because VCF > 1 for many of these values of ***J***. The number of lines in the image is ***n·S***/VCF because SCF = 1 (since 163 is prime). The table below provides a summary of the 14 images that emerge as ***J*** varies from 1 to 14. The three images below focus on ***J*** = 9.

How is the image filled in? The 7-line sub-image will ALWAYS appear to rotate clockwise because the 7th endpoint is just to the right and below the top (since ***J*** < ***n***/2). At left is the image, ***k = 7*** shows the **1st step**, and ***k = 19*** shows the **1st cycle**.



The blue highlighted row of the table shows attributes of the above image. One can see the **open 7,3-star sub-image** in the middle panel. This **7,3-star rotates ↻** but note that the image is filled in in a 1-time around ↺ fashion (see Section 5.2) because the first used vertex (at the end of the ***k = 19*** **1st cycle** in the right panel) is 27 (and VCF = 3 so this is the first ↺ vertex used). Note also the 10,3-star vertex frame is visible in each panel, but most especially in the left image.

Create a video of these 14 images. By setting *Drawn Lines* = 7 in the web version FCLD mode and clicking on ***J*** so you can change ***J*** using the up or down arrows, you can show each of these 14 images sequentially. Change ***J*** by 1 each time the image gets completed and if you extend ***J*** from 16 to 29 you will see the same images drawn in reverse. Below is ***J*** = 7.

A 5SST with DL = 11. On a related note, check out [(29,13,137,13)]().

J	VCF	Vertices used, V_u	Single-step subimage	VF of final image	Number of Lines $L = 19V_u$	Number of steps^	First cycle ends at	Times around for image
1	1	30	7,2-star	30-gon	570	81	13	↻ 13
2	2	15	7,3-star	15-gon	285	41	26	↺ 2
3	3	10	7-gon	10-gon	190	27	9	↻ 3
4	2	15	7-gon	15,2-star	285	41	22	↺ 4
5	5	6	7,3-star	6-gon	114	16	5	↻ 1
6	6	5	7,2-star	5-gon	95	14	18	↺ 2
7	1	30	7,3-star	30,7-star	570	81	1	↻ 1
8	2	15	7,2-star	15,4-star	285	41	14	↻ 7
9	3	10	7,3-star	10,3-star	190	27	27	↺ 1
10	10	3	7-gon*	3-gon	57	8	10	↻ 1
11	1	30	NC 7-gon~	30,11-star	570	81	23	↺ 7
12	6	5	7,3-star	5,2-star	95	14	6	↻ 1
13	1	30	3SST	30,13-star	570	81	19	↺ 11
14	2	15	7,3-star	15,7-star	285	41	2	↻ 1

*appears as a 5-gon or a 6-gon due to 1 to 2 collinear sides across a cycle.

~non-convex 7-gon. ^Calculated as ROUND(***L***/7,0)