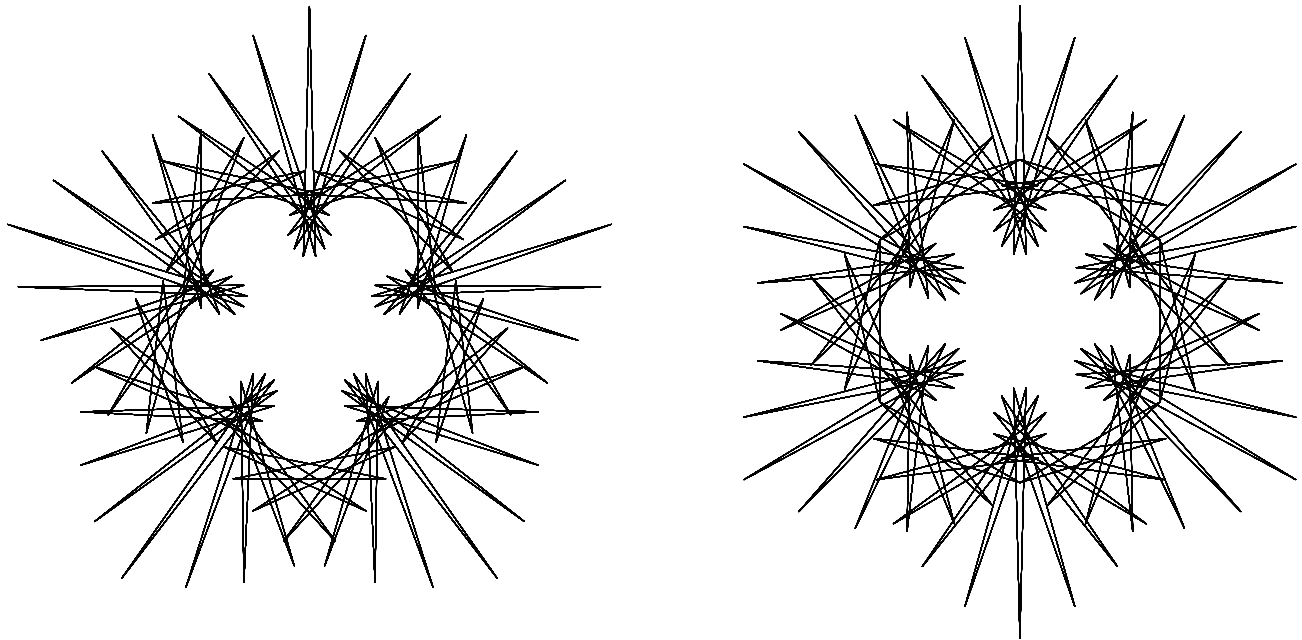# Spinning Needle Stars

Needles are created when large level differences exist between points or when points are "far" away from one another (like porcupine polygons). Spinning needle stars all have two attributes: 1) they are *one-time around* images; and 2) Each cycle does not include the center of the circle. The second attribute suggests that the points cannot be too far from one another thus we rely on images that have substantial change in level between at least some of the points (such as the first and last points of a cycle).

The first two images are examples of "open" versions, both have *n* = 30 so only 1/6th of the vertices are included in the left image (5) and 1/5th of the vertices are included in the right image (6). Both are based on *J* = 13 and both are drawn in a counterclockwise direction. That is readily changed by changing to *J* = 17. These are best seen using *Toggle Drawing*:

12 Level, 125 line, 5 point: https://www.playingwithpolygons.com?vertex=30&subdivisions=25&points=288&jumps=13
11 Level, 138 line, 6 point: https://www.playingwithpolygons.com?vertex=30&subdivisions=23&points=265&jumps=13

It is a bit harder to see the structure of spinning stars once the number of points on the star increases. By viewing the image using *Toggle Drawing* and watching multiple times while focusing attention on the initial part of the image, you should be able to discern the structure of the star. The links below take you to some examples:

9 Level, 190 line, 10 point: https://www.playingwithpolygons.com?vertex=30&subdivisions=19&points=219&jumps=13

8 Level, 255 line, 15 point: https://www.playingwithpolygons.com?vertex=30&subdivisions=17&points=196&jumps=13

5 Level, 209 line, 19 point: https://www.playingwithpolygons.com?vertex=19&subdivisions=11&points=116&jumps=9

3 Level, 161 line, 23 point: https://www.playingwithpolygons.com?vertex=23&subdivisions=7&points=18&jumps=9

5 Level, 330 line, 30 point: https://www.playingwithpolygons.com?vertex=30&subdivisions=11&points=127&jumps=13

12 Level, 720 line, 30 point: https://www.playingwithpolygons.com?vertex=30&subdivisions=24&points=277&jumps=13

14 Level, 840 line, 30 point: https://www.playingwithpolygons.com?vertex=30&subdivisions=28&points=323&jumps=13

Because the stars are created as a *one-time-around* image, spikes intermingle with one another, especially in the middle level range. This crossover is most readily seen in the annotated image on the next page. This is a different 6 point star from the one shown above. Note that the 10th line of the first cycle (from **9** to **10**) is a line whose endpoints are both at Level 5 (see last row of table at the bottom of the page). The even points before **10** create the left side spikes of the top star (centered at **24 & 0**) and the odd points after **9** create the right side of the star whose central spike is at **20**.

(S,P,J,n)=(19,124,11,24)

114 lines
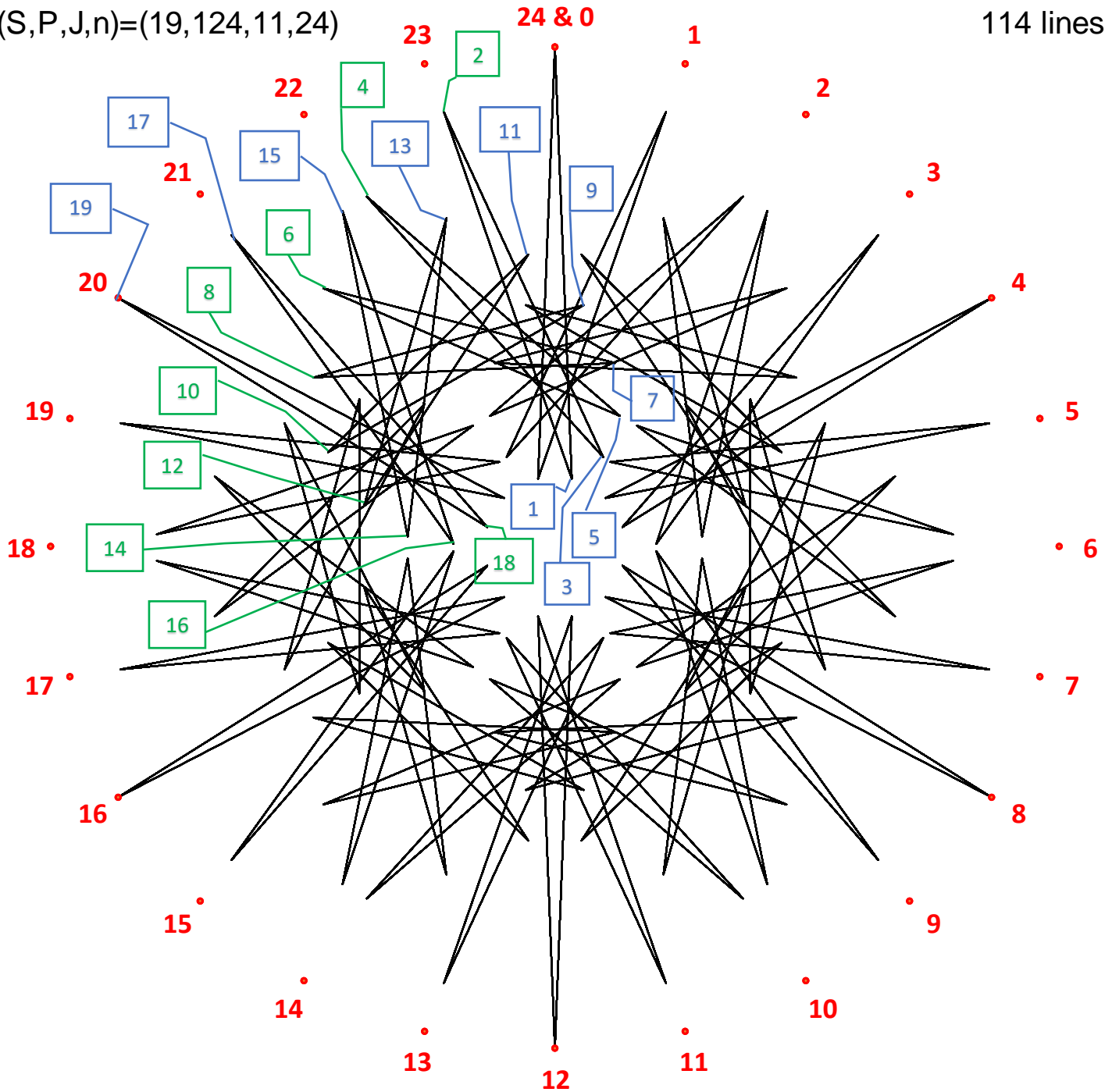
Tracking segments for first cycle of a *Spinning Star*

24 *n*
19 *S*
124 *P*
11 *J*

Sub End = MOD($k*P$, S)
Segment = $k*P/S$
VF Start = MOD(INTEGER(Segment)*J, n)
VF Stop = MOD(VF Start + J, n)
Level = MIN(Sub End, S-Sub End).

Polygon vertices are in RED
Endpoints of first cycle segments are labelled by color:
Odd endpoints in BLUE **Even endpoints in GREEN**

Line k	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Sub End	10	1	11	2	12	3	13	4	14	5	15	6	16	7	17	8	18	9	0
Segment	6.53	13.1	19.6	26.1	32.6	39.2	45.7	52.2	58.7	65.3	71.8	78.3	84.8	91.4	97.9	104.4	110.9	117.5	124.0
VF Start	18	23	17	22	16	21	15	20	14	19	13	18	12	17	11	16	10	15	20
VF Stop	5	10	4	9	3	8	2	7	1	6	0	5	23	4	22	3	21	2	7

The Vertex Frame (VF) start and stop values are the **RED** numbered vertices of the polygon.

Level	9	1	8	2	7	3	6	4	5	5	4	6	3	7	2	8	1	9	0