Stacked Circles, Take 3: Variations on the Theme

Stacked circles, as initially conceptualized, required four things:

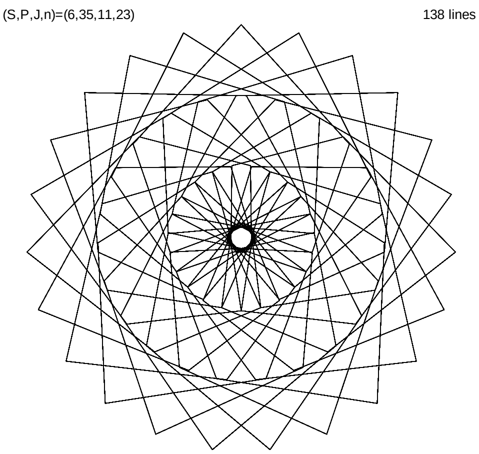
1) odd ***n***, **2)** ***J*** = (***n***-1)/2, **3)** even ***S***, and **4)** ***P*** is just-under an even multiple of ***S***, ***P*** = 2***kS*** – 1.

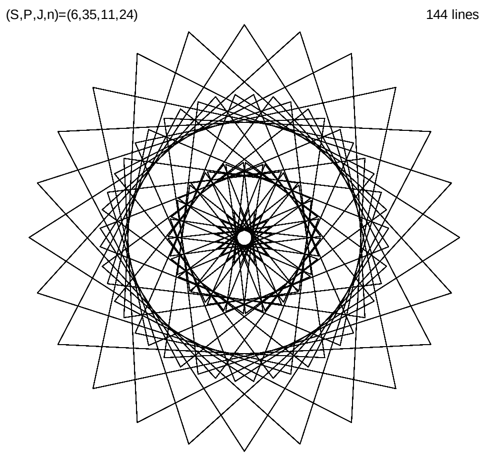
The resulting images have cycles that loop around the center of the circle. This creates an image with a tight-closed circle for the inner-most layer and cross-hatching that does not extend into neighboring layers.

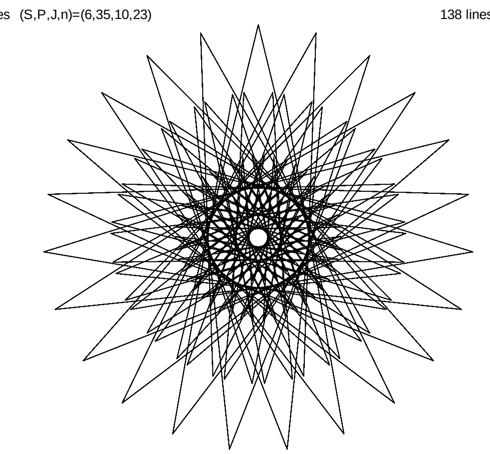
a) What happens when we relax each of these conditions without changing the other conditions ?

b) Can we find alternative conditions that produce versions of stacked circles?

Question a) We start from the 3 layer image annotated *in Stacked Circles, Take 1*, (***S***, ***P***, ***J***, ***n***)=(6, 35, 11, 23), shown to the left, and change each condition.







1a) Changing to even ***n*** produces significant overlap between layers even though the images are *One Layer Change* images. For example, changing ***n*** = 23 to 24 (middle image above) produces two levels of cross-hatching as well as a circle that is noticeably inside the subdivision vertices creating each layer (click this url and click *Subdivisions* to see):

https://www.playingwithpolygons.com?vertex=24&subdivisions=6&points=35&jumps=11

2a) Changing ***J*** to a value further away from the center (from 11 to 10 given ***n*** = 23, right image above) produces even greater amounts of apparent movement across levels (note that the image in this instance is more star-like).

https://www.playingwithpolygons.com?vertex=23&subdivisions=6&points=35&jumps=10

3a) Changing ***S*** to the next larger or smaller number (7 or 5) reduces the image to a simple star because the value of ***P*** (35) is a multiple of both. But, to be fair, ***P*** was defined as a function of ***S.*** If we maintain the relationship, ***P*** = 6***S***-1, then the nearest odd choices are ***S*** = 5, ***P*** = 29 or ***S*** = 7, ***P*** = 41, both of which produce images that could be mistaken as stacked circles. Both versions are provided here:

https://www.playingwithpolygons.com?vertex=23&subdivisions=5&points=29&jumps=11

https://www.playingwithpolygons.com?vertex=23&subdivisions=7&points=41&jumps=11

Careful viewing *of Toggle Drawing* shows that in both instances, the loops no longer include the center.

4a) Changing ***P*** to the just-over even multiple of ***S***, ***P*** = 2***kS*** + 1, produces images that are also quite similar to stacked circles. But note that, as with 3a), the loops no longer contain the center.

https://www.playingwithpolygons.com?vertex=23&subdivisions=6&points=37&jumps=11

Question b) We see that odd ***S*** and just-over ***P*** both produce alternative versions of stacked circles. It remains to be seen if we can find a version of stacked circles for even ***n*** and for ***J*** < (***n***-1)/2.

1b) If we combine an even ***n*** with a just-over odd multiple of ***S*** (here is ***P*** = 6*9+1) we obtain a credible version of stacked circles. The loop includes the center even though ***P*** is a just-over value. Just-under does not work quite as well here (try ***P*** = 53 and note that the center is no longer included).

https://www.playingwithpolygons.com?vertex=24&subdivisions=6&points=55&jumps=11

2b) Changing to ***J*** = 10 requires a larger ***P*** to create the loop required to make the stacked circle image. The best version here is ***P*** = 53 which, as just-noted, is just-under 9***S***. The 6-segment loop in this instance only rotates 1 vertex over for each time (click *Toggle Drawing* to see this progression).

https://www.playingwithpolygons.com?vertex=23&subdivisions=6&points=53&jumps=10

Notice that the loops now include the center (unlike in **1b**) with ***P*** just-below.

We see that the class of images that might be considered stacked circles is wider than initially conceptualized. All images are *One Level Change* images, but the 4 restrictions initially imposed need not apply.