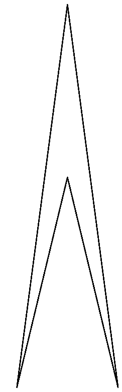
# On finding the smallest values of *S*, *P*, *J*, and *n* that creates an image



In order to make analysis easier, it is generally worthwhile to adjust parameters so that **VCF** and **SCF** are as small as possible and to decrease ***J*** and ***P*** so that they are as small as possible. It will not always be possible to have both **VCF** = 1 and **SCF** = 1, but it will make understanding how the image was created easier if you follow these suggestions. [Mathematically, **VCF** = GCD(***n***, ***J***) and **SCF** = GCD(***S****(***n***/**VCF**), ***P***).]

**An Example**: Suppose you want to understand a bit more about the image at right. This was created by the *Initial* settings of ***S*** = 8, ***P*** = 30, ***J*** = 9 and ***n*** = 15. You would like to know how this was created.

In this instance, **VCF** = 3 and **SCF** = 10 so the first thing to do is to divide ***n*** and ***J*** by 3, and ***S*** and ***P*** by 2 giving ***S*** = 4, ***P*** = 15, ***J*** = 3 and ***n*** = 5. The same image emerges but now **VCF** = 1 and **SCF** = 5.

One cannot reduce ***n*** and ***P*** by the common factor of 5 without doing damage to the image (***n*** = 1 results). But you can obtain the same image by making further adjustments to decrease the size of ***J*** and ***P***.

Let ***J*** = ***n*** – 3 = 2 (since then ***J*** is, clockwise, less than half-way around), and similarly, ***P*** = ***S****(***n***/**VCF**) – 15 = 5. The *Final* version, ***S*** = 4, ***P*** = 5, ***J*** = 2 and ***n*** = 5, will be easier to count.

To see the difference, compare the two images from the companion website. Click **Show Subdivisions** and **Show Vertices** to obtain the images below. There are twice as many subdivision points and three times as many vertices on the left than the right.

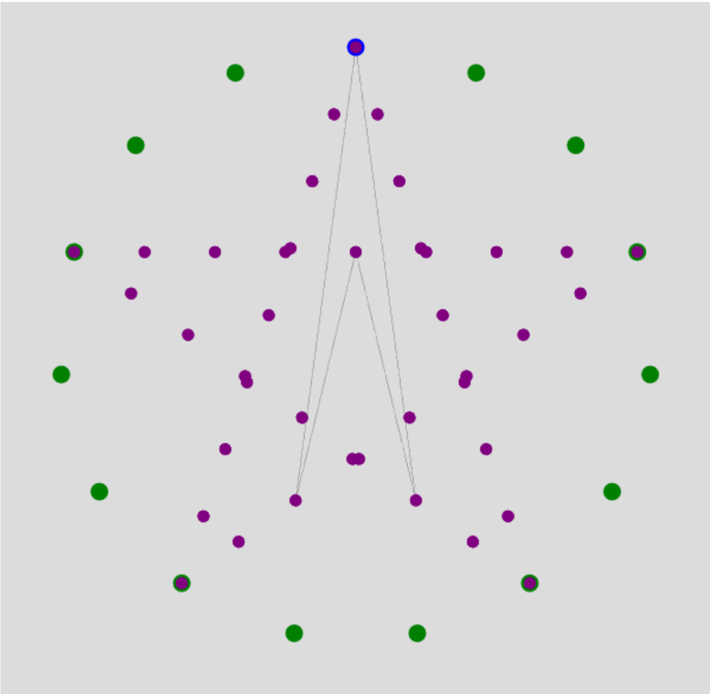
*Initial*, LEFT: https://www.playingwithpolygons.com?vertex=15&subdivisions=8&points=30&jumps=9

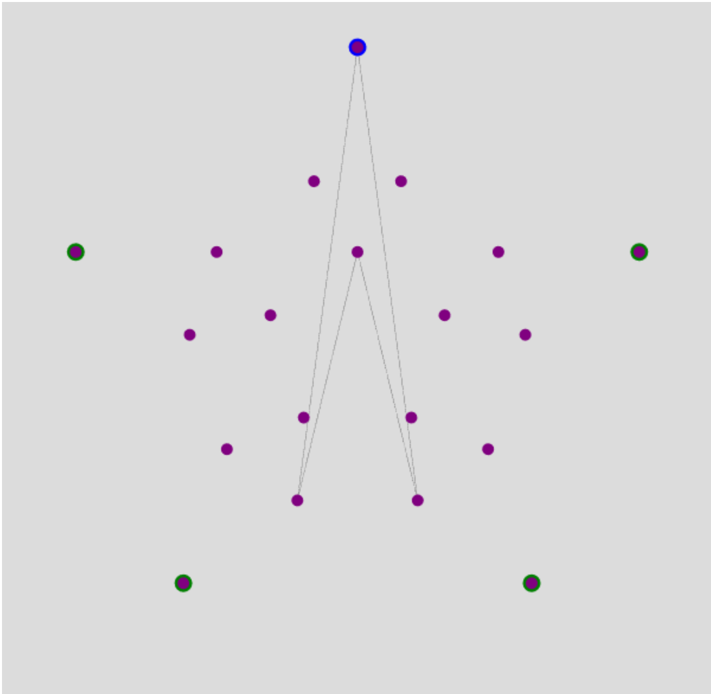
**To draw the first line:** The $30^{th}$ subdivision (endpoint of the $1^{st}$ segment) is on the $4^{th}$ line of the vertex frame since 30 = 3*8+6. The first 3 segments of the vertex frame go from vertex 0 to 9 to 3 to 12 and the $6^{th}$ subdivision point on the line going from vertex 12 to vertex 6 is the endpoint of the first segment in the final image.

*Final*, RIGHT: https://www.playingwithpolygons.com?vertex=5&subdivisions=4&points=5&jumps=2

**To draw the first line:** The $5^{th}$ subdivision (endpoint of the $1^{st}$ segment) is the first subdivision on the second line segment since 5 = 1*4+1. The first vertex frame segment goes from vertex 0 to 2 and the second goes from 2 to 4.

Both methods produce the same image, but the one on the right is easier to follow.





1/3 of vertices used (**VCF**=3) & 1/$10^{th}$ subdivisions (**SCF**=10) | All vertices used (**VCF**=1) & 1/$5^{th}$ subdivisions used (**SCF**=5)