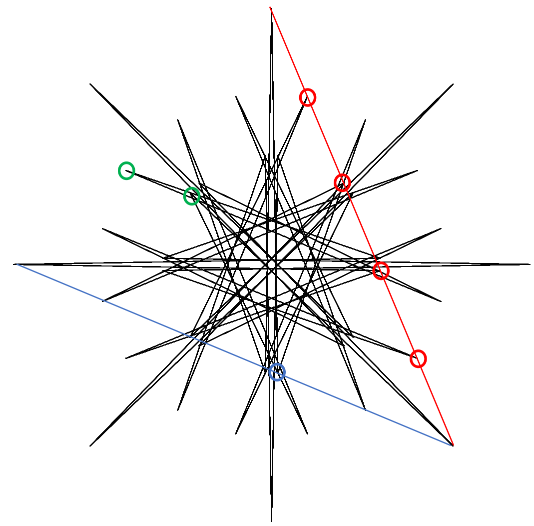
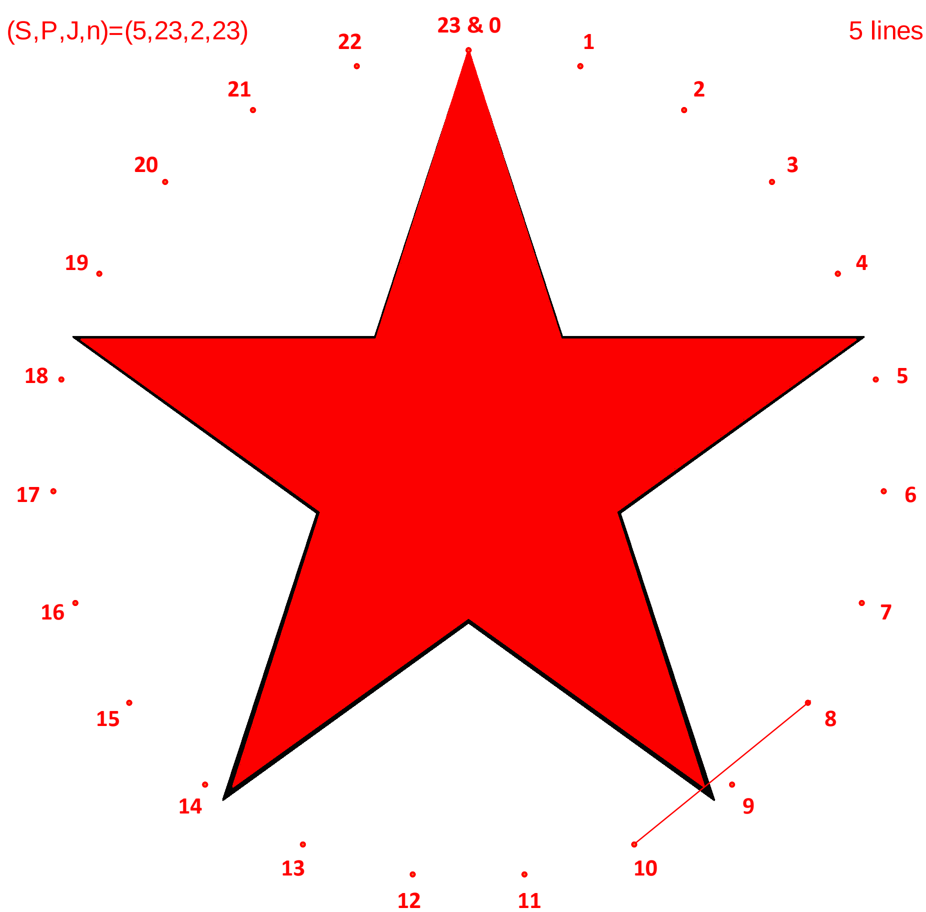
Reverse Engineering an Image

If you are presented with an image, but not the values of ***S***, ***P***, ***J*** and ***n*** that produced that image, there are some things to notice and questions you can ask that will help you to recreate the image yourself.

Things to notice.



1. If there is a kink in the image, then that point must be a subdivision point.
    a. There are two levels of internal vertices (**circled**).
2. All subdivision points are on the vertex frame.
    a. The first line of the vertex frame is shown in **red**.
    b. The subdivision points on this line are circled in **red**.
    c. Since these subdivisions appear to be equal distances on the line, ***S*** = 5.
3. Line segments in the image may or may not be part of the vertex frame.
4. The only vertex point that **MUST** be used is the starting and ending point at the top of the circle. Think of this as vertex ***n*** & 0.
5. Points on the polygon are easier to spot than internal points. But make sure that they are on the polygon and not simply near the polygonal frame. To clarify this idea, consider the two examples on this page.
    a. The image above has 8 vertices, ***n*** = 8, and the red line shows ***J*** = 3. Additional inspection (see second vertex frame line in **blue**) suggests that ***P*** = 7. You should verify that ***S*** = 5, ***P*** = 7, ***J*** = 3 and ***n*** = 8 produces this image.
    b. The image below contains two images superimposed on one another. The attributes of the Red image are noted, the Black image is a standard ***n*** = 5, ***J*** = 2 pentagram.



One additional line is shown in this compound image, a **red line** from Red's vertices 8 to 10.

This is the 5th line of Red's vertex frame.

The first 4 lines are 0 to 2 to 4 to 6 to 8.

The subdivision jump ***P*** = 23 will be on the fifth line, given ***S*** = 5 (4 < 23/5 < 5).

The first line in the Red image is 3/5 of the way from vertex 8 to 10.

CLAIM: The Red image is not a regular pentagram. Consider the angle at 23 & 0.

1. Black's regular pentagram's angle is 36°.
2. Red's bottom vertices are inside Black's.
3. Red's 23 & 0 angle is enclosed in Black's.
4. Red's angles cannot all equal 36°.
5. Therefore Red is not a regular pentagram.

Further, Red's pentagram includes a single polygonal vertex (at 23 & 0).

Had you seen Red alone without vertices shown or without attributes you may well have thought that this was a regular pentagram, ***n*** = 5 and ***J*** = 2.

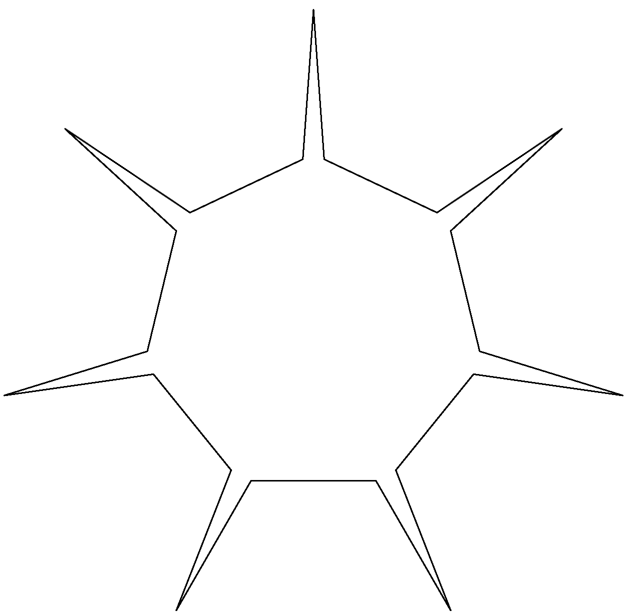
6. The first (and the last) part of the image starts (and ends) at the top, so focus on the first jump to find ***P*** (see 5a).
7. If there are internal subdivision that are close to the center they MUST come from ***J*** values that are close to ***n***/2.
8. If internal subdivision points are all close to the outside, then they are from smaller ***J*** values.
9. If some of the subdivision points appear to be halfway between endpoints, then ***S*** must be even.
   a. If only one such point is on each line in the frame, then ***S*** = 2.
10. If you know that ***n*** is larger than the number of vertex points used, then at least half of the subdivision points are not used in the final image. Do not worry about unused vertices or subdivisions.

Questions to ask.

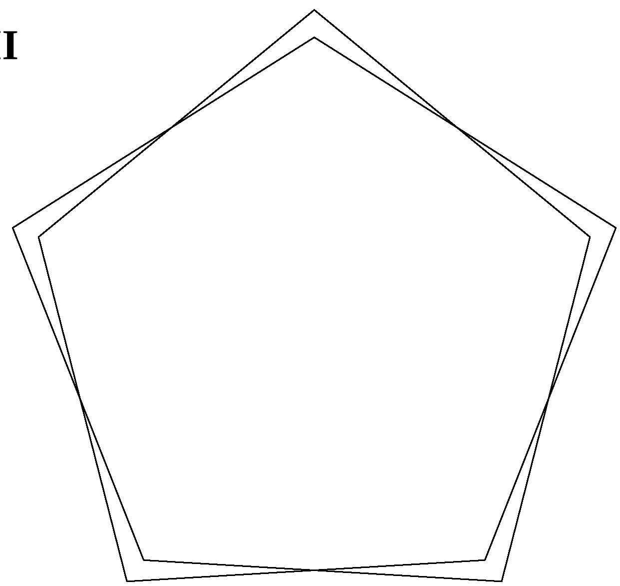
A. What is the minimum number of ***n*** required to create this image? For example, can **II** be created with ***n*** = 5?
B. How many jumps support subdivision points that are used in the image?
   a. Put another way, what does the vertex frame look like?
C. How far along are the internal subdivision points on the segment of the vertex frame?

Challenge Questions. Use the strategies outlined above to find ***S***, ***P***, ***J***, and ***n*** for each of these images.

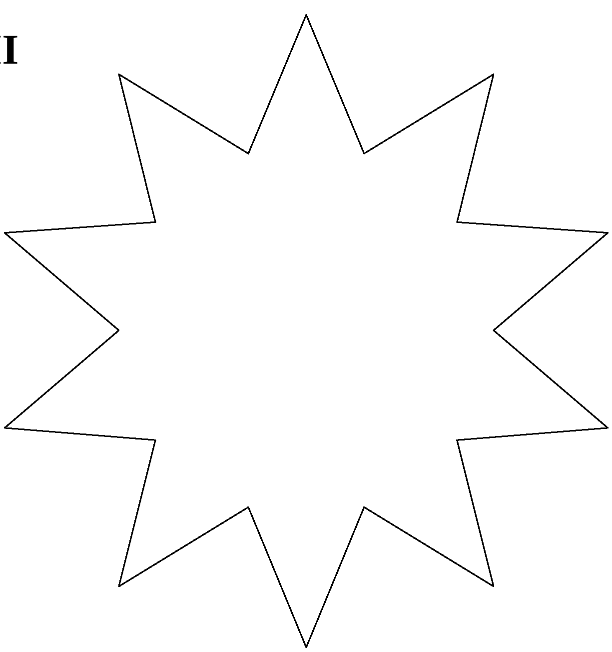
I



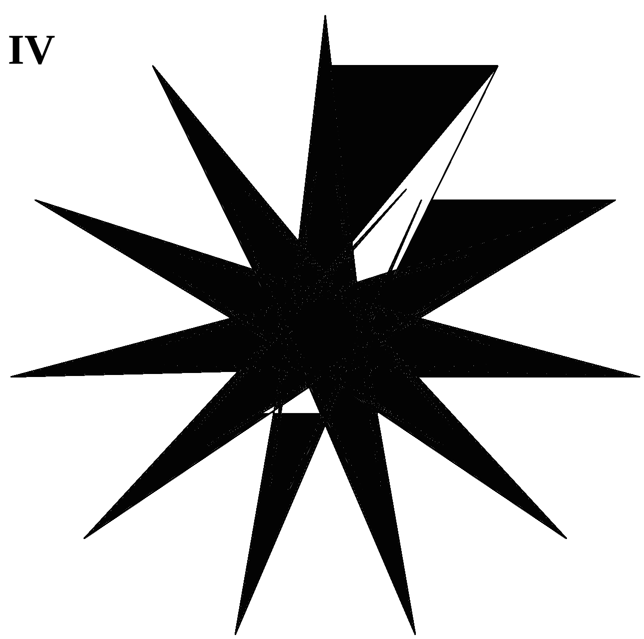
II



III



IV



HINT: It may help to print out this page so that you can use a ruler to find subdivision points on a line.