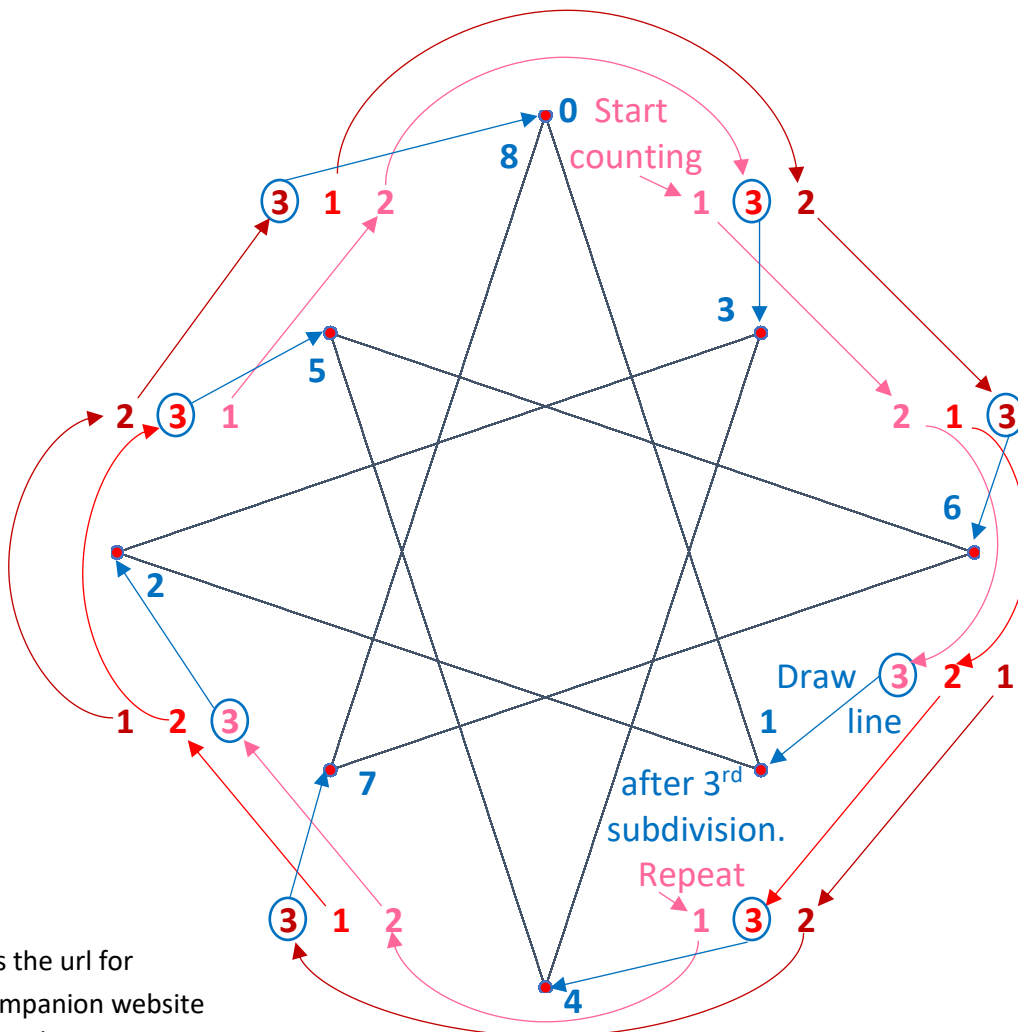


Description of how Lines are Created from Subdivisions (without multiplication)

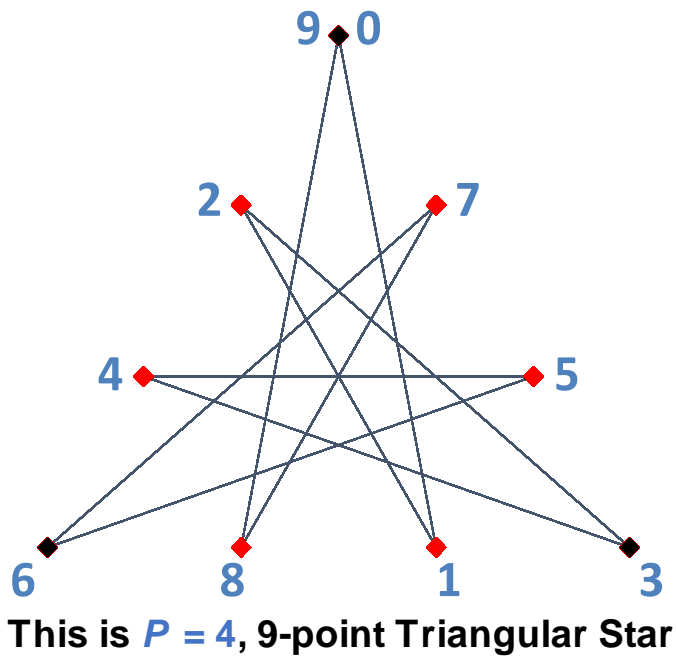
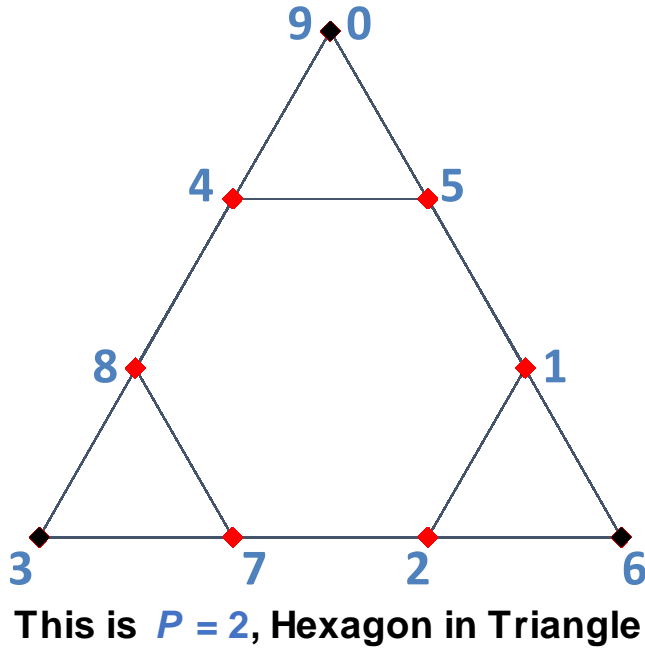
The most important thing to understand in **PART I** is the subdivision counting rule. Subdivisions are equally spaced segments between vertices. If **S** is **2** then there are two subdivisions between the starting point and the first vertex, and two more between first and second, and so on. Each of the intermediate points would be a midpoint between vertices so that there are twice as many points to use if we include the midpoints along with vertices of the polygon as line segment endpoints. So, if **n** = 4 and **S** = **2** we would have 8 points that can be used as the endpoint of a line segment.

Suppose we want to connect every third subdivision endpoint with a line segment. Call this **P** = **3** where **P** stands for the number of subdivisions between points. Subdivisions are counted clockwise starting at the top, then draw a line every third subdivision. There are multiple ways to count off subdivisions to create line segments but the simplest is to simply say: **1, 2, 3 draw line; 1, 2, 3 draw line; 1, 2, 3 draw line; ...** . Once this is done 8 times, you end up back at the top and you have created an 8-point star using a square frame. A version of what that looks like is provided below with annotations in color denoting counting subdivisions around the circle (on which the square is inscribed) with **PINK** first time around, **RED** second, and **DARK RED** third. Line segments are numbered in **BLUE**. Follow from **0** to **1** to ... to **8** to see the image created as 8 connected segments:



Here is the url for the companion website showing this image. To see image created, click *Toggle Drawing*: <https://www.playingwithpolygons.com?vertex=4&subdivisions=2&points=3>

Here are two more examples, both use triangles with 3 subdivisions ($n = 3, S = 3$), so there are 9 possible endpoints for line segments. The image connects 0 to 1 ... to 9.



The only other image that can occur when $n = 3$ and $S = 3$ is a triangle. You can use the file to see that a triangle occurs when $P = 1, 3, 6$, and 8 and the above images occur twice. Images typically occur twice for $P < n * S$ because P and $n * S - P$ produce the same image (but require going around the triangle a different number of times). The table below shows the possibilities.

Given $n = 3, S = 3$, and $P =$	1	2	3	4	5	6	7	8
Image:	Triangle, \triangle	\triangle in- \triangle	\triangle	9-pt. \triangle -lar \star	9-pt. \triangle -lar \star	\triangle	\triangle in- \triangle	\triangle
Segments required:	9	9	3	9	9	3	9	9
Times around triangle:	1	2	1	4	5	2	7	8