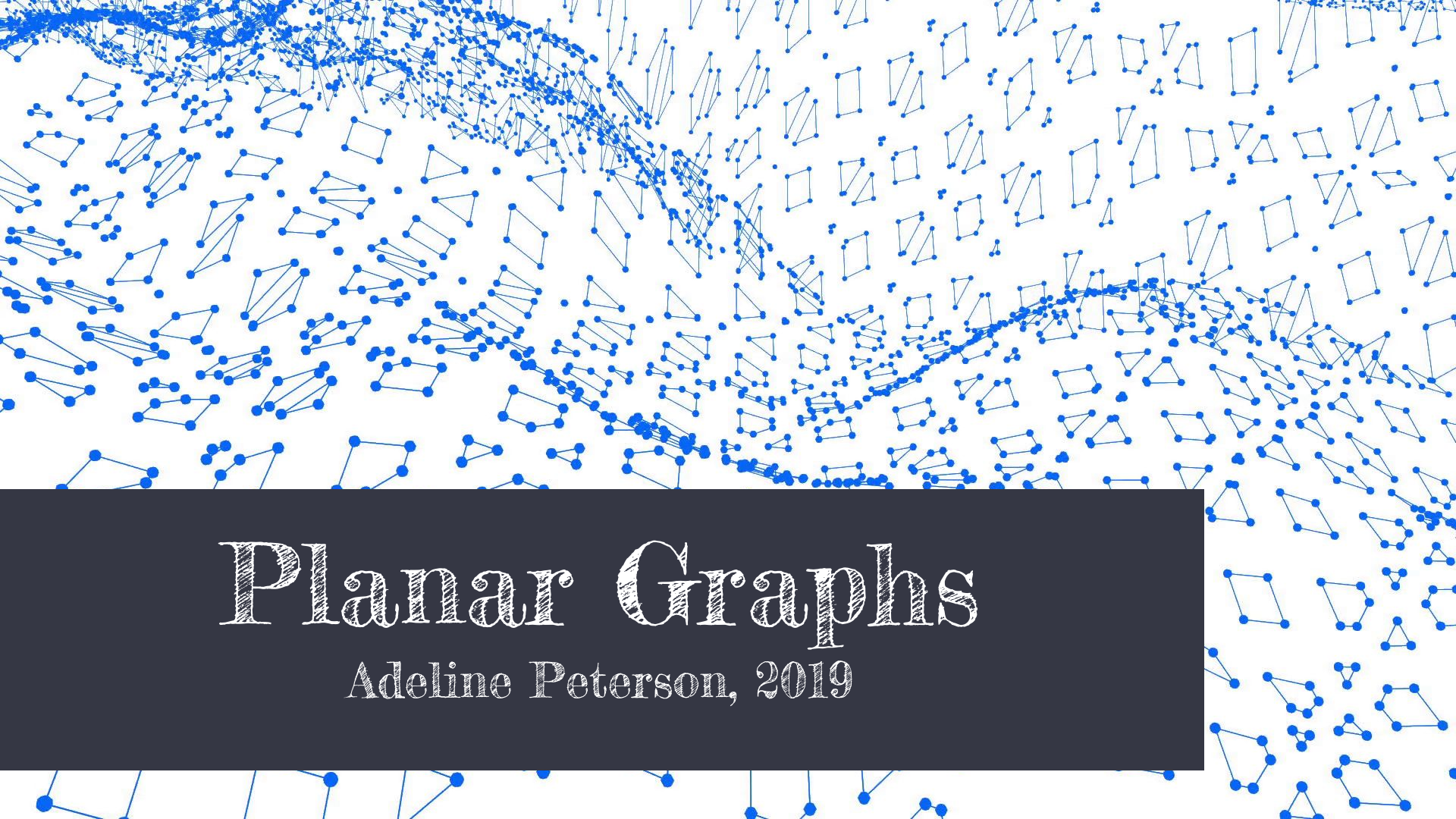
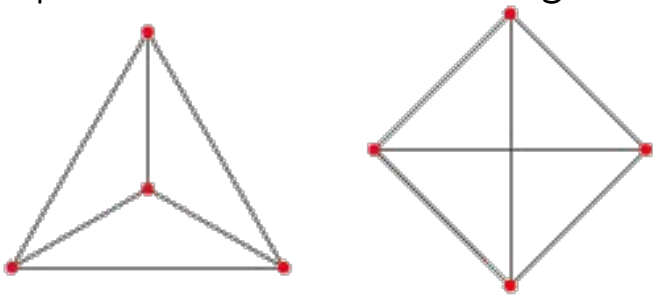


Planar Graphs

Adeline Peterson, 2019

Introduction

- *Planar graphs* are connected graphs that can be drawn without any connections crossing
  - may appear to be non-planar, but can be redrawn in a way without connections crossing(planar representation)
- Connections and nodes divide the plane into faces
  - Faces are counted when in a graph's planar representation form
  - divided sections of the graph and the "outside" region are considered faces

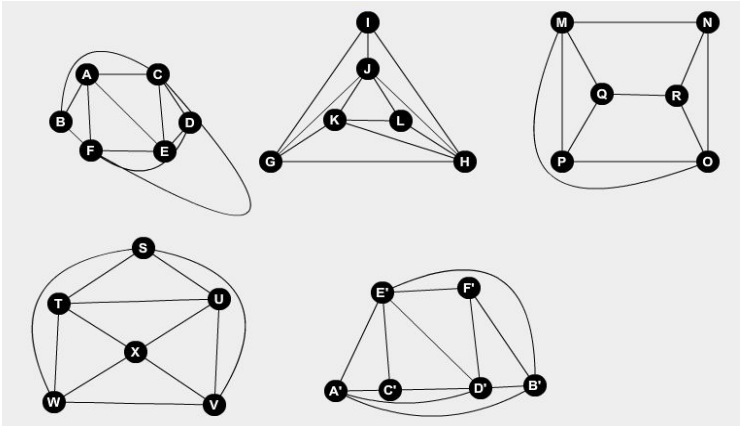


Problem Statement

- Does the shape of a planar graph affect the maximum number of connections?
- Is there a relationship between the number of nodes, connections and faces?

Results

- I drew graphs of different shapes, but using the same number of nodes.
- I started with 6 nodes, using 6 shapes
  - hexagon, triangle, square, pentagon, trapezoid, and line
  - I did the same with 8, 12, and 15 nodes
- The shape of a planar graph didn't change the maximum number of connections because they all had the same number of nodes



Results

- I drew a table that included the number of faces and connections for a certain number of nodes
- Using point slope form I found three equations relationship
  - nodes and connections: $y=3x-6$
  - nodes and faces : $y=2x-4$
  - connections and faces: $y=2/3x$
- I started to find the equation for all three variables by trying to find a relationship between them
- I tested possible equations until I found $x-y+z=2$.

Table

Nodes	Connections	Faces
1	0	0
2	1	1
3	3	2
4	6	4
5	9	6
6	12	8
7	15	10
8	18	12
9	21	14
10	24	16

Conclusion

- What I learned
  - There isn't a relationship between the shape of a planar graph and the maximum number of connections
  - The relationship between the number of nodes, connections and faces is x-y+z=2
- How to make my problem more challenging
  - Do the same equations work for non-planar graphs?