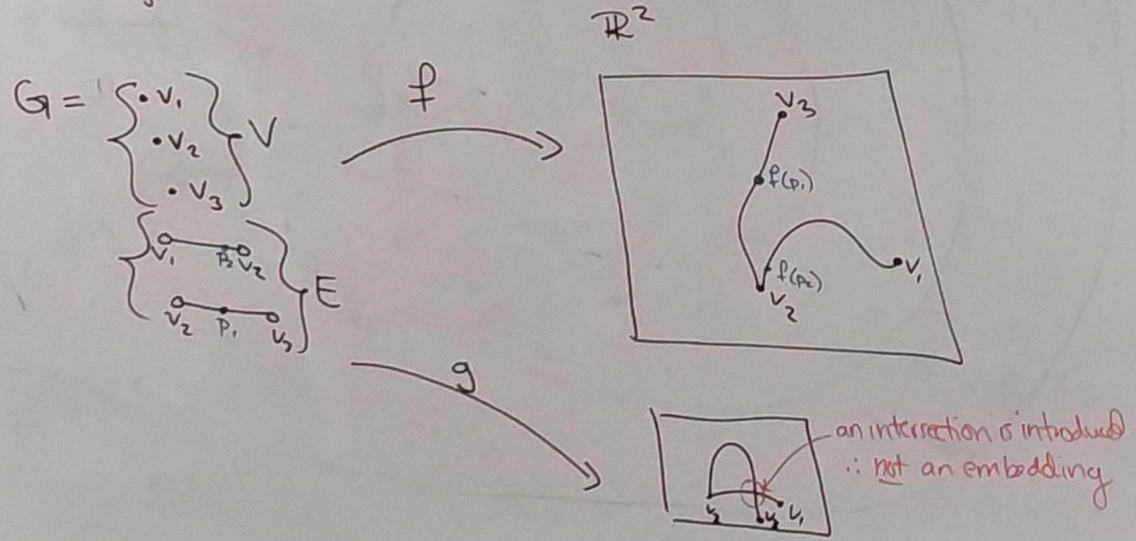
"abstract things"

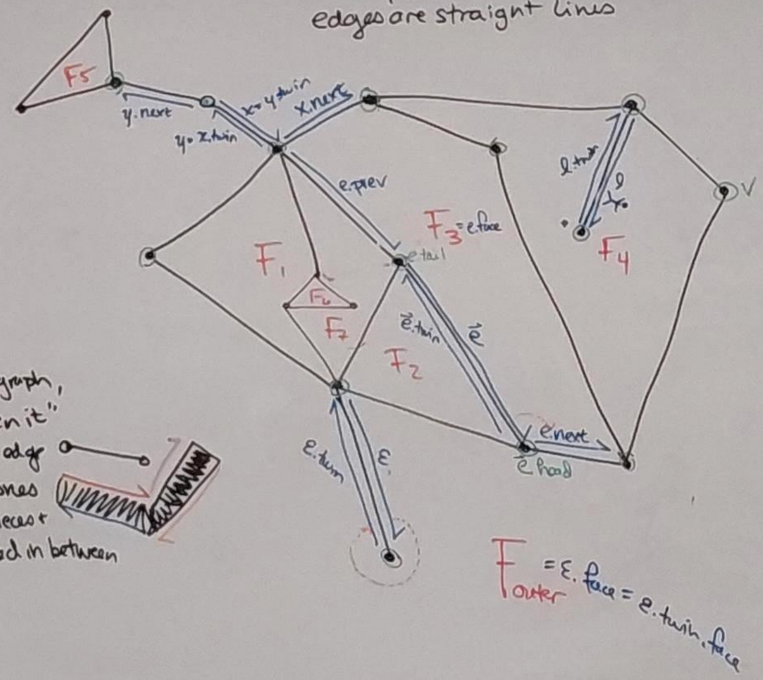
graph $G = (V, E)$ — vertices = pts; edges = copies of open unit interval, glued at the endpts

G is embedded in $\mathbb{R}^2$ using $f: G \to \mathbb{R}^2$ such that f is homeomorphic (continuous bijection) onto its image

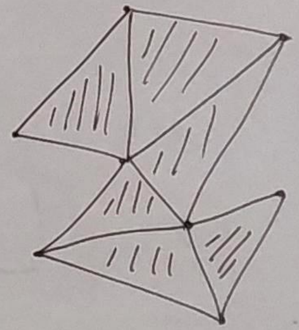


(G, f) be an straight-line embedded connected graph

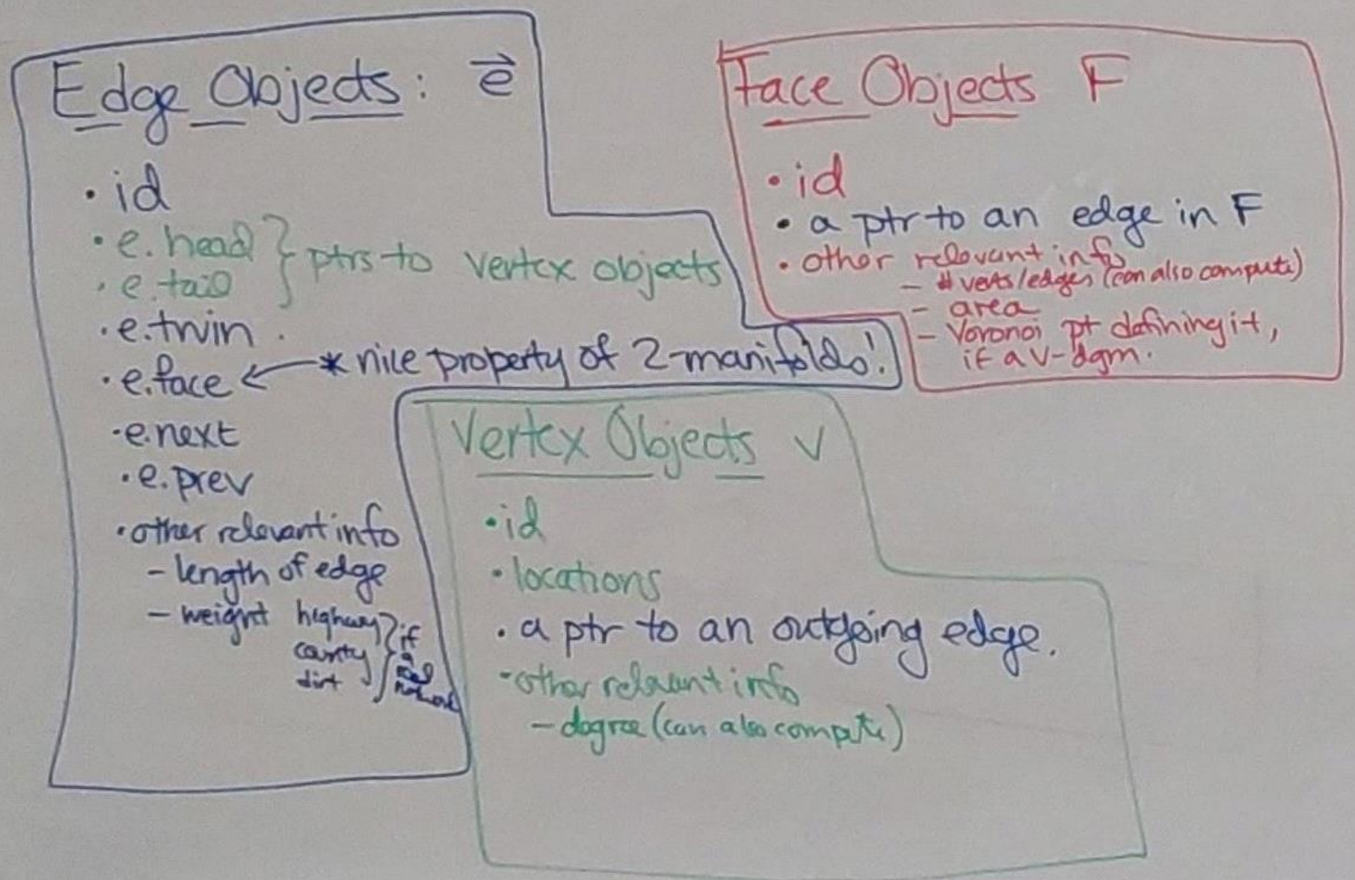
↑ aka piecewise linear (PL) edges are straight lines



(special case) Triangulation: all induced 2-cells (faces) are triangles, except the outer one.



Doubly-Connected Edge List (DCEL)
or Half-Edge Data structure



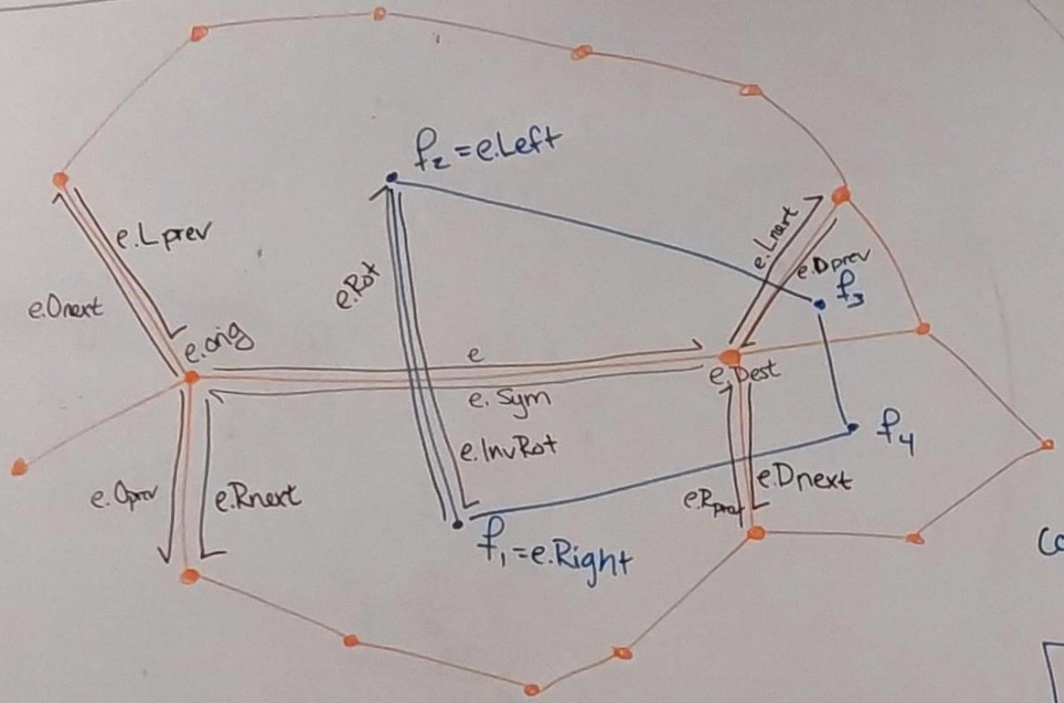
Things I can do:

→ find ALL edges on a face by following "next"

→ find all edges incident to a vertex (Exercise: How?)

→ test if v=e.head is a "leaf" vertex (ie., is v degree-1?)
A: check if e.next = e.twin

Quad Edge Data Structure

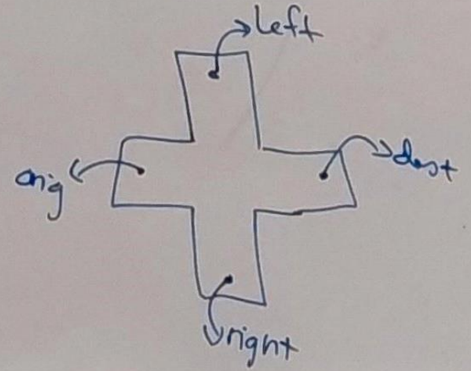


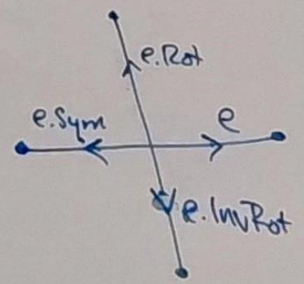
Given a graph G embedded in $\mathbb{R}^2$, there is a dual graph G^*

- vertices of G^* represent the faces
- edges connect 2 faces that share an edge.
- $(G^*)^* = G$

$\Rightarrow$ faces / vertices have similar rolls in $G \cup G^*$

common pits of this DS:

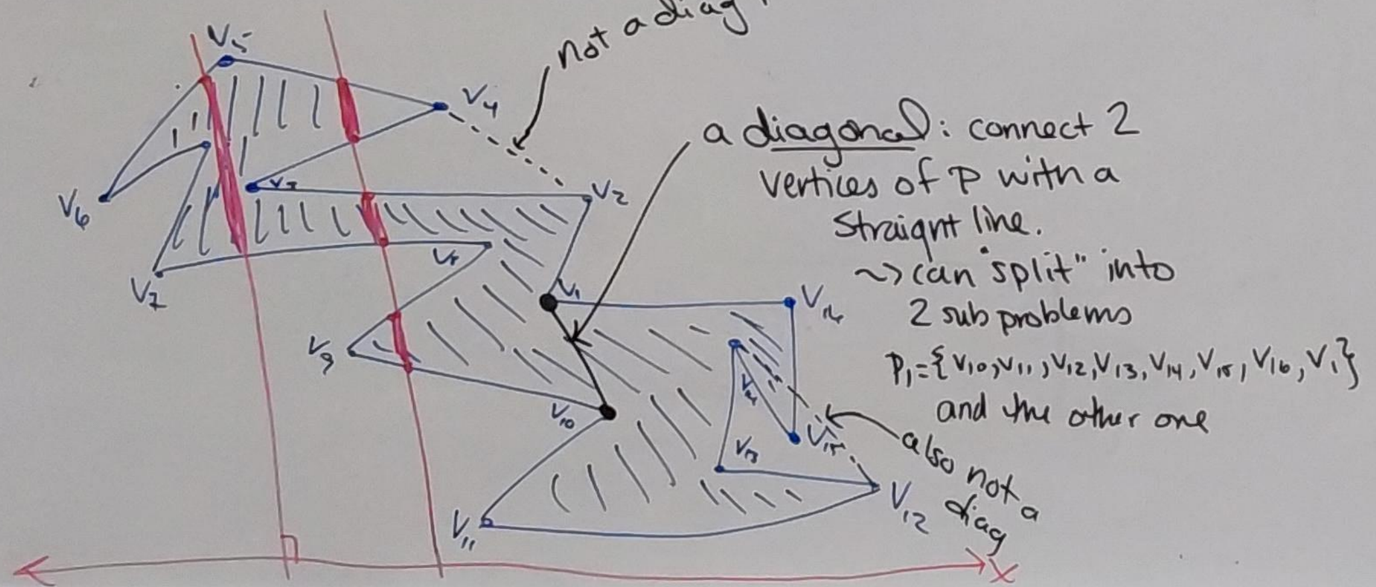




PROBLEM:

Given a polygon P, vert in CCW order around the bdry

Find: a triangulation of it
(e.g., using DCEL)
+ don't add vertices



Algorithm: 2 sweep lines

(1) break P into "simple" polygons (=Monotone!)

(2) solve for simple polygons independently

A polygon is [x-monotone] if intersecting w/ any [vertical line] has at most one connected comp.
(l-monotone for line l; vertical line: line l_1 to l_2)

(intersection can be: line segment, pt, $\emptyset$)

$\Rightarrow$ Every vertical line intersects 2 edges,