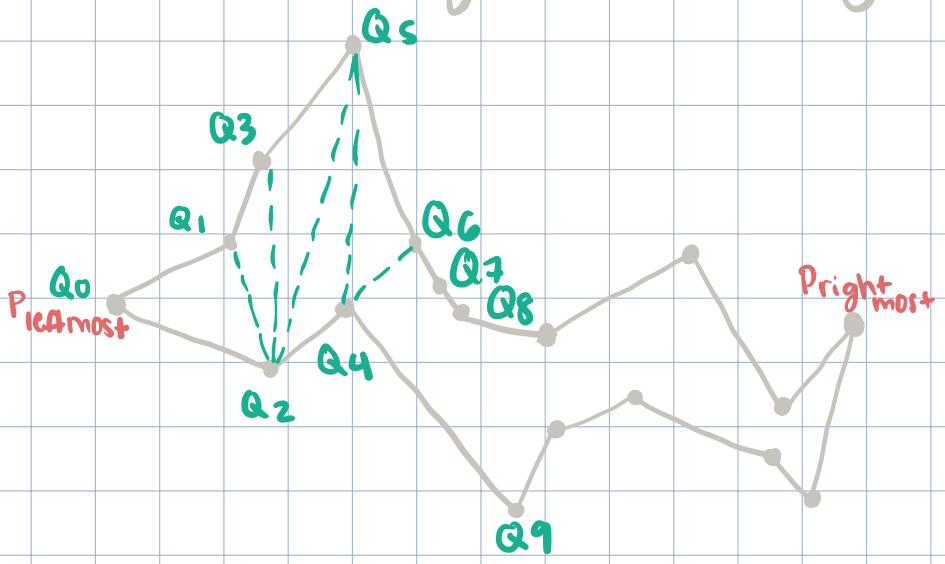
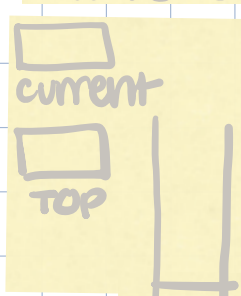
Regularizing a Planar Subdivision

- into montone regions → O(n log n)
- monotone polygon into Δ regions ↴



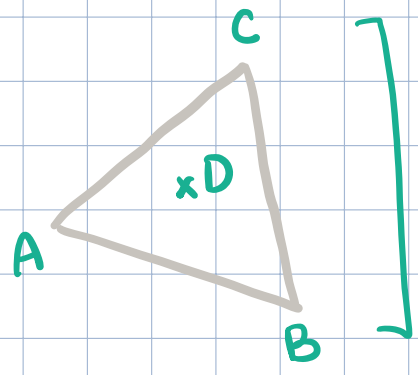
- can get left & rightmost in log n
- want sorted order by x-coordinate in linear time
  - ↳ merge top & bottom into one list

Preprocessing
θ(n)

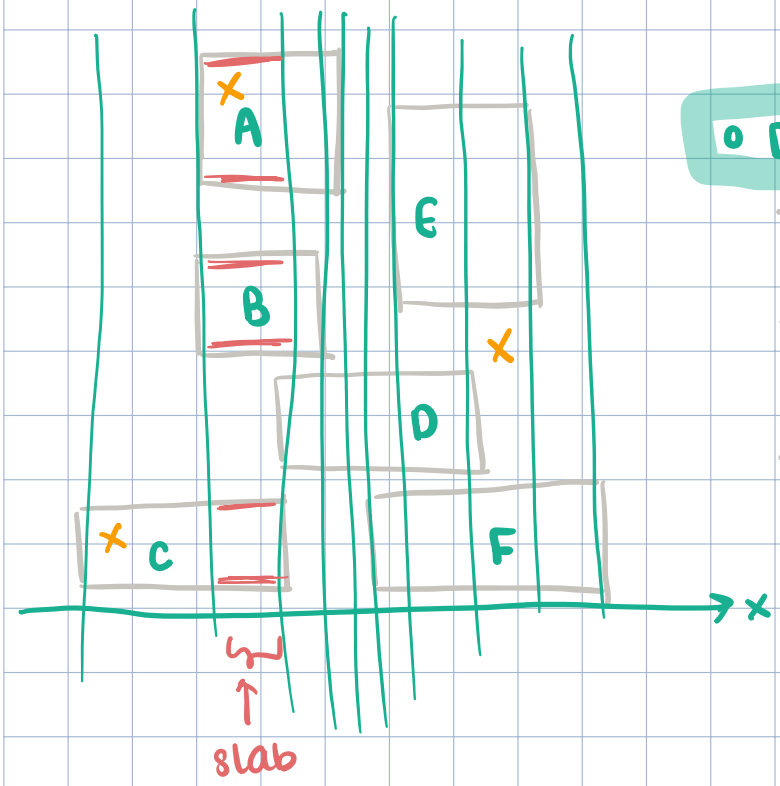


- if can't make Δ, put on stack
- pop off as they are connected
- look @:
  1) current
  2) top
  3) top of stack

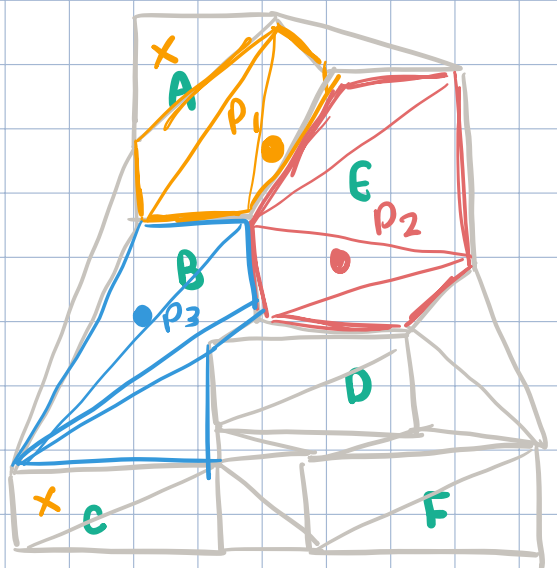
Triangulating
θ(n)
↳ using DCEL



Decide if pt in Δ
↳ constant time!
↳ (3 left turn test)



- Dobkin-Lipton: "Slab Method"
  - binary search on x-coordinate - $O(\log n)$
  - binary search on y-values in slab - $O(\log n)$
  - space = $O(n^2)$



- each time pull pt out, 2 fewer Δs

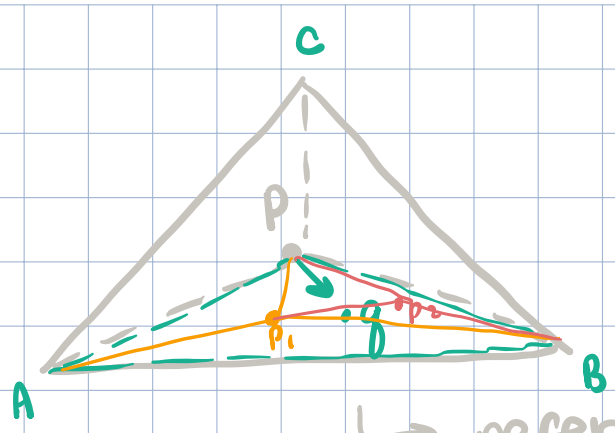
Triangulate Region~

- preprocessing ~ $O(n \log n)$
- space ~ $O(n)$

- make copy of graph w/ each vertex pointing to its copy
  - place all vertices w/ degree ≤ 11 into candidate set → S
  - pick P, remove all neighbors, remove all connected edges, retriangulate w/ P ptng to each new Δ
  - can throwout $\frac{n}{24}$ pts every time

  } while $S \neq \emptyset$

- space ~ $S(n) = n + S(\frac{23n}{24}) = \Theta(n)$

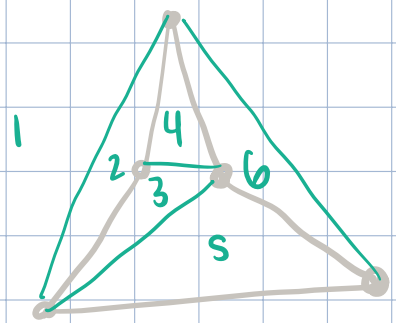


Hierarchical Search

- preprocessing = $O(n \log n)$
- space = $O(n)$
- query time = $O(\log n)$

↳ reference pt in $\triangle$ to divide into 3 parts

↳ continue doing until get to the bottom



- $v = n = 5$
- $f \leq 2n - 4 = 6$
- $e \leq 3n - 6 = 9$
- Average Degree < 6
- Total Degree $\leq 6n - 12$

KIRKPATRICK: $\frac{1}{2}$ of the vertices have degree ≤ 12