ACM ICPC 2017 - Amritapuri Regional

Presentation of solutions

1. Coder Life Matters — Easy
2. Quadratic Functions — Easy
3. A Few Laughing Men — Easy
4. Nested Candy Boxes — Easy-medium
5. Crypto Trading — Medium
6. Poetic Word — Medium
7. Magic Board — Medium
8. Longest Races — Med-Hard
9. Drunk Man in Large City — Hard
10. Sliding Puzzle — Hard
11. A Simple Polygon — Hard

Problem 1
Coder Life Matters

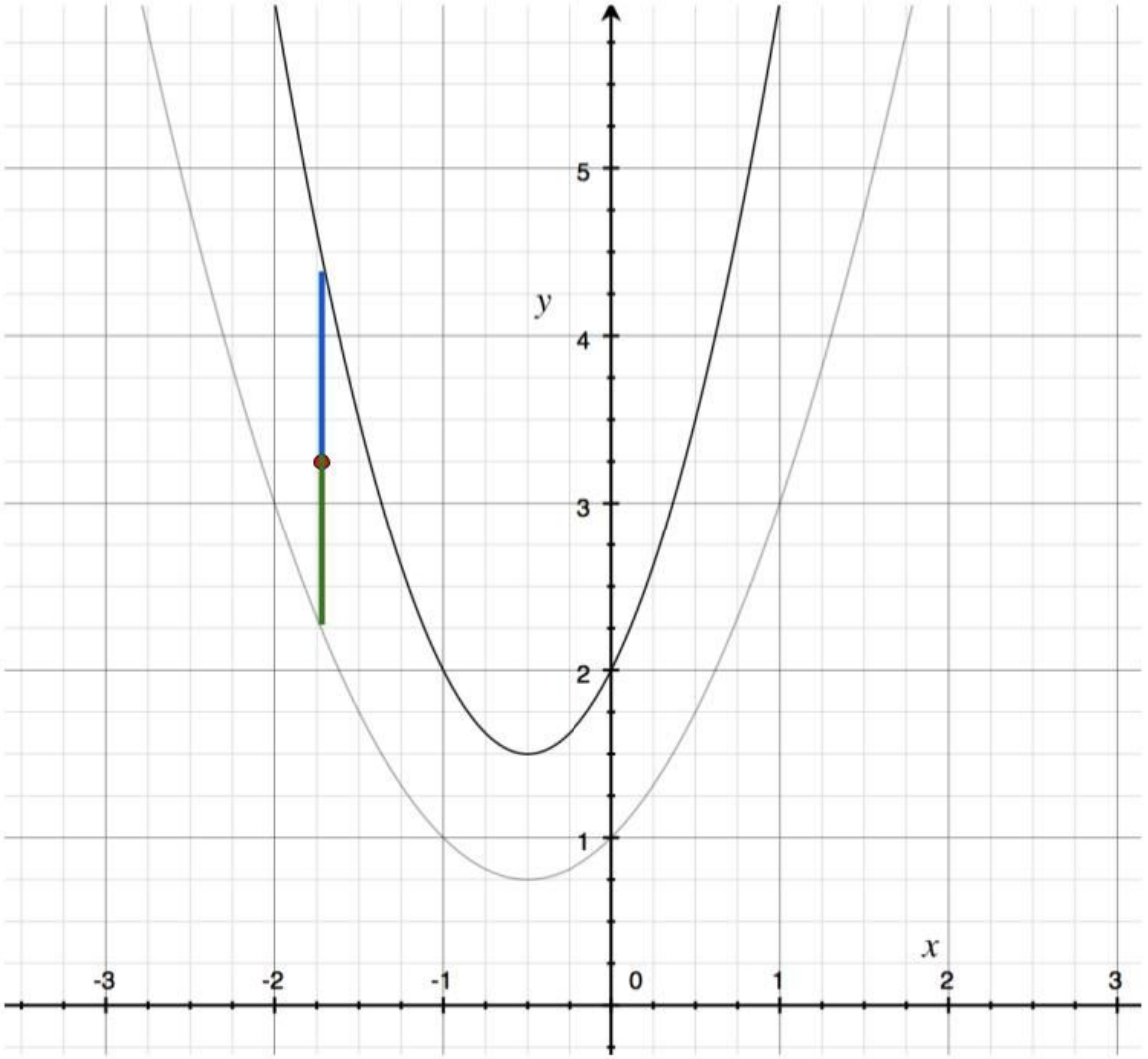
Author: Praveen Dhinwa

- Brute force
- For each i,
  check if all a[j] are 1
  for j in [i..(i + 5)].

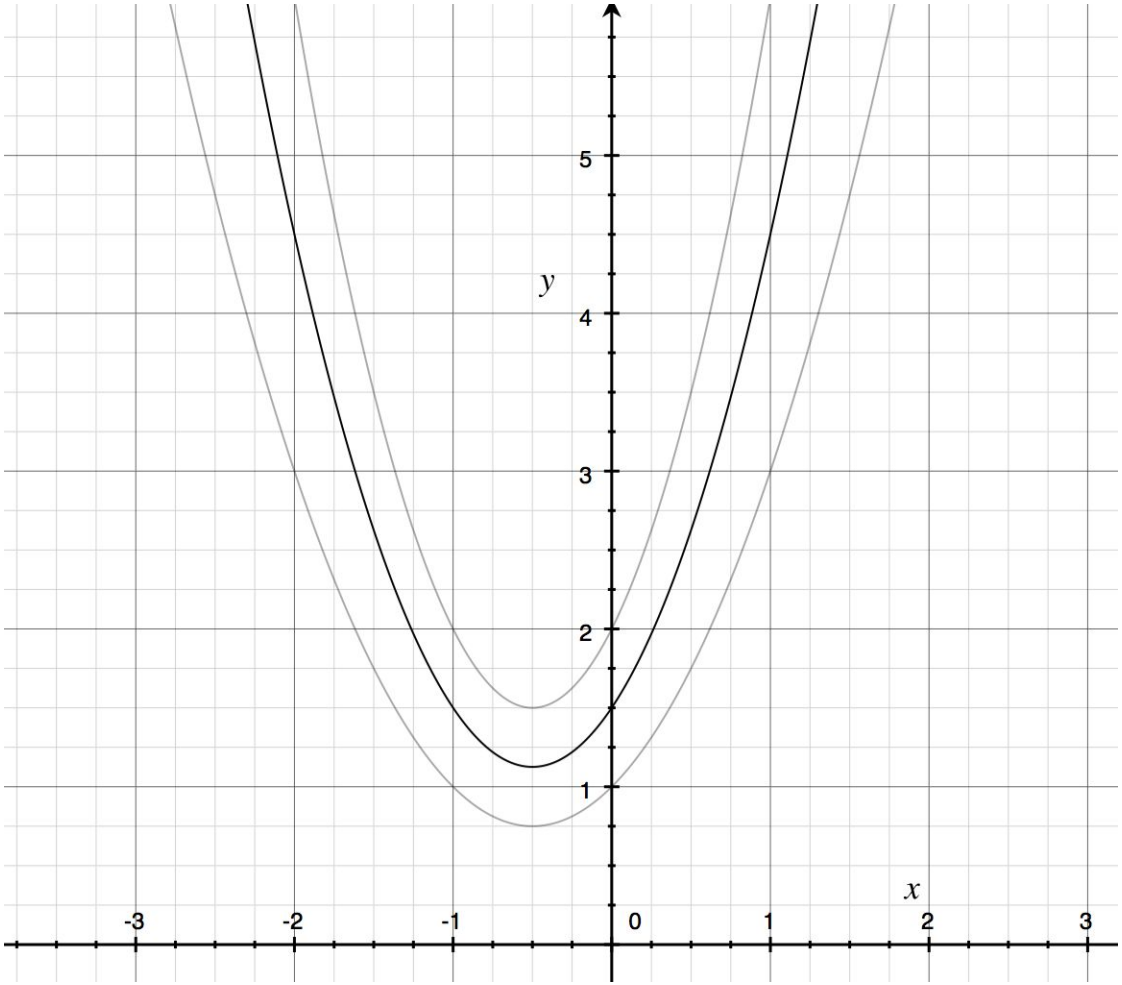
Problem 2
Quadratic Functions

Author: Vaibhav Tulsyan

- Observation 1: h(x) should lie between f(x), g(x)



- Observation 2: You can choose any non-intersecting quadratic equation lying between f(x), g(x).



- Final answer is area between the f(x) and g(x) from L to R.
- Area between f(x), g(x) =
  - Area under f(x) - Area under g(x) ; f(x) > g(x)
  - Area under g(x) - Area under f(x) ; g(x) > f(x)

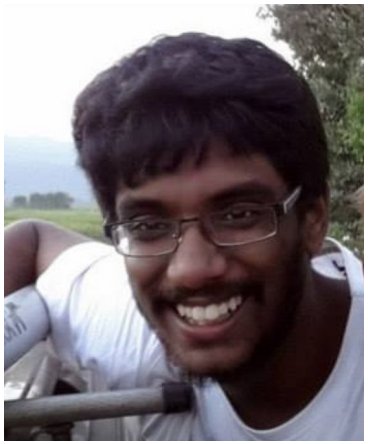
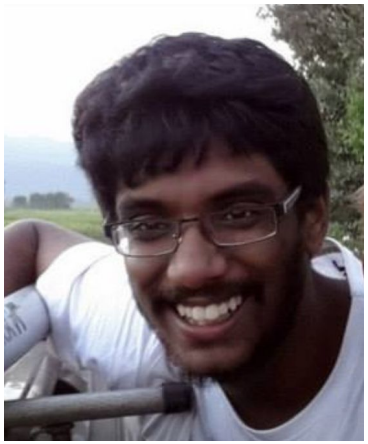
$$\left| \int_L^R f(x) - \int_L^R g(x) \right|$$

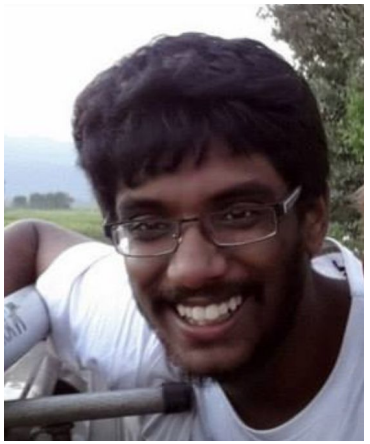
$$\left| (A - D)x^3/3 + (B - E)x^2/2 + (C - F)x \right|$$

Problem 3
A Few Laughing Men

Author: Praveen Dhinwa

+1 +1 -1 +1



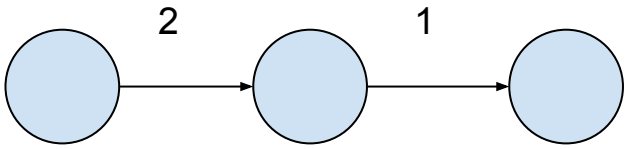
- The intensities which have their corresponding joke type as -1 are irrelevant. So throw them away. Let the rest be in array R.
- R should either form a strictly increasing sequence, or after removing one element it should form a strictly increasing sequence.
- One over-the-top way to check this, is to compute the longest increasing subsequence of this sequence and checking whether it is >= |R| - 1
- The other way is a boring method where you find one offending consecutive pair and spend time and penalties coping with the edge cases.

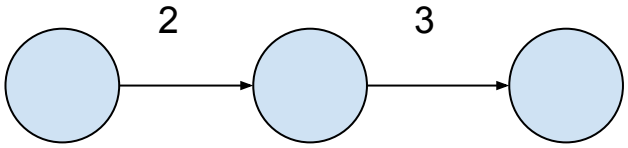
Problem 4
Nested Candy Boxes

Author: Mikhail Tikhomirov

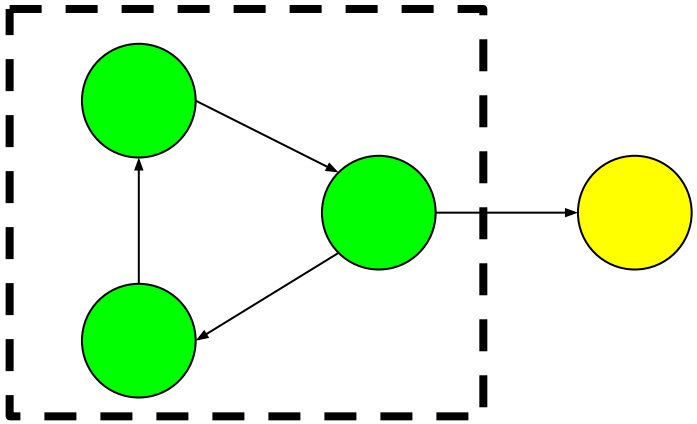
Problem 5
Crypto Trading

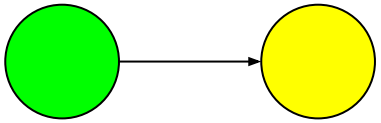
Author: Vaibhav Tulsyan

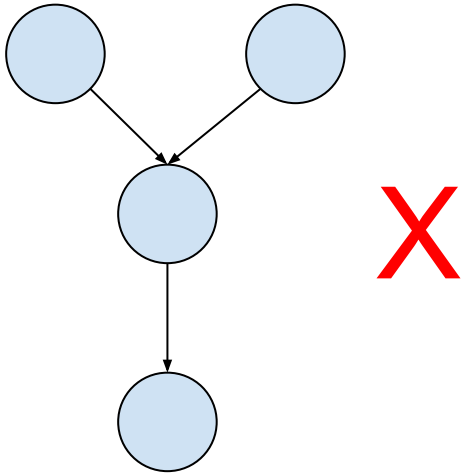


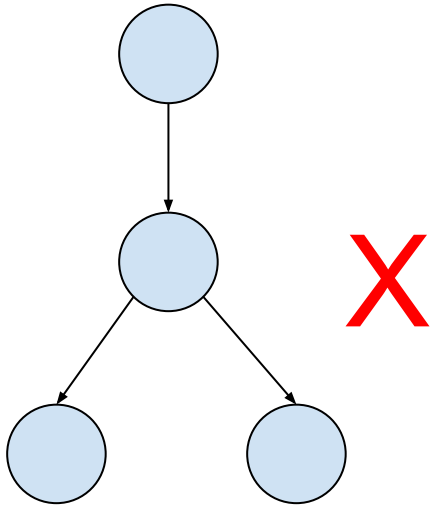


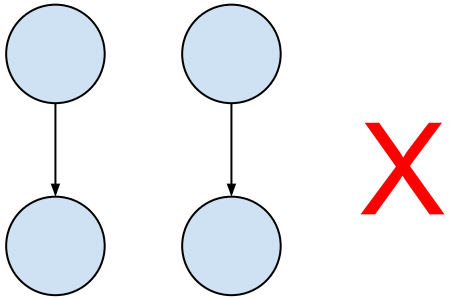
0	0	0	0	1	1	1	1

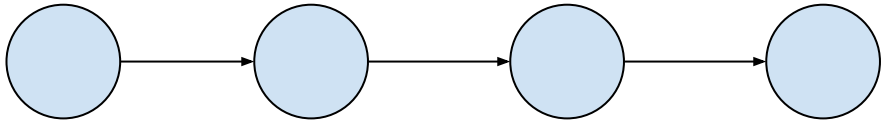


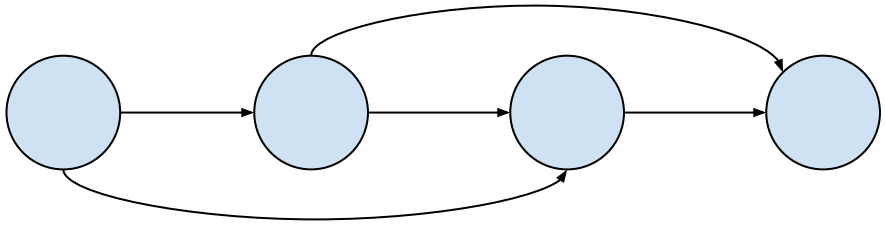












- Key observations:
  - Compress graph into a DAG of SCCs
  - Check if topological ordering of the DAG is such that there exists some path starting from a node with 0 incoming edges that visits all other nodes.

- Binary search on the maximum weight (W) that you can select.
- Construct graph with edges with weight <= W.
- Compress graph and check ordering.

Problem 6
Poetic Word

Author: Akashdeep Nain

Poetic Word

Greedy solution.

Choose all indices where only character **a** is possible, fill it then fill remaining **a's** sequentially. Do the same for rest of the characters.

Why greedy won't work?

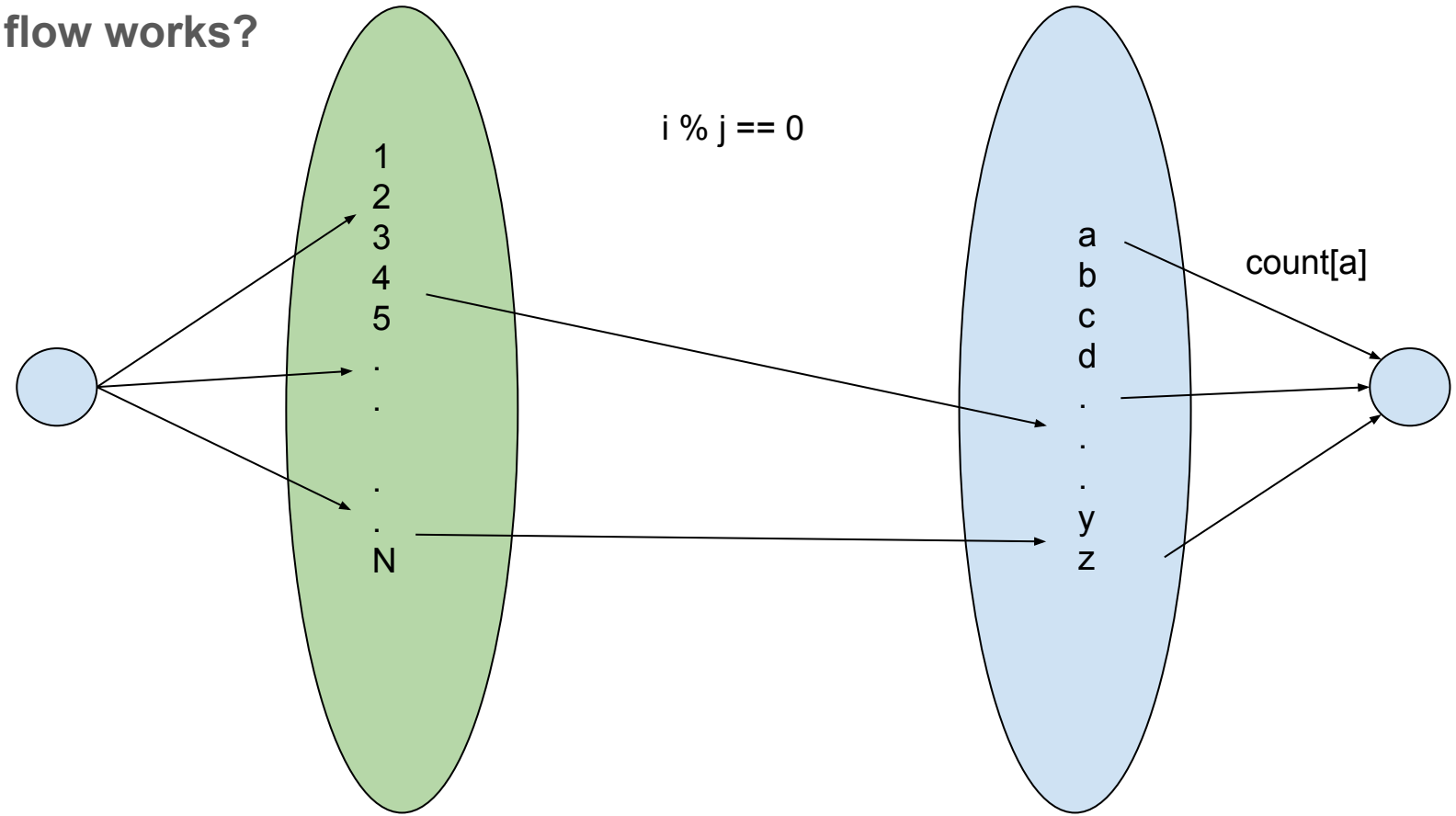
Suppose there are indices of the form **a**, **ab** and **ac** with counts as **x**, **y** and **z** respectively. And count of characters **a**, **b** and **c** are **x+1**, **y**, and **z - 1** respectively. The you can't greedily fill character **a** on any number with factors **ab** (even if index of **ab** < **ac**) else you won't be able to fill all **ac's**.

Poetic Word Contd..

What to do?

Apply max flow per index after fixing any character.

Why max flow works?



Problem 7
Magic Board

Author: Gleb Evstropov

Problem 8
Longest Races

Author: Mikhail Tikhomirov (Endagorion)

Problem 9
Drunk Man in Large City

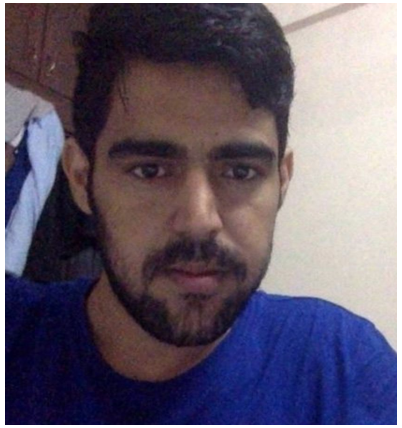
Author: Gleb Estropov

Problem 10
Sliding Puzzle

Author: Gleb Estropov

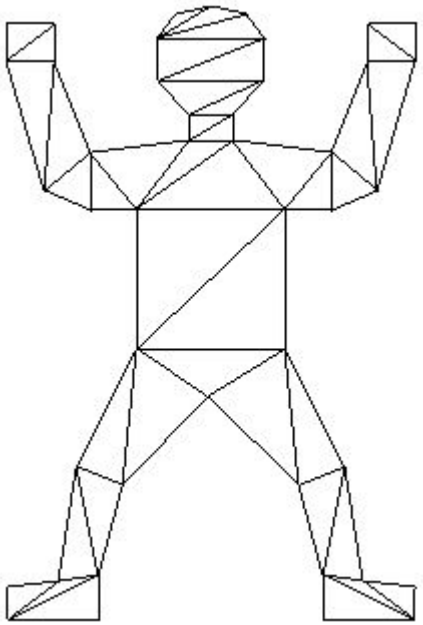
Problem 11
A Simple Polygon

Author: Praveen Dhinwa**ji**



Classic and Standard Approach

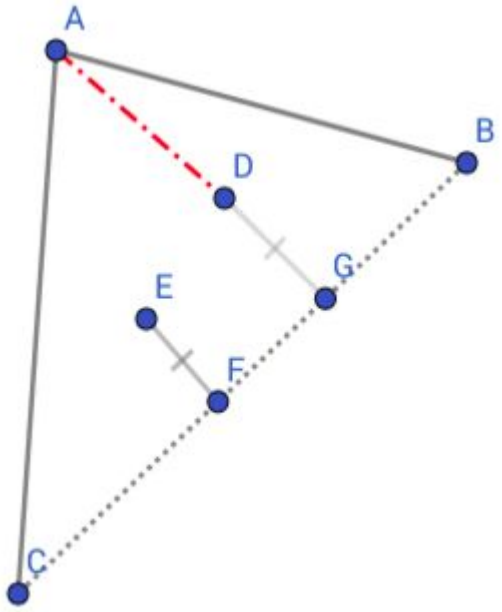
- Triangulate and print 500 of those segments



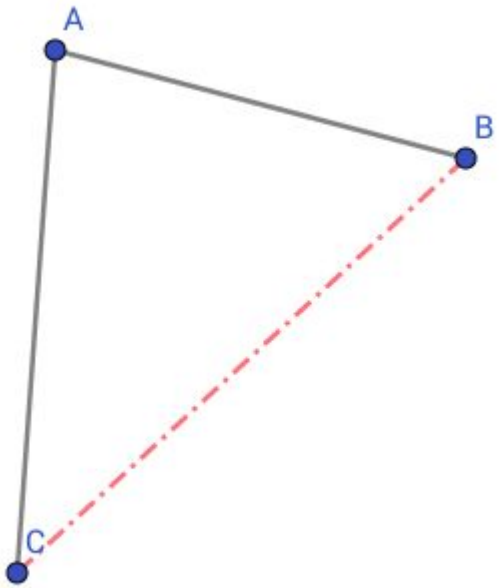
Nicer Approach

- Find any line joining two vertices of polygon that lies completely inside the polygon.
- This line segments divides the polygon into two smaller polygons, so recurse on the polygon till you achieve 500 line segments.

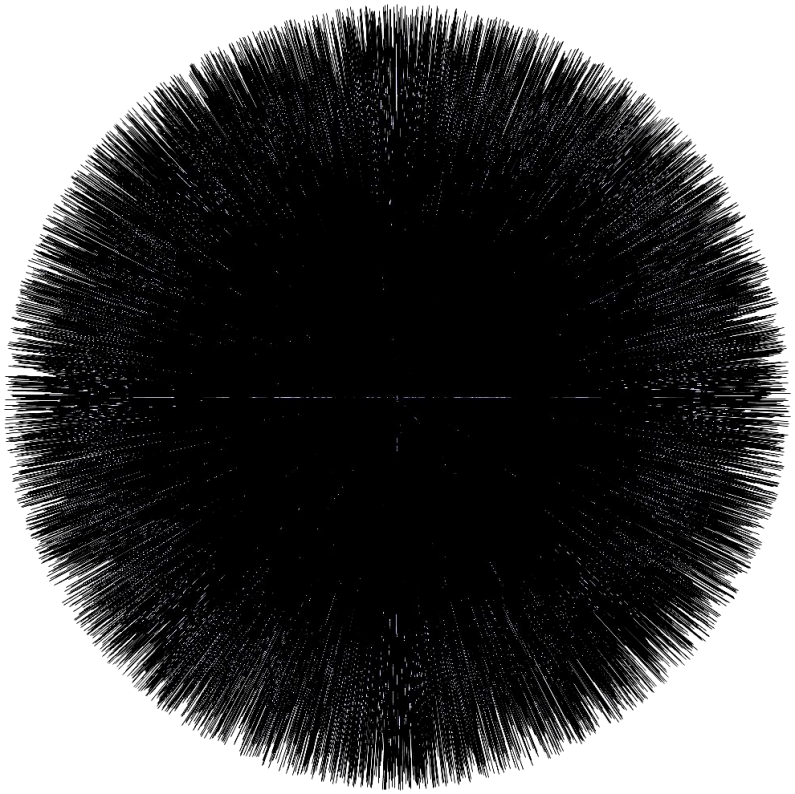
- Find a convex angle A in the polygon. Let B and C be it's adjacent vertices in the polygon. Then find the nearest vertex D of the polygon that lies inside the triangle ABC and is closest to A (not euclidean distance, but distance parallel to the line BC).

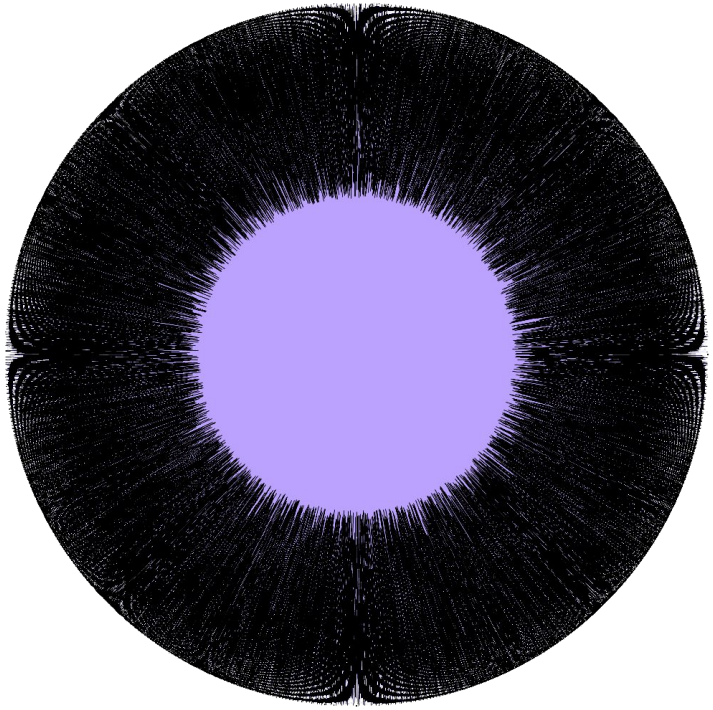


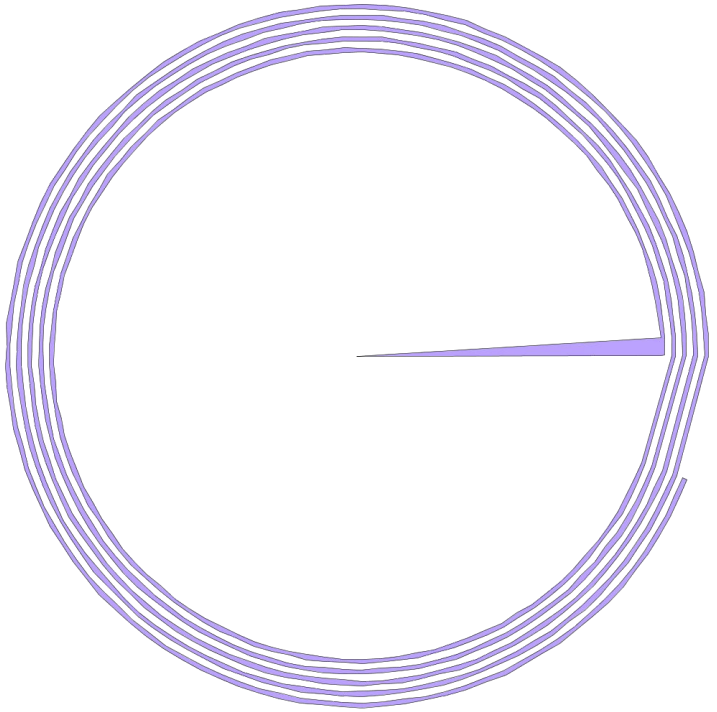
- If no point exists in the triangle ABC, then the line segment BC is the required line segment. Otherwise line segment is AD.

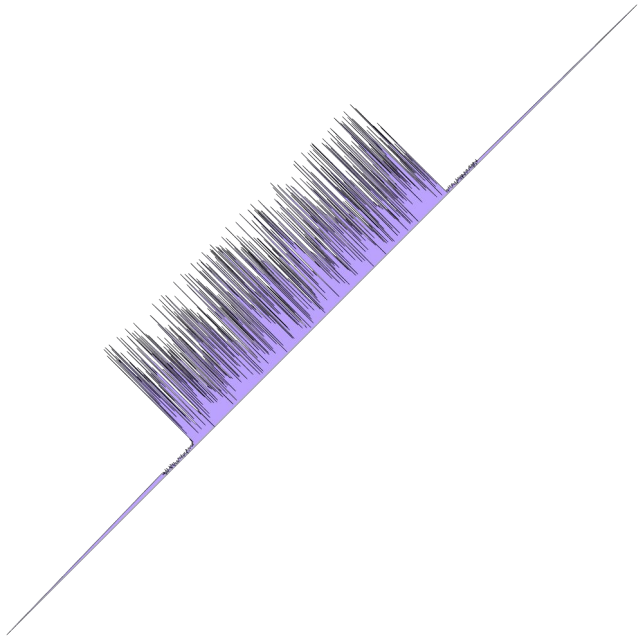


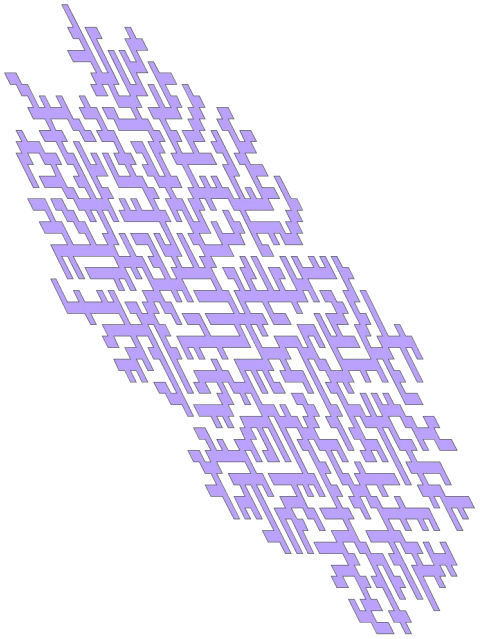
Some nice simple polygons!!

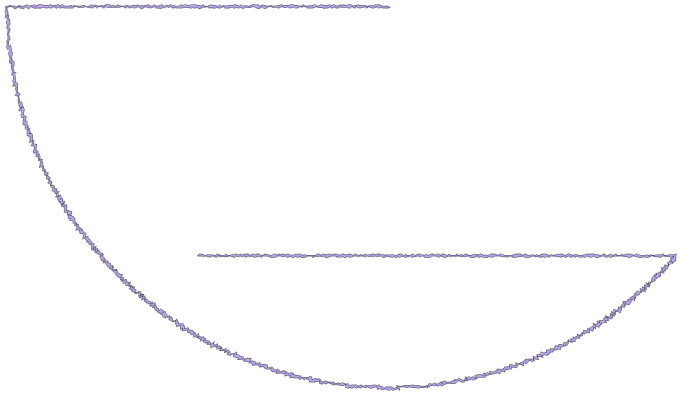


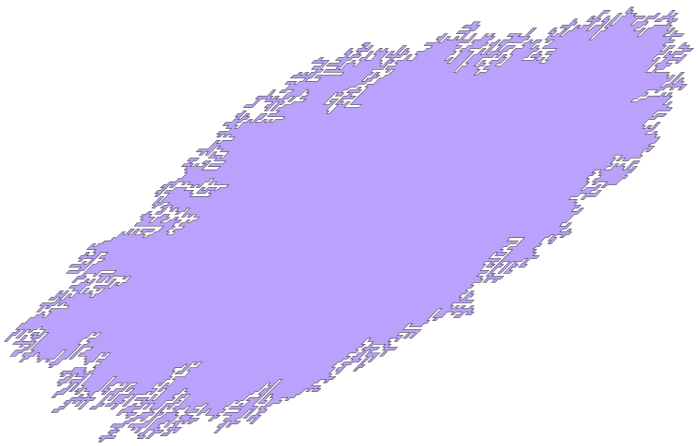


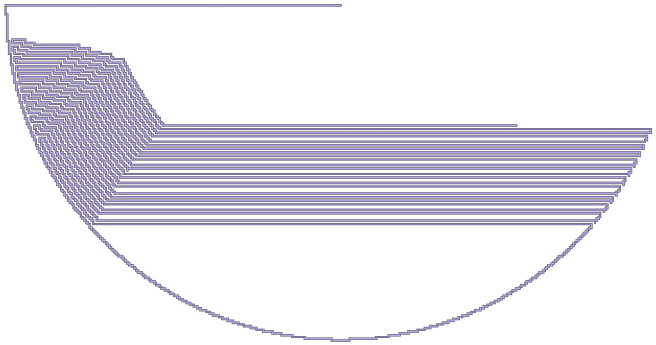


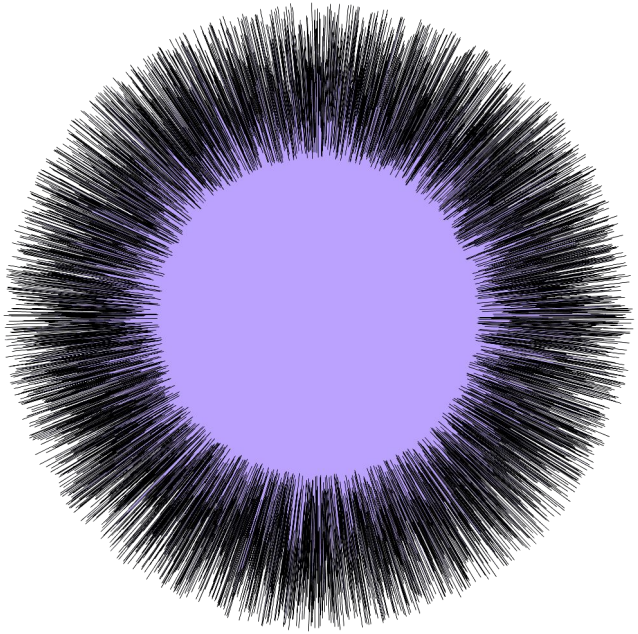


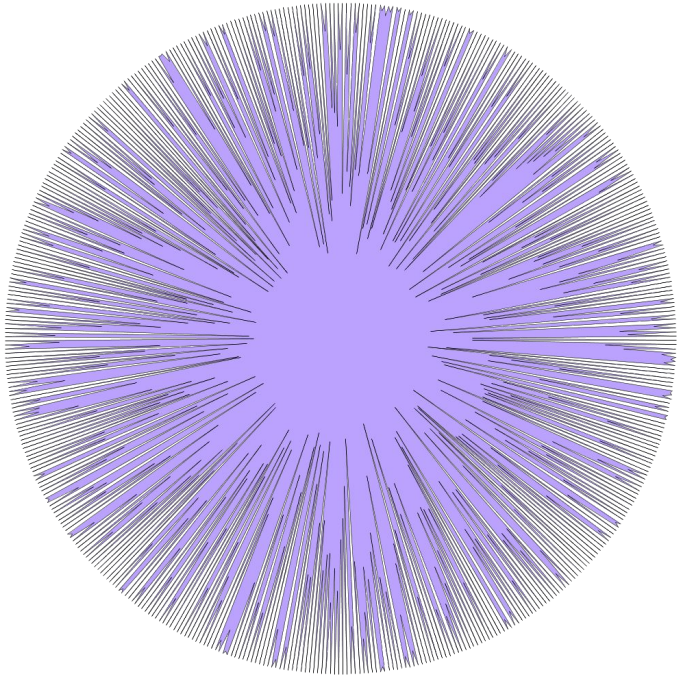


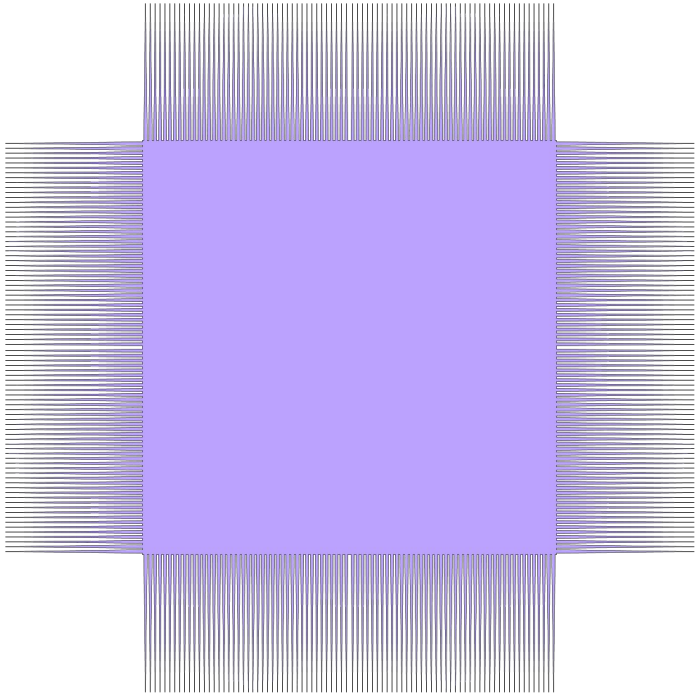


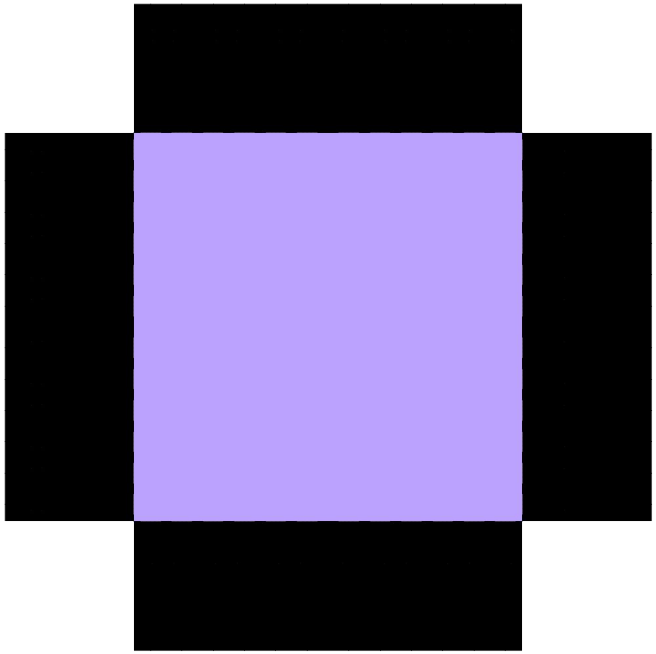


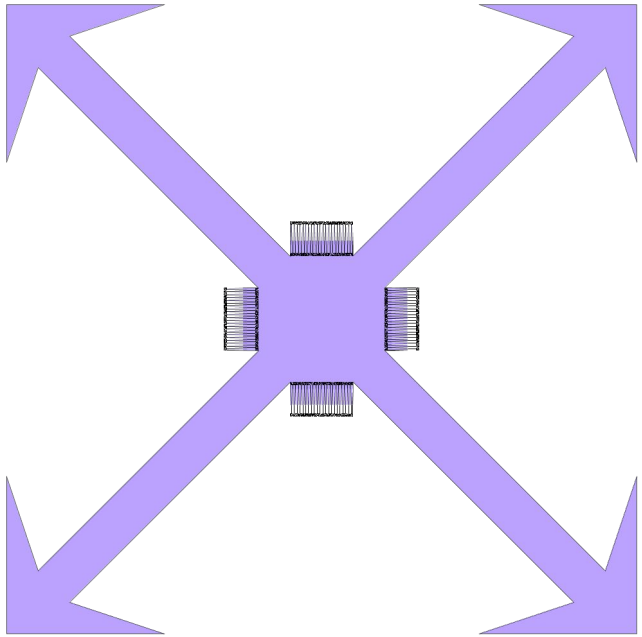












Thanks!