Lecture 27

CSE 331

Nov 1, 2019

HW 7 out

Homework 7

Due by **11:00am, Friday, November 8, 2019**.

Make sure you follow all the homework policies.

All submissions should be done via Autolab.

Question 1 (Exponentiation) [50 points]

The Problem

We will consider the problem of exponentiating an integer to another. In particular, for non-negative integers a and n, define `Power` (a, n) be the number a^n. (For this problem assume that you can multiply two integers in $O(1)$ time.) Here are the two parts of the problem:

- Part `(a)`: Present a naive algorithm that given non-negative integers a and n computes `Power` (a, n) in time $O(n)$.

> **Note**
> For this part, there is no need to prove correctness of the naive algorithm but you do need a runtime analysis.

- Part `(b)`: Present a divide and conquer algorithm that given non-negative integers a and n computes `Power` (a, n) in $O(\log n)$ time.

HW 6 solutions

At the end of the lecture

Video due on Monday

By 11am

! ALL group members submit!

Each group member must submit the PDF. *Further, the PDF must EXACTLT be the same for all three group members.*

! PDF only please

Autolab might not be able to display files in formats other than PDF (e.g. Word cannot be displayed). **If Autolab cannot display your file, then you will get a zero (0) on the entire question**.

Survey 12pm Mon to 11am Wed

Submitting the survey

The peer evaluation survey will have to be filled on https://cse.buffalo.edu/teamwork. You will evaluate yourself and your groupmates in all the five categories.

The workflow

1. Between **12:00pm on Monday Nov 4** and **10:59apm on Wednesday Nov 6** the website above will be ready for you.
2. You will need to enter your UB email and click on a button to generate a verification code.
3. You will have limited time (~10 mins) to enter the verification code into the webage.
4. You will then fill in the survey: the website will ask you to evaluate yourself and your groupmates in all the five categories above.
5. Your part is done. Atri will use your survey responses and your video submission to post your video mini-project scores on Autolab (the scores will be posted on your video submission).

UB CSE Evaluation Form

Please enter your UB email address! You'll then receive a verification code you can type in further down the page.

ubitname@buffalo.edu

Get Verification Code

Already have valid code?

UB Hacking!


note

stop following 37 views

UB Hacking over the weekend!

I hope many of y'all are registered for UB Hacking over the weekend @1060

I'm sure it'll be a ton of fun and I'll try and stop by and say Hi :-)

Some logistical implications:

- Many of your TAs will also be a UB Hacking so our response over the weekend would be slooooooooow
- Before any of your ask, no there will not be any extension to the deadline for this coming week.

#pin

homework7 mini_project piazza

edit · good note | 2

Updated 56 minutes ago by Atri Rudra

Coding project Problem 3 out!

note

stop following 84 views

Problem 3 on Coding Project is now live!

Well, "a few days" in @980 turned out to be a few more days than I had anticipated! Apologies again for the delay in getting this done but Autolab is now accepting submissions for Problem 3 for the coding project. The coding project webpage has been updated with the required coding details:

http://www-student.cse.buffalo.edu/~atri/cse331/fall19/coding-project/index.html

Few things to keep in mind:

- As with problem 1 (@801) and 2 (@980), this is group submission-- please see the webpage for instructions on how to do so. *Please follow the instructions EXACTLY. Not following the instructions might make the group submission on Autolab not behave as intended.*
- You have to form your group **AGAIN** for Problem 3 on Autolab-- it unfortunately does not carry over from Problem 1 or Problem 2.
- **Please download the zip for Problem 3 and use that for Problem 3 submission.** In particular, do NOT use the zip for Problem 1 or 2 for Problem 3.
- Since I released Problem 3 a few days after I would have liked, **I am extending the deadline for Problem 3 ONLY to 11am on Tue, Nov 26**.
  - *All the other deadlines (including that for Problem 2) remain as before.*
- Problems 4 and 5 should be up by next week.

If you have questions, please post on piazza! Or go to office hours. Have fun :-)
#pin

coding_mini_project

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Updated 6 hours ago by Atri Rudra

Addendum to CSE 410

Resolved Unresolved

Actions

Atri Rudra 3 days ago

I should also clarify that the workload is going to be nowhere as crazy as 331. Pretty much the only things that y'all will have to do is to have a final output-- all of the rest of the semester is going to be milestones towards the final goal. I just realized that I forgot to post the tentative logsitics for the course, which now follows.

TENTATIVE LOGISTICS

The main graded component for the students will be a project that the students will be working on over the semester. The students will form groups of size 2-3 (depending on class size) and explore application of algorithms on some segment of society. Ideally, the group should not have everyone from the same school. The students are expected to come up an impact of the chosen algorithm in the said segment of society that has either not been studied before or has received little attention (either in popular media or academic research). The group is supposed to identify a potential research question that can be investigated further (some initial suggestions will be provided). The mini project will have three main components: (1) a written report, (2) a YouTube video and (3) a demo of a prototype. The students will submit a preliminary version of the report by the middle of the semester so that they can get feedback from the instructor that they can use towards their final report, video and prototype. Tentatively, the final report should be up to 10 pages and the video up to 10 minutes long. Each group will also meet with the instructor every week for a short (<= 10 mins) update on their progress in the last week. This is to ensure that the groups are making sufficient progress as the semester moves along.

Students in Section A1 are expected to be the main contributors in their group of building the prototype while students in Section A2 will be the primary contributors in their group to looking into the societal implications of their project. Students in two sections will be graded differently on the prototype based on their primary contributions.

Every week, the class will focus on one segment of society (e.g. criminal justice system or human resources (i.e. hiring)) and discuss the impact of algorithms on that segment of society OR will talk about a stage in the algorithm development pipeline. Students will be expected to participate in the in-class discussion. Whenever possible, we will have domain experts (e.g. someone from law school talking about the criminal justice system) come and talk during the week.

Depending on the class size, the last week (or two) will be used to screen the videos that various student groups have submitted and the groups will answer any question or address any comments/thoughts that the class might have. All this feedback will be incorporated in the final report and prototype, which will be due in the finals week. We will use the final exam time for demo of the prototypes.

Reply to this followup discussion

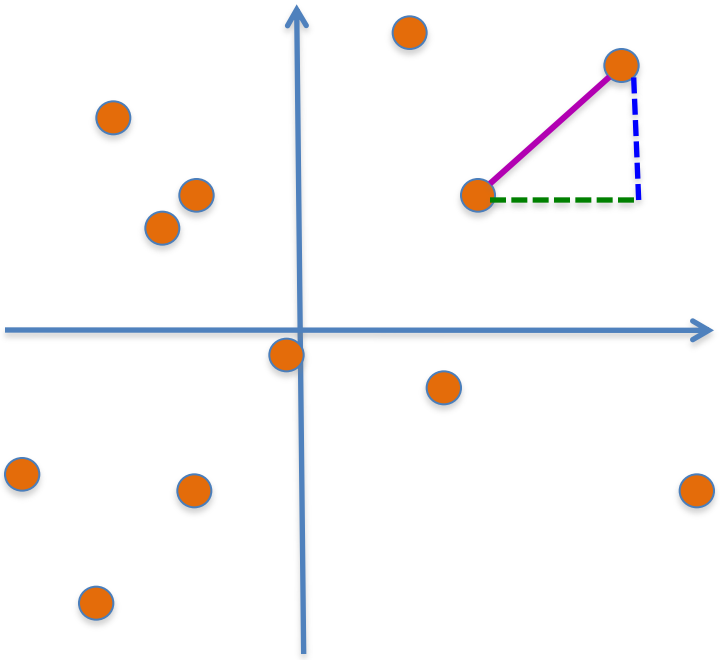
Questions?

Closest pairs of points

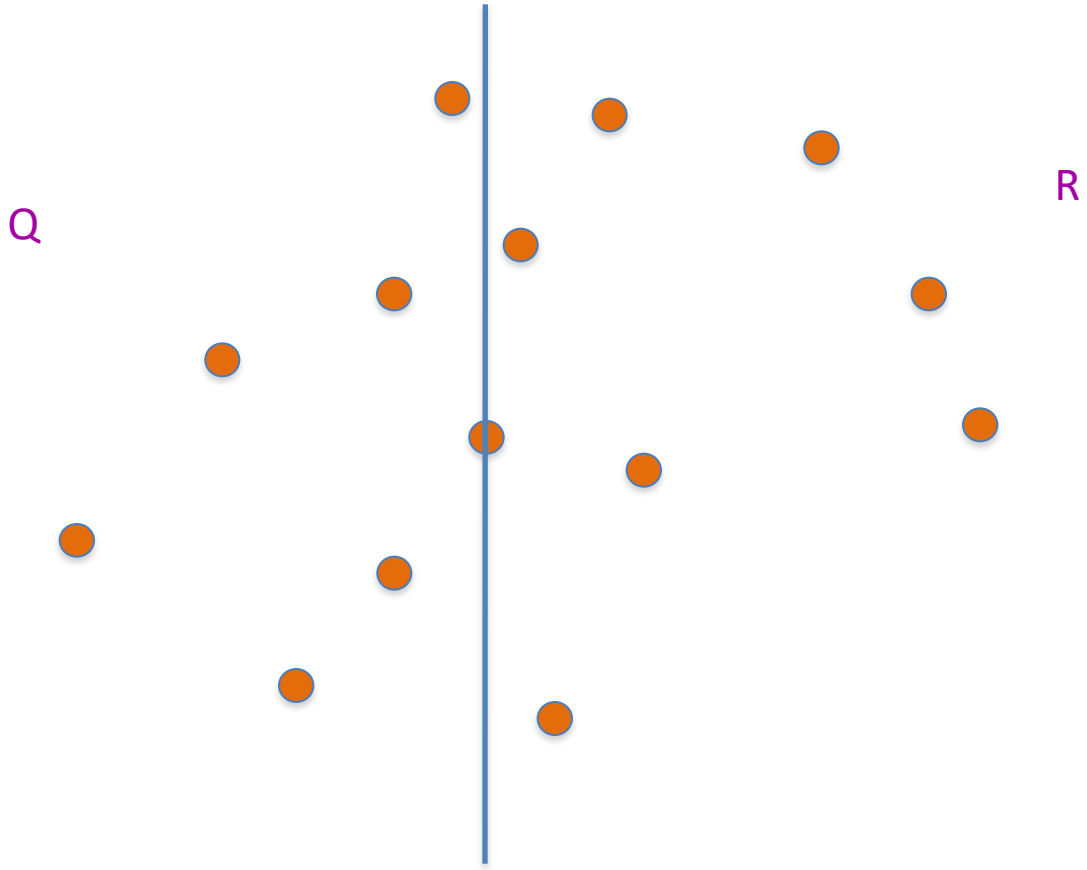
Input: n 2-D points $P = \{p_1,\ldots,p_n\}$; $p_i=(x_i,y_i)$

$d(p_i,p_j) = ((x_i-x_j)^2+(y_i-y_j)^2)^{1/2}$

Output: Points p and q that are closest

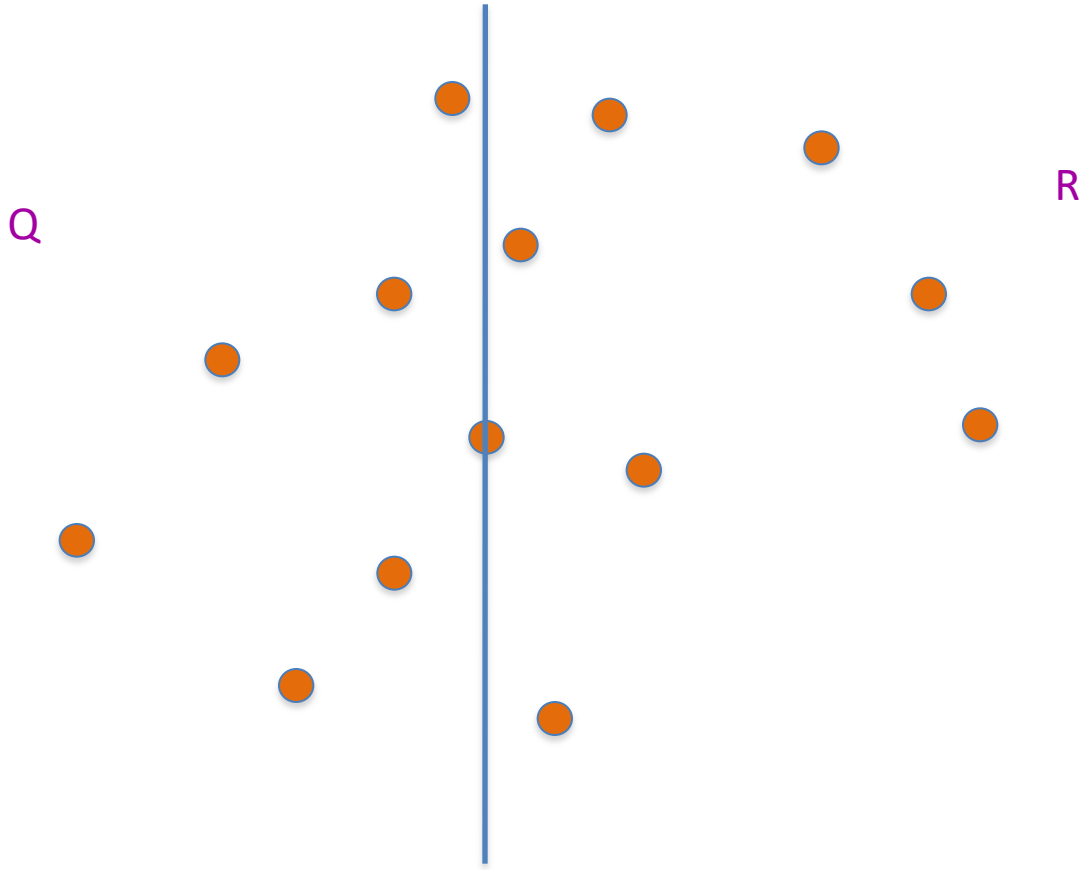


Dividing up P



First n/2 points according to the x-coord

Recursively find closest pairs



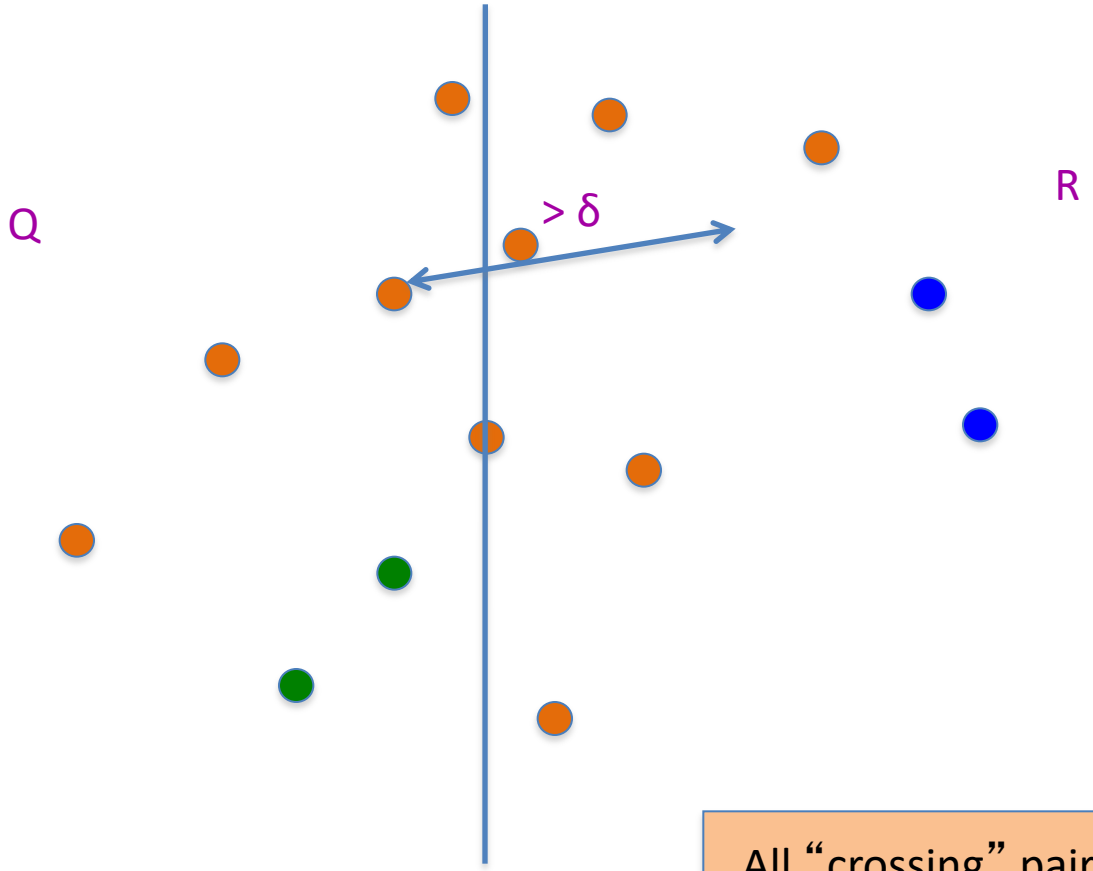
δ = min (**blue**, **green**)

An aside: maintain sorted lists

P_x and P_y are P sorted by x-coord and y-coord

Q_x, Q_y, R_x, R_y can be computed from P_x and P_y in $O(n)$ time

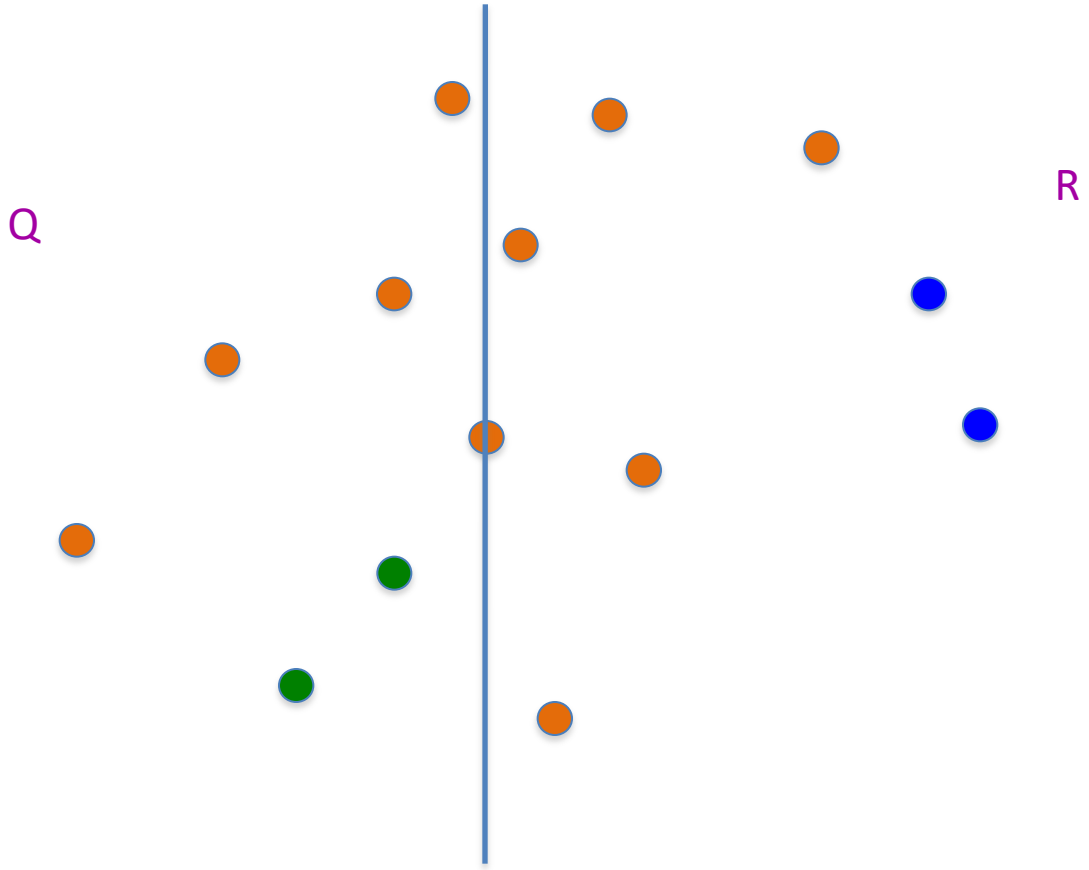
An easy case



All "crossing" pairs have distance > δ

δ = min (**blue**, **green**)

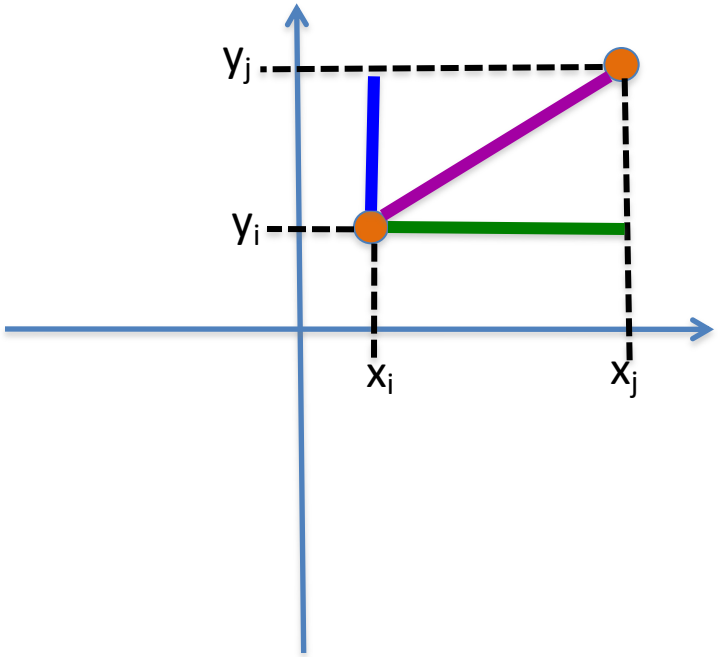
Life is not so easy though



δ = min (**blue**, **green**)

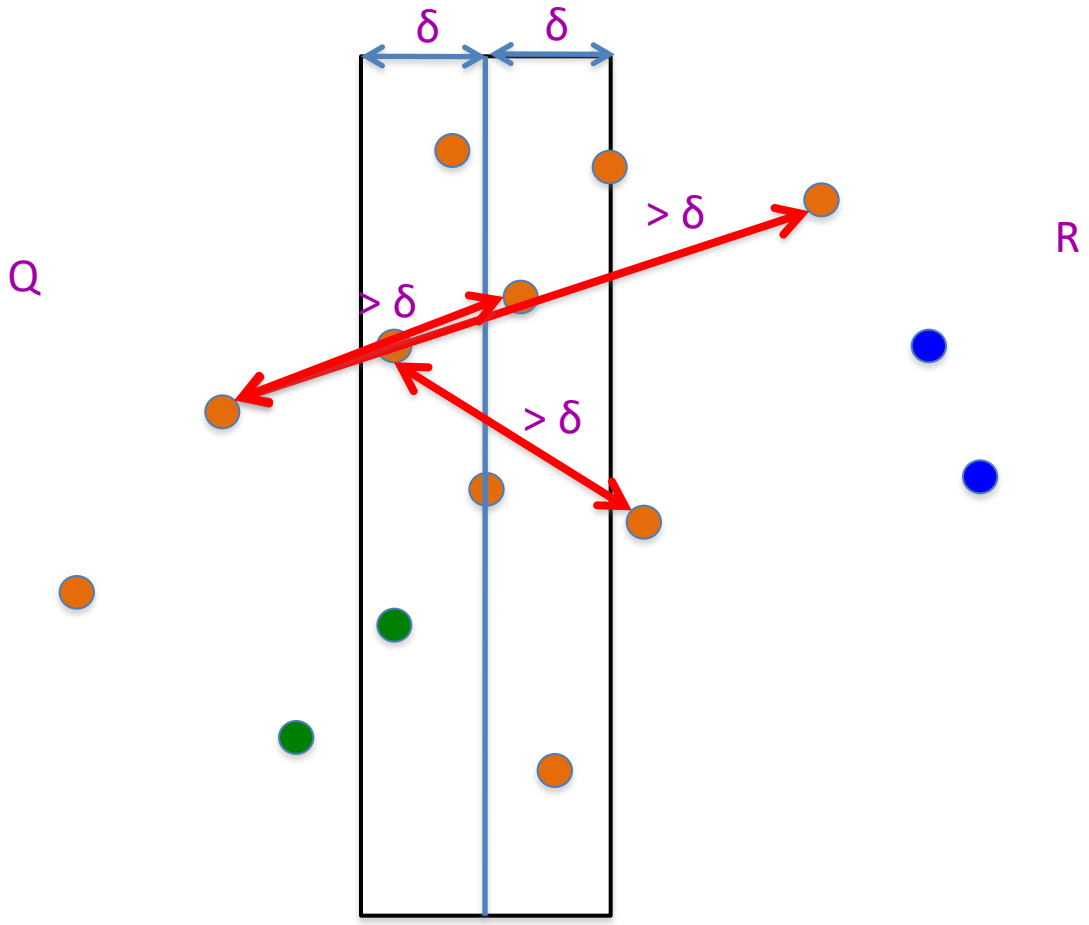
Euclid to the rescue (?)

$$d(p_i,p_j) = ((x_i-x_j)^2+(y_i-y_j)^2)^{1/2}$$



The distance is larger than the **x** or **y**-coord difference

Life is not so easy though



δ = min (**blue**, **green**)

All we have to do now

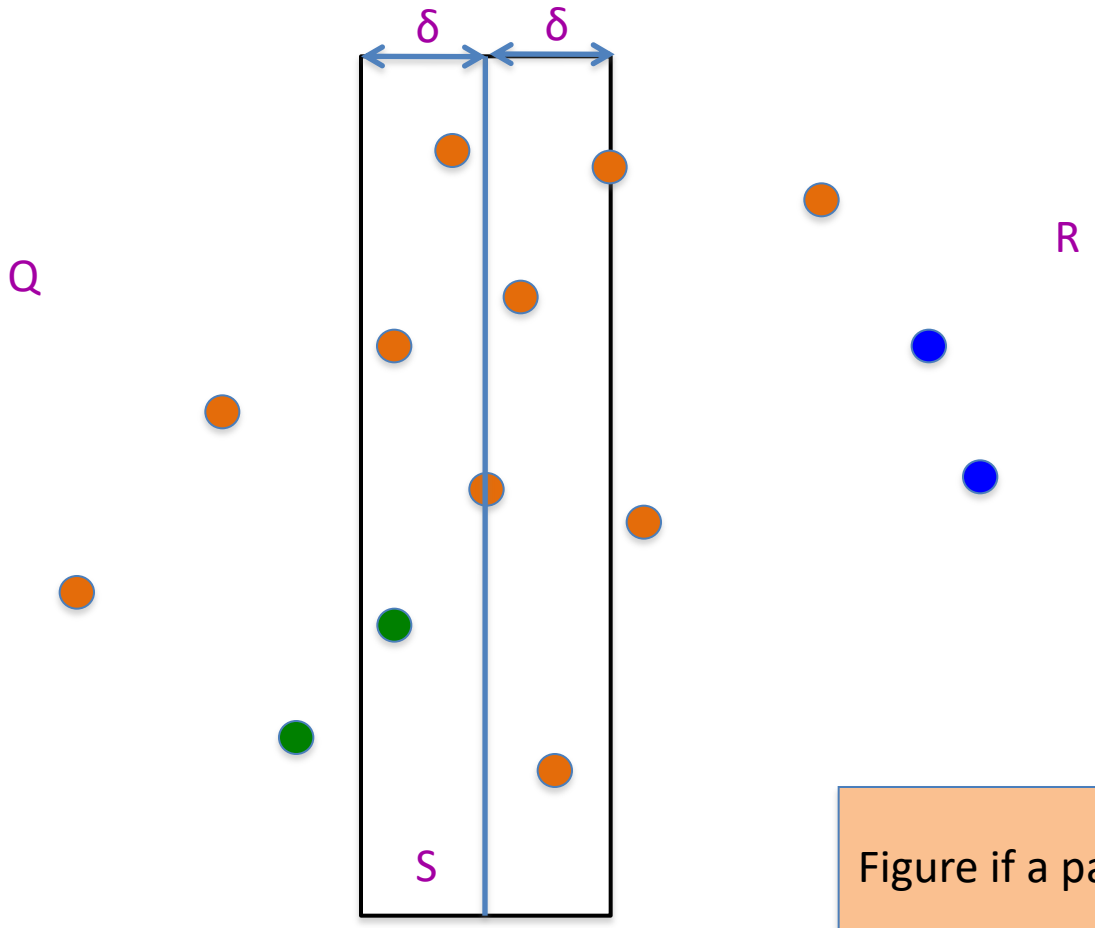


Figure if a pair in S has distance < δ

δ = min (**blue**, **green**)

The algorithm so far…

$O(n \log n) + T(n)$

Input: n 2-D points $P = \{p_1,\ldots,p_n\}$; $p_i=(x_i,y_i)$

Sort P to get P_x and P_y — $O(n \log n)$

Closest-Pair (P_x, P_y)

If $n < 4$ then find closest point by brute-force

$T(< 4) = c$

$T(n) = 2T(n/2) + cn$

Q is first half of P_x and R is the rest — $O(n)$

Compute Q_x, Q_y, R_x and R_y — $O(n)$

(q_0,q_1) = Closest-Pair (Q_x, Q_y)

(r_0,r_1) = Closest-Pair (R_x, R_y)

$O(n \log n)$ overall

$\delta = \min (d(q_0,q_1), d(r_0,r_1))$ — $O(n)$

S = points (x,y) in P s.t. $|x - x^*| < \delta$ — $O(n)$

return Closest-in-box (S, (q_0,q_1), (r_0,r_1)) — Assume can be done in $O(n)$

Rest of today's agenda

Implement Closest-in-box in O(n) time