Lecture 31

CSE 331

Nov 13, 2017

Mini project video due TODAY

note

stop following 131 views

Video submission now open on Autolab

Sorry, forgot to do this earlier: you can now submit your video (note still PDF with the link in it) on Autolab.

YOU WILL NEED TO FORM YOUR GROUP ON AUTOLAB AGAIN BEFORE SUBMITTING.

See the mini project page for the details:

http://www-student.cse.buffalo.edu/~atri/cse331/fall17/mini-project/index.html

#pin

mini_project

edit · good note | 0

Updated 4 days ago by Atri Rudra

Two changes in HWs

note

stop following | 34 views

Two upcoming changes to Homeworks

For HW 9 and HW 10 we will be piloting the following changes:

- For Q2 and Q3 we will provide some sample input/output pairs. This way you can at least "run" your algorithm on the sample input(s) to make sure that your algorithms output matches the given output.
  - Of course your algorithm computing the correct outputs on the sample inputs does not guarantee that your algorithm is correct but at least it would give some way for you to double-check your algorithms.
  - We have been doing this in an ad-hoc manner in the previous HWs: we're just making this explicit for HW 9 and 10.
  - This will also hopefully clarify some of the questions on what the input and outputs are supposed to be.
- For Q2 and Q3 that involve designing algorithms, the points for the proof idea:proof details will be a 80:20 split instead of the current 50:50 split.
  - This is the case in the exams anyway so I think it makes sense to do this for HWs too.

At the end of the semester, I'll get your feedback and if it is positive we'll make these changes for all HWs in fall 2018.
#pin

homework9 homework10 grading

edit | good note | 0

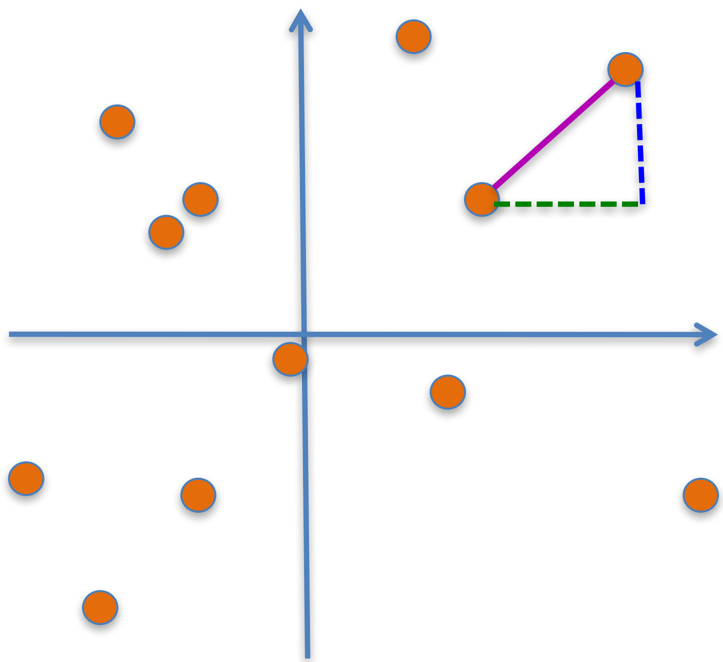
Updated 11 hours ago by Atri Rudra

Closest pairs of points

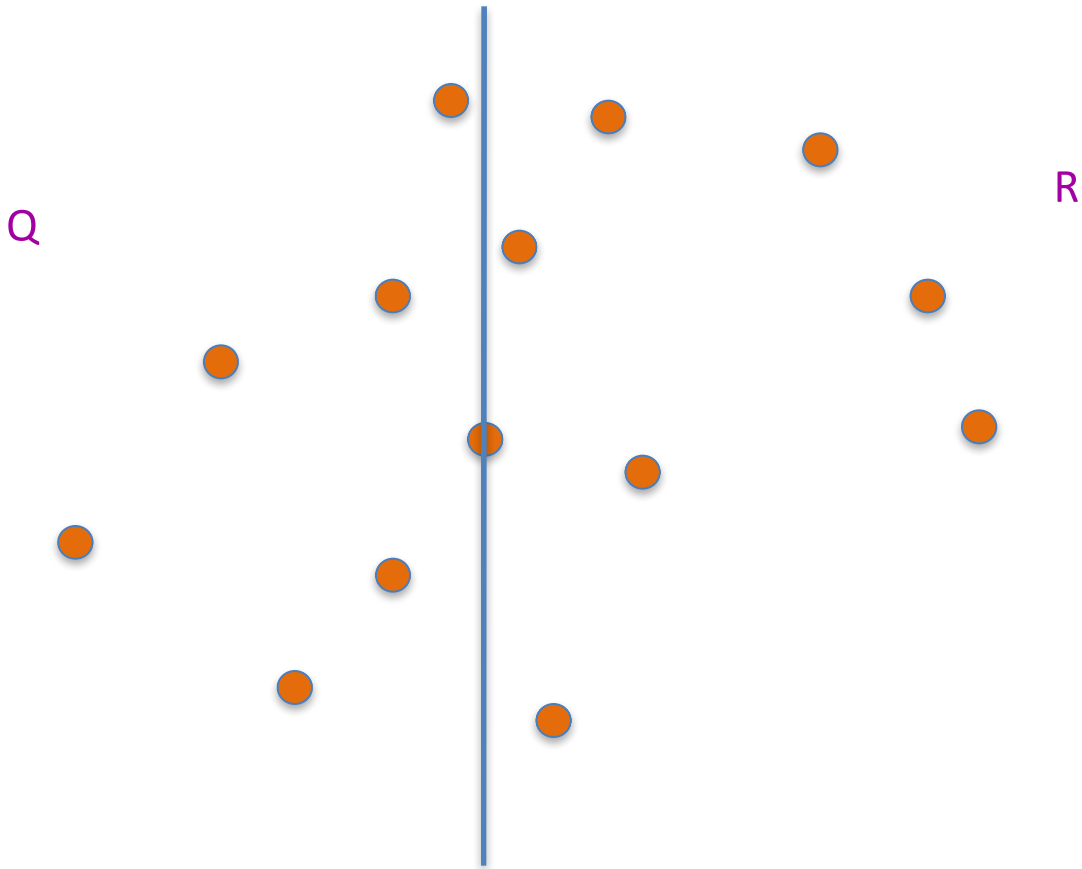
Input: n 2-D points $P = \{p_1,\ldots,p_n\}$; $p_i=(x_i,y_i)$

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

Output: Points p and q that are closest

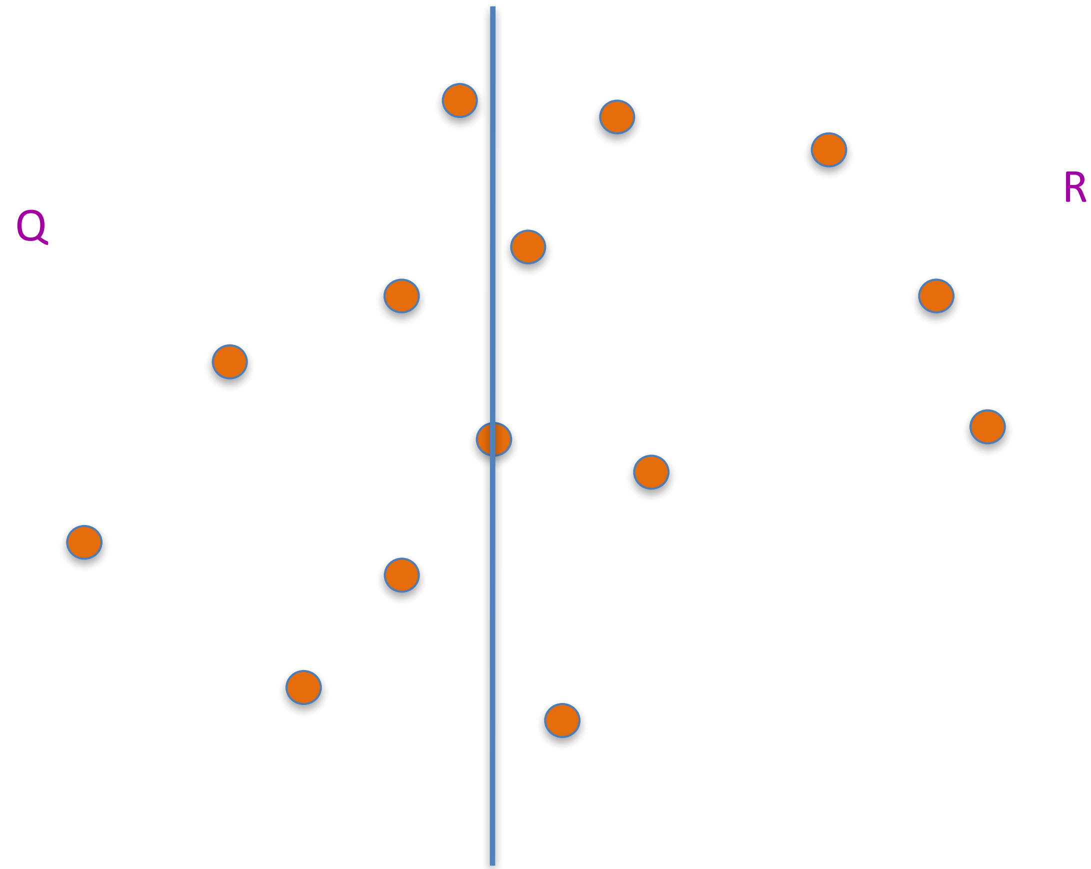


Dividing up P



First n/2 points according to the x-coord

Recursively find closest pairs



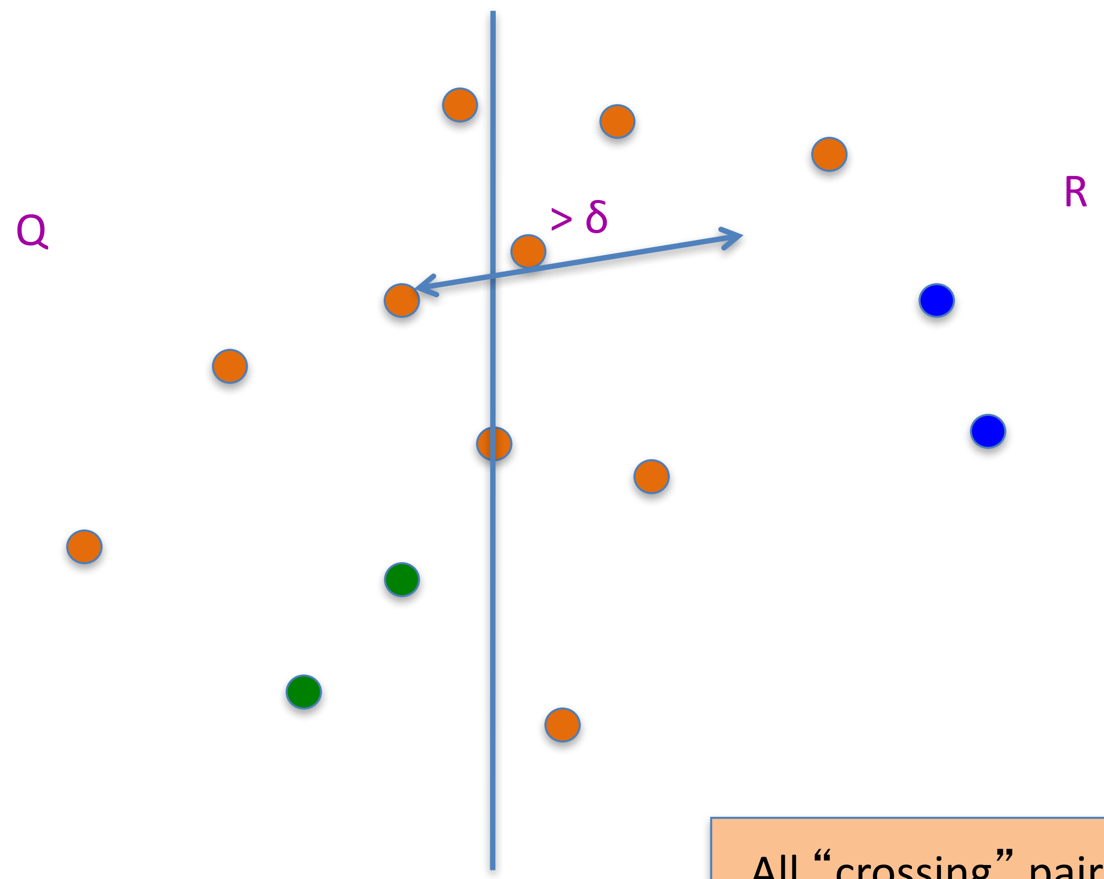
δ = min (**blue**, **green**)

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

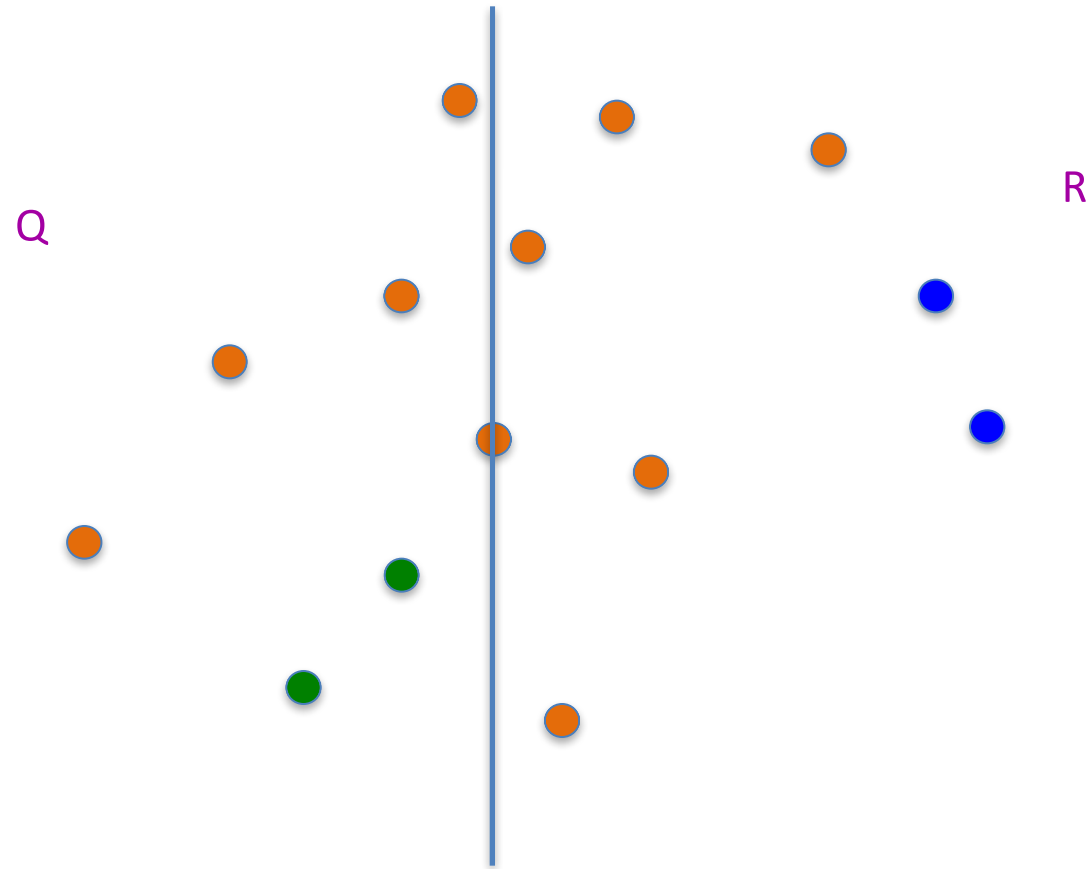
An easy case



All "crossing" pairs have distance > δ

δ = min (**blue**, **green**)

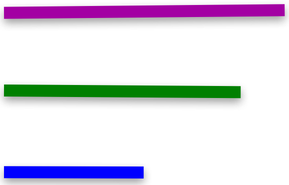
Life is not so easy though

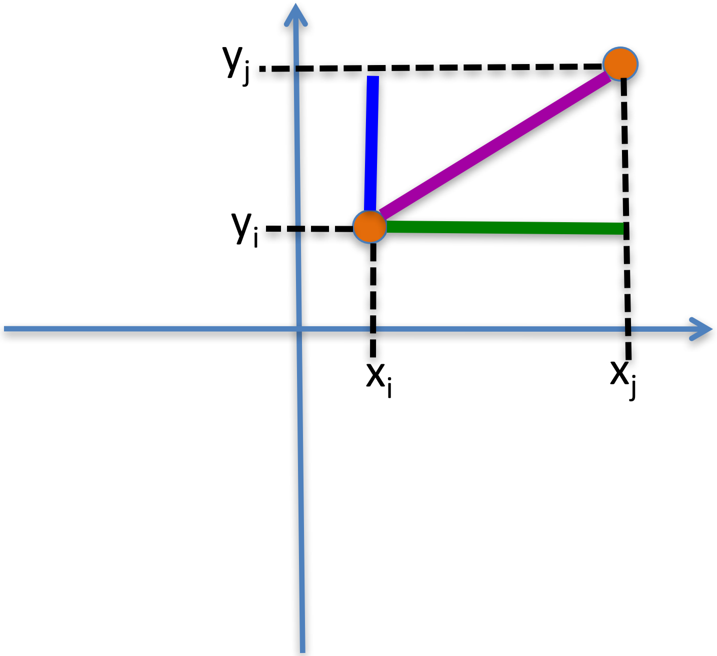


δ = min (**blue**, **green**)

Euclid to the rescue (?)

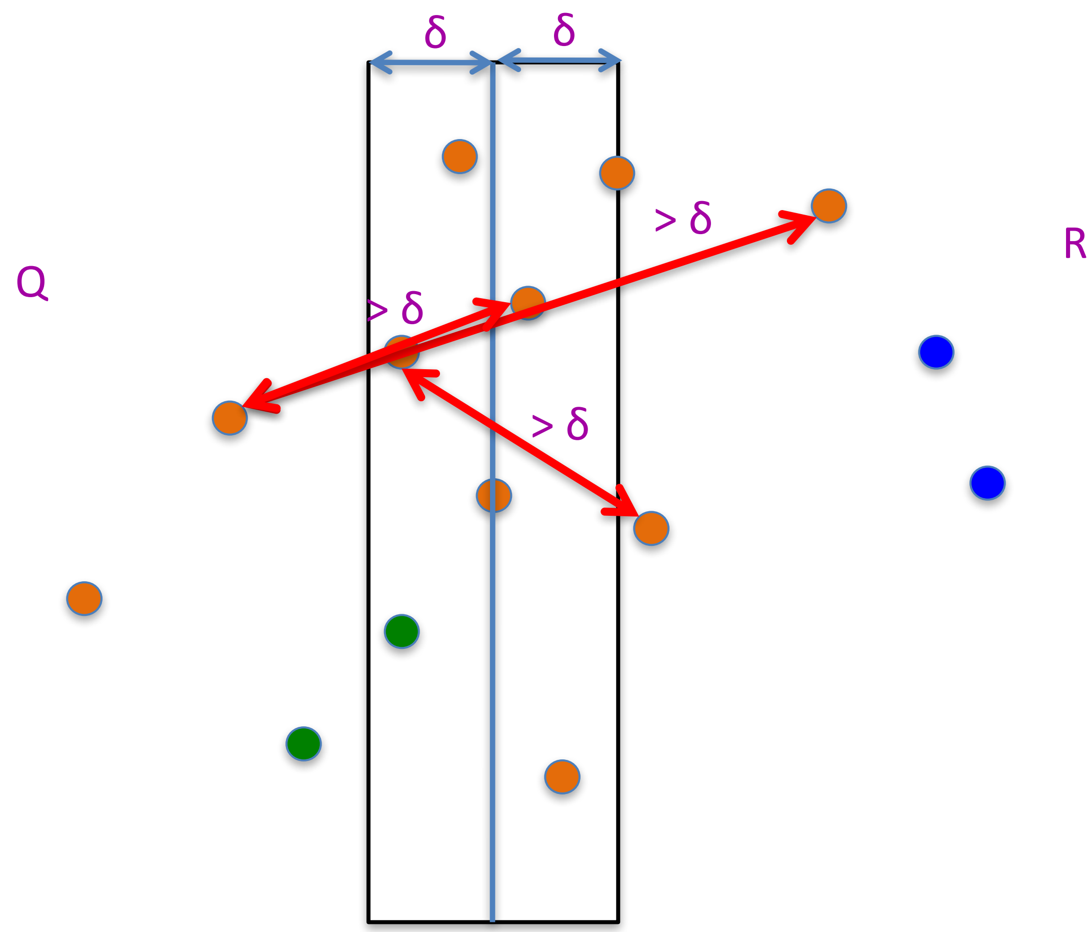
$d(p_i,p_j) = ((x_i-x_j)^2+(y_i-y_j)^2)^{1/2}$





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

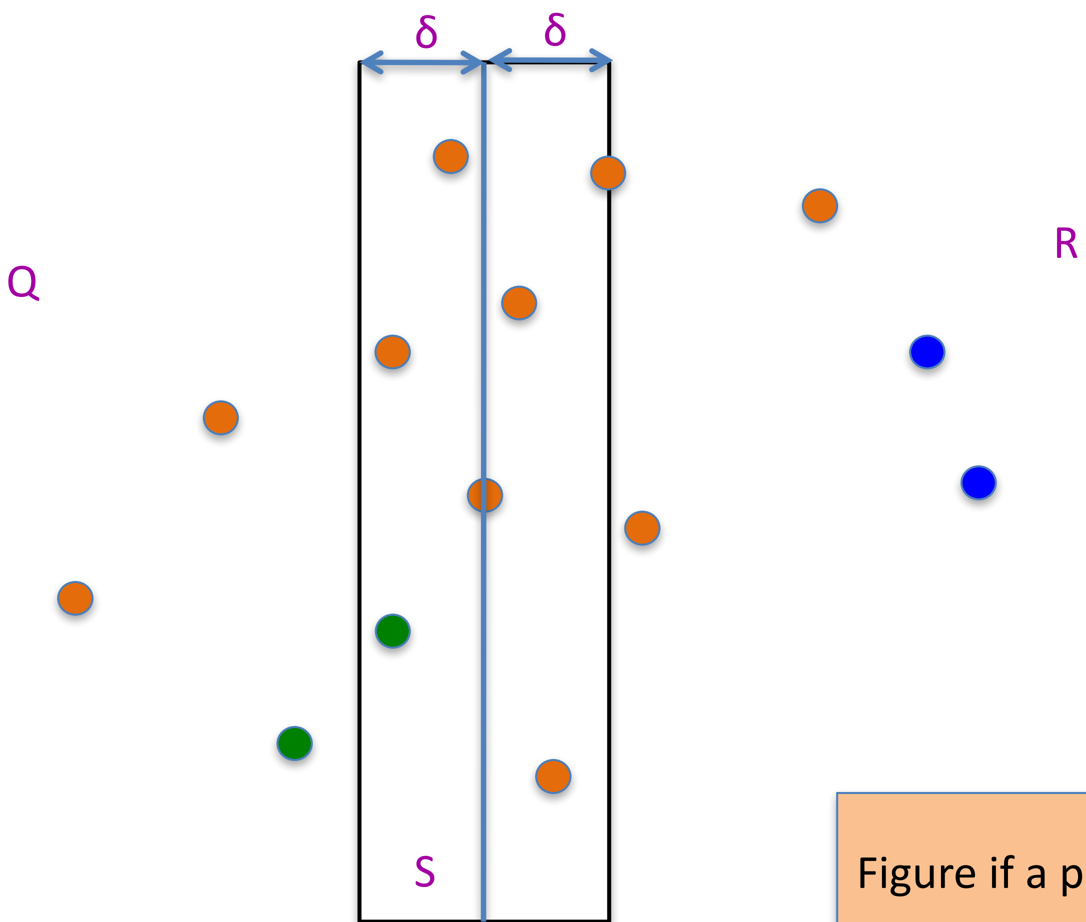


Figure if a pair in S has distance $< \delta$

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

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)

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

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 $O(n)$

$T(< 4) = c$

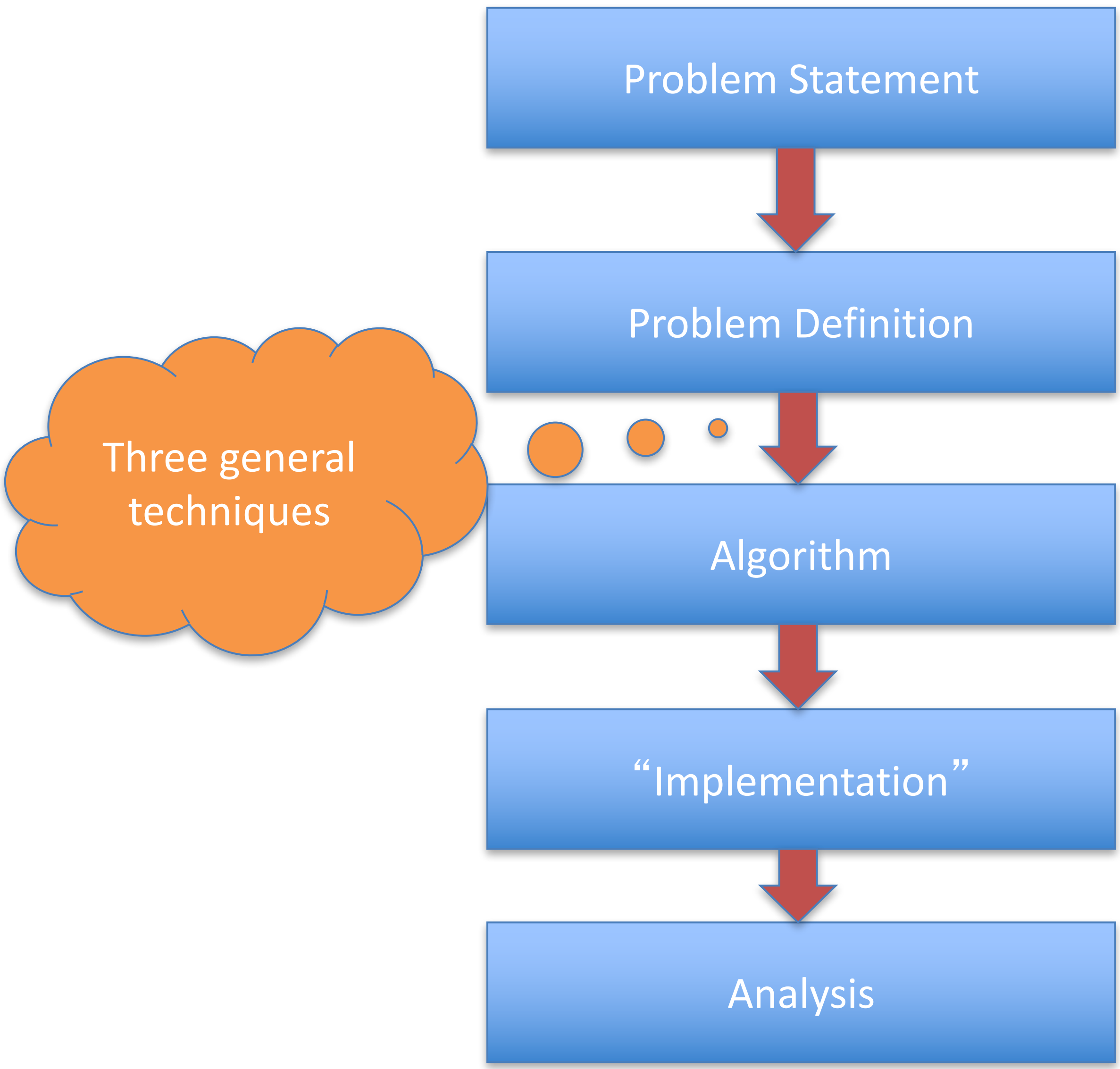
$T(n) = 2T(n/2) + cn$

$O(n \log n)$ overall

Rest of today's agenda

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

High level view of CSE 331

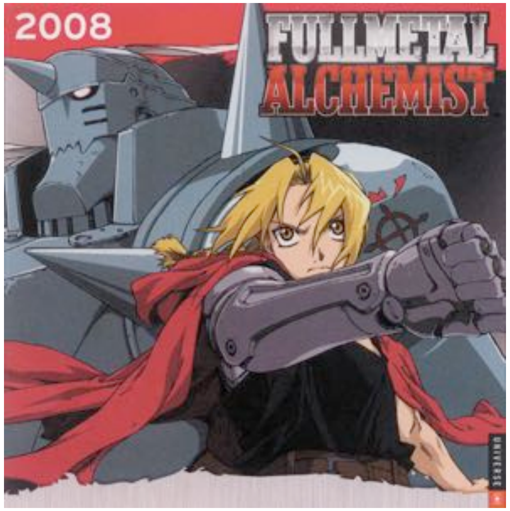


Data Structures

Correctness+Runtime Analysis

Greedy Algorithms

Natural algorithms



Reduced exponential running time to polynomial

Divide and Conquer

Recursive algorithmic paradigm

Reduced large polynomial time to smaller polynomial time

A new algorithmic technique

Dynamic Programming

Dynamic programming vs. Divide & Conquer

Same same because

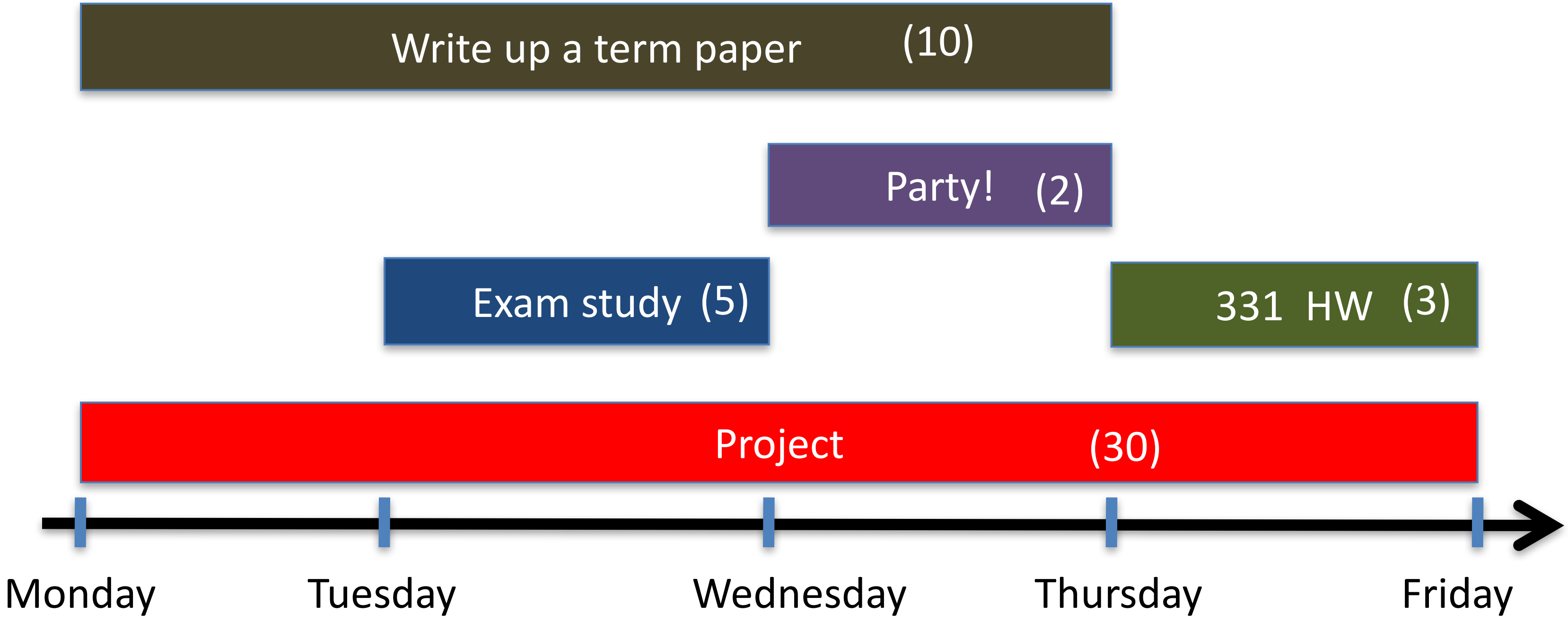
Both design recursive algorithms

Different because

Dynamic programming is smarter about solving recursive sub-problems

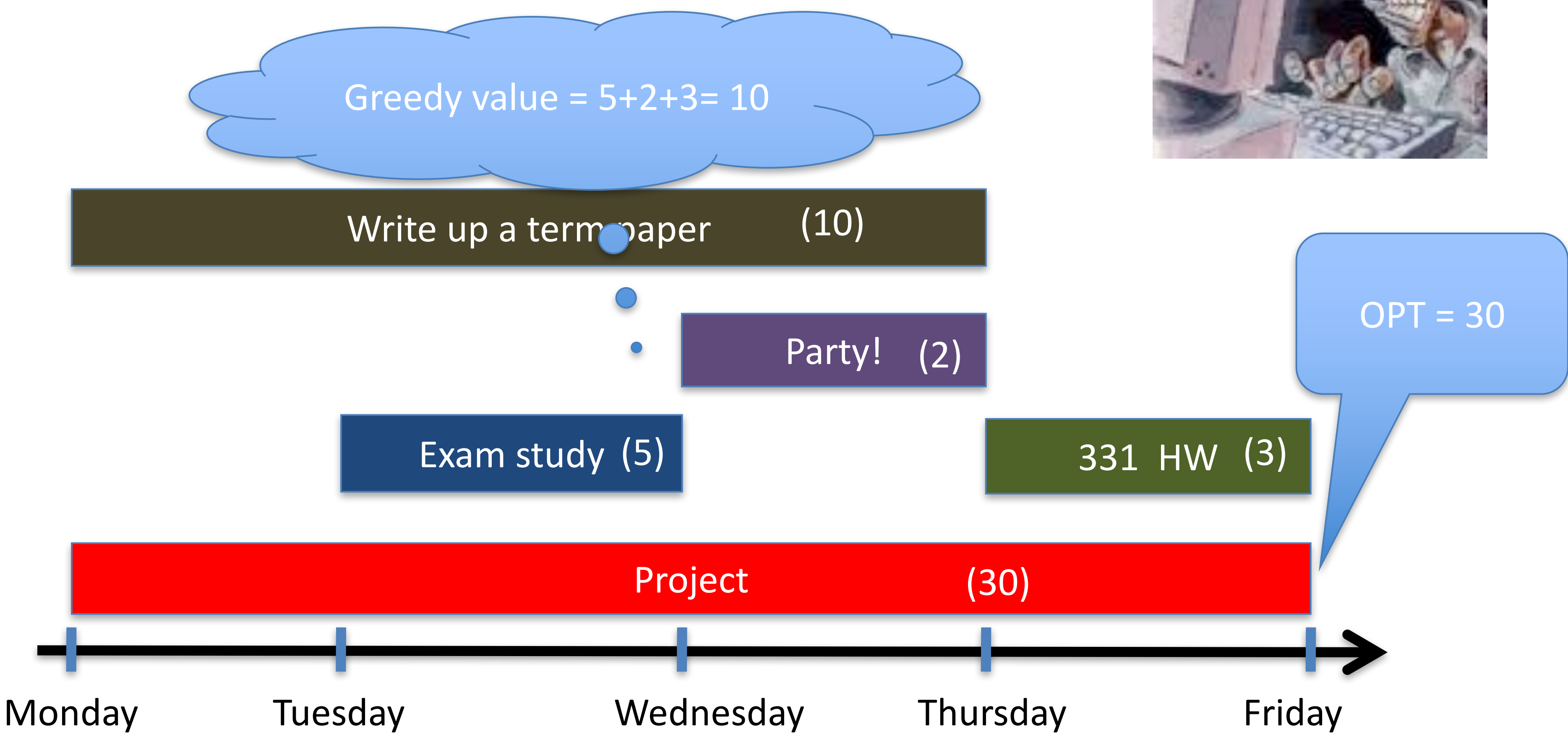
End of Semester blues

Can only do one thing at any day: what is the optimal schedule to obtain maximum value?



Previous Greedy algorithm

Order by end time and pick jobs greedily



Today’s agenda

Formal definition of the problem

Start designing a recursive algorithm for the problem