LS3000 5/8- Mon. (First Day!) Laney Strange (snelher) Tanysonortherstein.edu, ME 313 OH M, W 17-2 pm Ask/answer questions in unss, say name

Agenda

1. Algorithms Overriew V

2. Example Algorithm

3. About (\$3000

## 11. Algorithms aversion

What is an algorithm? (characteristics, examples, - has a run time (ex: O(n)) kinds of things)

· Sorting algorithms (ex)

· list of steps to runieve an articone

· defined set of specific steps

· has a lost (space)

Alyos in (53000)

· solve a computational problem

· Talas in an input, produces an output

Samay number String dara structure

is solution hunber moditical zony new array

- · (5500) IS pencil and paper, programming language agnostic
- · CLRS Style pseudocode

Arrays in (53000)

A = [-, ~, ~, ..., -]

Similar to a Python lest, Java/C# aray index from 1, not \$ Every value in A has a position

A= [-, ~, ~, ..., ~] pos 1, 2, 3, ..., A. length (n) User (usually) for loop to iterate over A for i=1 to Alength 3 Change every A[i] = -1 modifying the array in a function modifies the ariginal Func (A)
for i = 1 to A. length 3 no need to A [: ]= -1 FUNCA(A) Let B[1, ..., A.length] be a new array for i=1 to A. length 3 make and return a new army return B Juhat makes a good algorithm? · space complexity 3 untime . Space complexity & cost(space & · Solves the problem it's supposed to the = Madability · Solves the problem in rel cases extensibility (?)

· have one purpose

[Correctness

Drawing correctness:

- 1. Loop humint #
- 3. Proof by Induction! "

Etticiency

Show time(space

- Assume each step incors a contof [1]
- Step, sun them see
  - · End complexity ass

12. Example Algorithm - Seanh

LINEAR SEARCH (A, key)

1. for i=1 to A. length

2 if A [i] == key

3. return -1

> return position of key if fand, or -1 if not there

Proving Correctness: Loop Invariant

· Something true locker the loop terminates

[Invariant] At the start of the loop in lanes 1-4,
A [1...i-1] consists of elements originally
in A[...i-1] and that are not == key

[1. Initialization ] -> find to first iteration · ASI..i-1] when i=1 A [1.0], empty anay · Loop inv. is trivially true 2. Maintenance) -> If the before iteration, its the refter · We resume buy is not in A [i.. i-i] · compre lay with ACiZ, if Some we return, loop/function are arer? · If different, i gets incremented (only tray trat unpocase) " at end of iteration, A [...i] is does not have 3. Termination -> loop is over, the loop inverse the key shows the under rulgo works when loop is over, i = A. length + 1 · By loop invariant, A[1..A. length] does not have thereby Linear Search-Efficiency · How many steps does it take on an impet of size 1? 1start with worst rase LINEAR SEARCH (A, key)

for i=1 to A. length

if A [i] == key

return i # 1m2> Cost 14

return -1

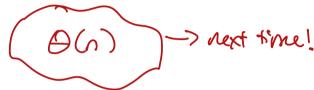
Ч.

## WORST - case Notime of linear seach. (n+1) + n + 0 + 1 = 2n +2

Preview: put on algorithms untime in a complexity class

· drop coefficients } 200 n grows 21 bitanily
· drop laner-order terms | large, they don't

matter



3. (53000

Everything on the website!

[HW]

- · Short Tue Tho
- · Long Thu- Tue
- · Slomit up to 48 hours (zere

Rec

- . Tre probaem set, ne fraded
- Tho Fin problem solving :

[5175 inclass | 6/15 (n (1255)

