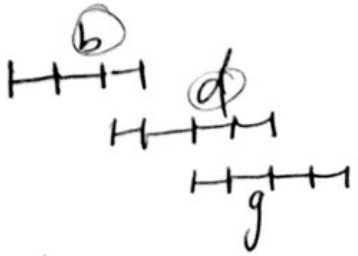
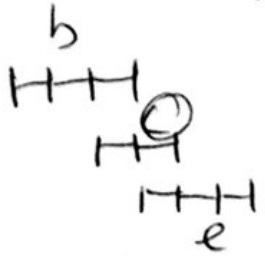
Final exam on Monday ~ 4
- Let me know any conflicts.
- HW 4 due on Oct 9th
- Monday - There are no recitations
Don's OH are cancelled.

Incremental Algs: Insertion Sort
Dynamic Prog.
Divide and Conquer
Greedy Algorithms.

Smallest First strategy
c, h
This strategy does not work.
Counterexample in slides.



~~does not~~ is not a counter-example

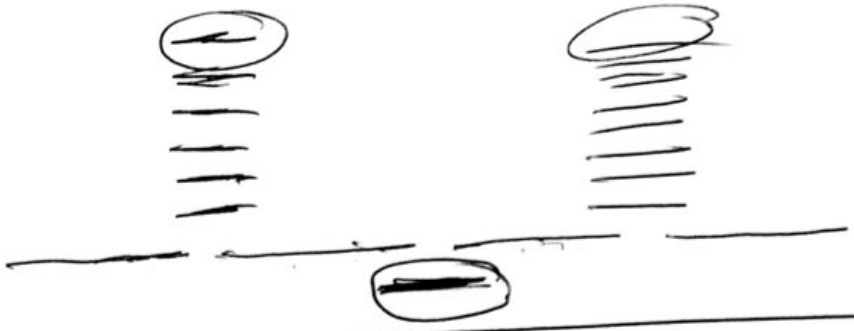


← counter example.

- Earliest Finish Time
- Pick job w/ fewest conflicts.

b, e, h

Counterexample,



Earl. Fin. Time: b, e, h.

Theorem: Greedy (using Earliest Finish Time) is optimal.

Proof: Suppose f.s. o.c that Greedy is not optimal. Let.

- $i_1, i_2, \ldots, i_k$ denote the set of jobs selected by Greedy.
- $j_1, j_2, \ldots, j_m$ denote the set of jobs in an OPTIMAL solution that agrees w/ as many initial jobs

- $j_1, j_2, \ldots, j_m$ denote the set of jobs in an OPTIMAL solution that agrees w/ as many initial jobs of Greedy sol as possible.
- Let r be the largest index s.t.

$i_1 = j_1$

$i_2 = j_2$

$\vdots$

$i_r = j_r$

$i_{r+1} \neq j_{r+1}$

Greedy — — i_r i_{r+1} — — — —

OPT — — — j_r j_{r+1} — — —

j_{r+1} cannot finish before i_{r+1}

j_{r+1} cannot start after i_{r+1} finishes (b/c you could improve OPT by adding i_{r+1})

- We want to come up w/ another optimal sol (OPT') that agrees with Greedy on more initial jobs than r.
- $OPT' = OPT - \{j_{r+1}\} \cup \{i_{r+1}\}$.

(remove j_{r+1} and add i_{r+1})

- Need to prove
  1. OPT' doesn't have conflicts
  2. $|OPT'| = |OPT|$
  3. It agrees on more than r initial jobs w/ GREEDY.

- Because j_{r+1} finishes after i_{r+1} finishes.

- Now, OPT' is another opt sol that agrees on $r+1$ jobs with Greedy.
- This contradicts of OPT — it was supposed the optimal sol that agrees on the MOST initial jobs w/ GREEDY, but now we found this is not true — OPT' agrees on more initial jobs. ∎

- "Greedy stays ahead" proof strategy