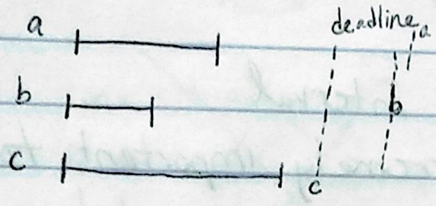
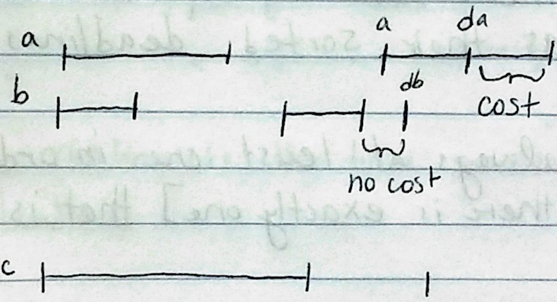
2/4/11

4-6 problems on midterm
90 minutes

ex: Given a set of intervals w/ same start time

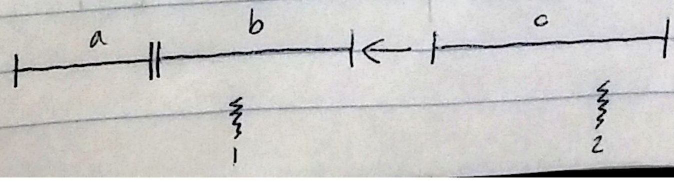


each deadline is for a specific task
each task must be _fully_ completed (no partial)
goal: do all the tasks
missing deadline results in a penalty
penalty: linear in the amount you are late



algorithm:
deadlines dictate the order of schedule

proposal: there is no optimal algorithm w/ a space (or a gap between intervals) [always an optimal w/o a space]
prove by contradiction
removing spaces will always either decrease or keep the cost constant but the cost will never go up (unlike adding spaces)



even if deadline was 1 or 2, the cost will always go down if we remove the space → optimal

the greedy approach:
- look at length of interval
- deadlines are extremely important to the problem
  - → consider deadline first

maybe we should sort the deadlines in increasing order

an in order solution means that the intervals are in the same order as their sorted deadlines

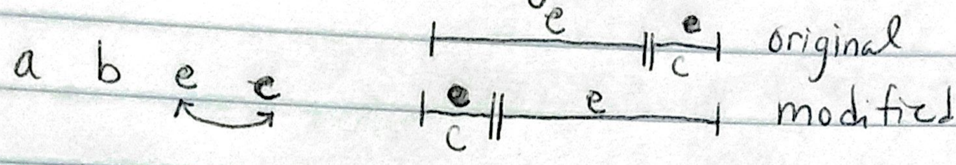
claim: there is always at least one in order solution [actually there is exactly one] that is optimal

proof by contradiction
if we have solution that is out of order (a, b, c, e...)

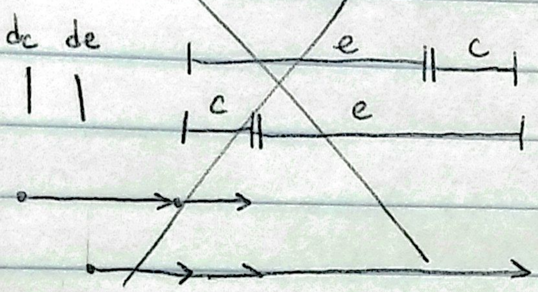
there can be n^2 out of order pairs
show: you can take any out of order solution an reduce the number of out of order pairs and show the cost either improves or doesn't change

# of out of order pairs $i \longrightarrow i-1$

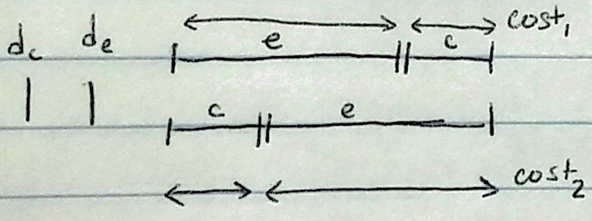
take the first out of order pair, switch the interval (without affecting the other intervals)



~~one situation:~~



one situation:



$cost_2 \leq cost_1$
(proof will be complete when considering 2 other cases)

runtime is the time needed to sort the deadlines

if the way we measured the penalty was different then this solution would no longer work