Let's start by 9:05 PM

L56
Greedy Classical Problems - 1

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RECAP

Some classical greedy problems

1. Activity Selection Problem

$1 \le N \le 2 * 10^5$

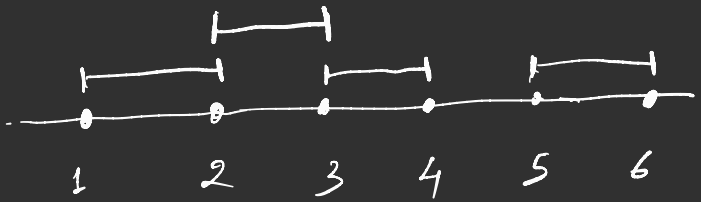
$1 \le S \le e \le 10^9$

$N = 4$

start = [1, 3, 2, 5]

end = [2, 4, 3, 6]

ans = 3



Intuition

1) Do the one that starts earlier first.

2) Do the one with the shortest duration first.

3) Do the one that ends earlier first.

1) ✗

2) ✗

3) ✓

Solution

1) Sort by end time.

Let’s
implement

Remember the diamond problem?

1.) Pick the lowest weight first ✗

$W_2 = 2, V_1 = 1$ | $W_2 = 2, V_2 = 100$

2) Pick the highest value first ✗

$W_2 = 109, V_1 = 120$ | $W_2 = 1, V_2 = 99$

3.) Pick the highest V/W first ✗

Cap = 10 | $W_1 = 7, V_1 = 80$ | $W_2 = 4, V_2 = 40$ | $W_3 = 5, V_3 = 45$ |

cap = odd

v/w ⇒ 2

v=1

w=1

↳ 0-1 Knapsack

↳ Can't be solved using greedy (acc. to me)

2. Fractional Knapsack

Intuition

Solution

Let’s implement

3.1 Job Scheduling to minimise lateness

We'll be given N jobs.

$T_i \Rightarrow$ Time taken to complete i^{th} job

$D_i \Rightarrow$ Deadline to complete i^{th} job.

We've to do all N jobs. We can do only 1 job at a time.

Minimize the maximum lateness among all the jobs.

Eg. $N = 4$

$T = [3, 1, 2, 5]$ (for j_1, j_2, j_3, j_4)

$D = [4, 10, 2, 8]$

$j_3 \rightarrow j_1 \rightarrow j_2 \rightarrow j_4$

2	5	6	11
0	1	0	3

$j_1 \rightarrow j_2 \rightarrow j_3 \rightarrow j_4$

$f_i \Rightarrow$	3	4	6	11
$l_i \Rightarrow$	0	0	4	3

$j_3 \rightarrow j_2 \rightarrow j_1 \rightarrow j_4$

$f_i \Rightarrow$	2	3	6	11
$l_i \Rightarrow$	0	0	2	3

$j_3 \rightarrow j_1 \rightarrow j_4 \rightarrow j_2$

$t_i \Rightarrow 2, 5, 10, 11$

$l_i \Rightarrow 0, 1, 2, 1$

ans = 2

Intuition

1.) Let's do the shortest (T_i) job first

$T_1 = 1, D_1 = 10 \mid T_2 = 2, D_2 = 2$

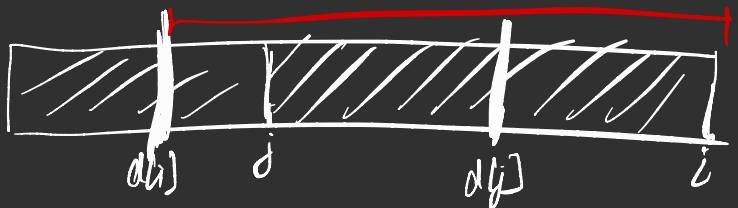
2.) Let's do tightest deadline (D_i) first

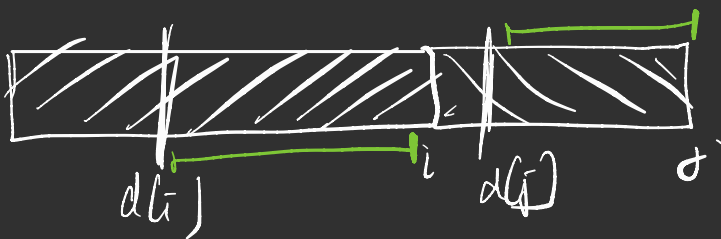
3.) inc. order of slack time $(D_i - T_i)$

$T_1 = 1, D_1 = 5 \mid T_2 = 3, D_2 = 8$

Job$_i$ & Job$_j$

deadline [i] < deadline [j]





task1 ⇒ 10am ⇒ 8 hrs ⇒ 6 PM

task2 ⇒ 6 PM ⇒ 3 hrs ⇒ 9 PM

task2 ⇒ 10am ⇒ 3 hrs ⇒ 1 PM

task1 ⇒ 1 PM ⇒ 8 hrs ⇒ 9 PM

Solution

Earlier deadline first

Let’s
implement

Thank You!

Reminder: Going to the gym & observing the trainer work out can help you know the right technique, but you'll muscle up only if you lift some weights yourself.

So, PRACTICE, PRACTICE, PRACTICE!