3.2

Job sequencing with deadlines:

Given a set of 'n' jobs,

deadline d_i for each job i ($d_i > 0$)

profit $p_i > 0$ for each each job

- For any job i, the profit p_i is earned iff the job is completed by its deadline.
- only one machine is available for processing
- A job is completed, when it gets executed on a machine for one unit of time.
- A feasible solution for this problem is a subset J of jobs, such that each jobs in this subset can be completed by its deadline.
- An optimal solution is a feasible solution with maximum value.

Greedy Approach

1. Sort all jobs in decreasing order of profit.
2. Initialize the result sequence as first in sorted jobs, as late as possible
3. Do the following for remaining n-1 jobs:
   - If the current job can fit in the current result sequence without missing the deadline, add current job to the

-result, else ignore the current job.

Ex: Solve the below instance of job sequencing with deadlines problem and obtain the optimal solution:

Let $n = 4$

$P_i = \{ 100, 10, 15, 27 \}$ $\quad 1 \le i \le 4$

$d_i = \{ 2, 1, 2, 1 \}$ $\quad 1 \le i \le 4$

Step 1

Sort all jobs in decreasing order of profit

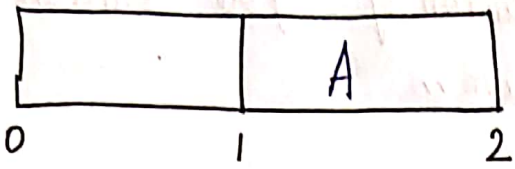
job	A	B	C	D
P_i	100	10	15	27
d_i	2	1	2	1

⇓ After sorting.

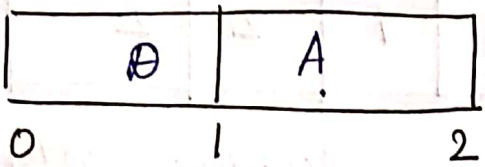
job	A	D	C	B
P_i	100	27	15	10
d_i	2	1	2	1

Step 2 - Initialize Resultant as 1st Job and schedule as late as possible

Draw Gant chart



Step 3 : Repeat the same for others:



- other jobs are Rejected as they wont fit

∴ the selected job set

$J = \{D, A\}$

profit earned = 27 + 100 = 127

2. Solve the following instance of job

Let n=5, profits (10, 3, 33, 11, 40) and deadlines (3, 1, 1, 2, 2). Find the optimal sequence of execution of job solution using greedy algorithm

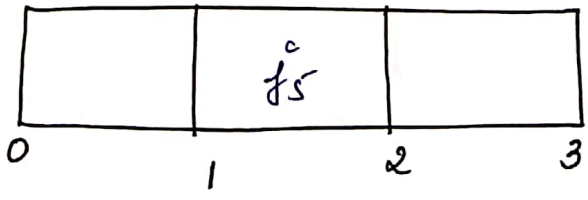
i	j_1	j_2	j_3	j_4	j_5
p_i	10	3	33	11	40
d_i	3	1	1	2	2

Step 1: Sort it in Ascending order

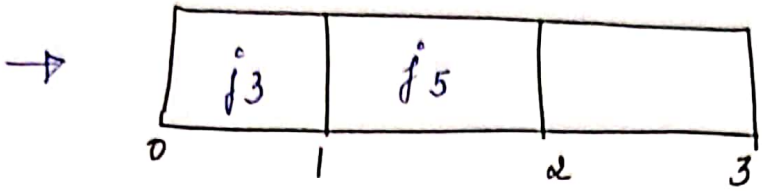
	j_5	j_3	j_4	j_1	j_2
p_i	40	33	11	10	3
d_i	2	1	2	3	1

Step 2: Initialize Result as 1st job and schedule as late as possible.

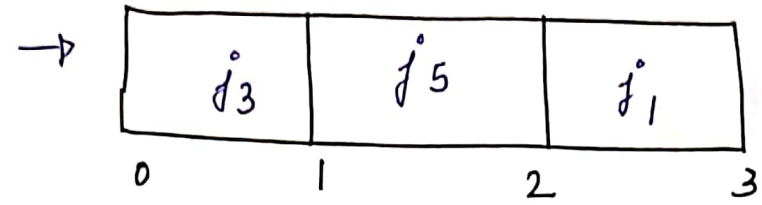
Draw Gantt chart



Step 3: Repeat the same for others:



j_4 is rejected as its deadline is 2, consider j_1



- j_2 is rejected as the sequence is full.

∴ the selected job set:

$$J = \{ j_3, j_5, j_1 \}$$

Profit earned = 33 + 40 + 10 = **83**

3. Solve the following instance of job sequencing with deadlines problem:

P_i	20	15	10	5	1
d_i	2	2	1	3	3

Sol/n = $\{ J_1, J_2, J_4 \}$

20 + 15 + 5 = 40