SMART
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Scheduling Algorithms (9)

- Production Scheduling Algorithm (3) -

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Scheduling Methods for Production Scheduling Problems

- Method to derive a near optimum solution
  - Meta Heuristic Methods
  - Dispatching Rule Method

  a method which derives a good solution empirically.
- Method to derive an Optimum Solution
  - Jackson Algorithm
  - **Branch and Bound Method**

    a search method for excluding solution space which is no need to search

Branch and Bound Method

- Disassemble the given whole problem to several partial problems
- Solve the given whole problem by solving several partial problems.

branching operation: Disassemble to partial problems

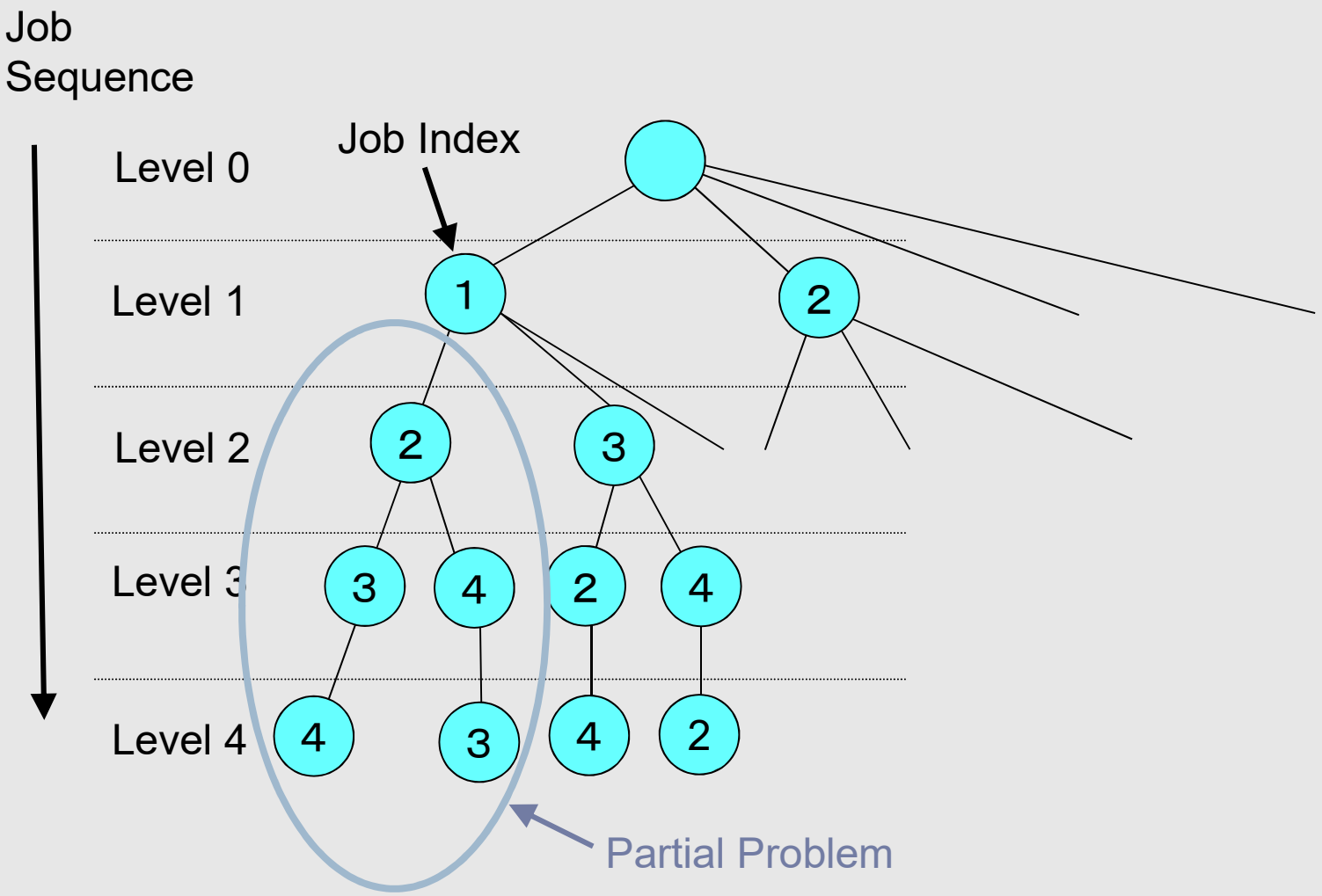
bounding operation: Set the best value at current stage as *upper bound*. This operation is a procedure that bounds the node that has bigger *lower bound* than *upper bound*, that is, it becomes clear that there is no possibility to get better results

Scheduling Example for Branch and Bound Method

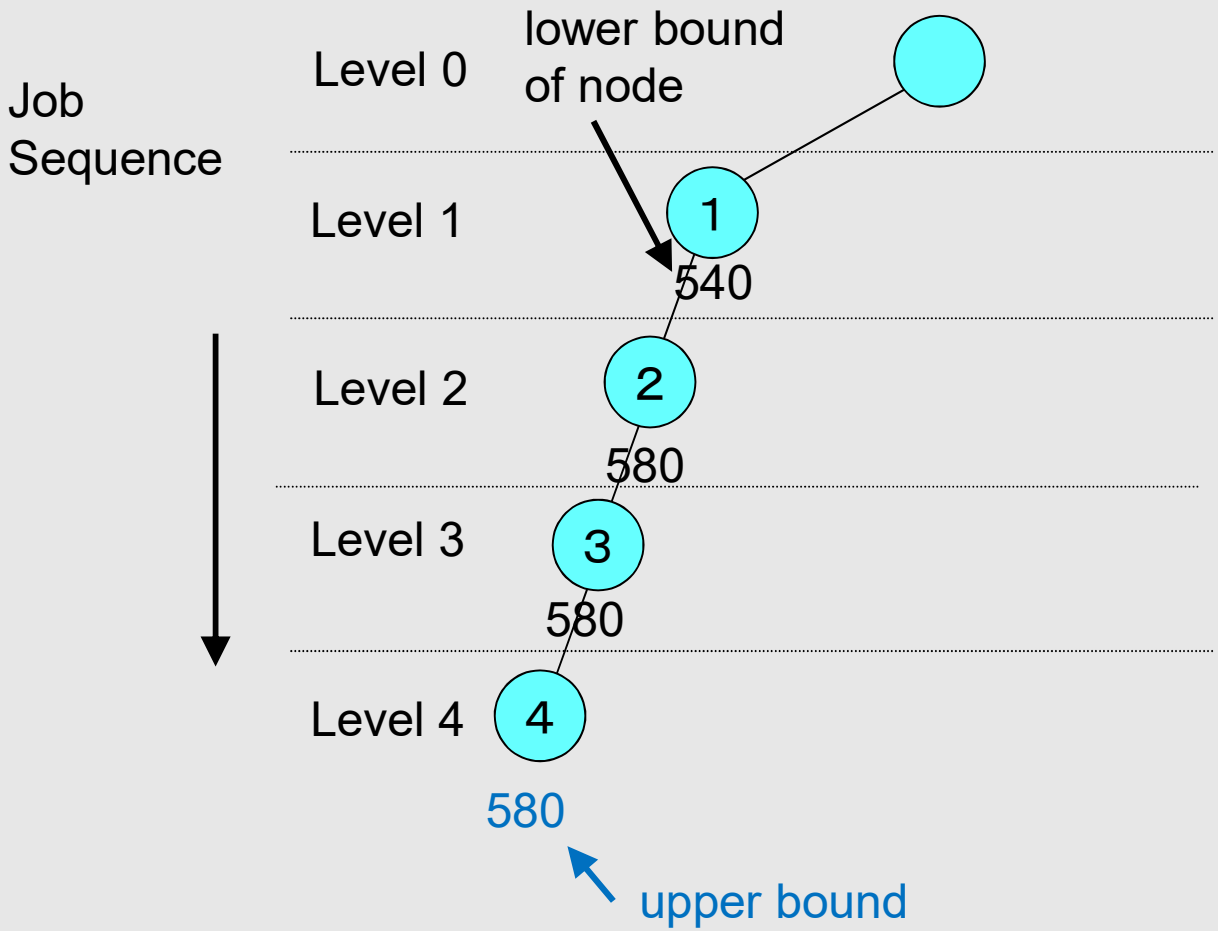
Find a job sequence which makespan is shortest.

Job	Processing Time		
	Ope1 using M1	Ope2 using M2	Ope3 using M3
1	20	180	80
2	140	120	40
3	40	40	160
4	100	20	60

Search Tree for Branch and Bound Method



Search Tree for Branch and Bound Method



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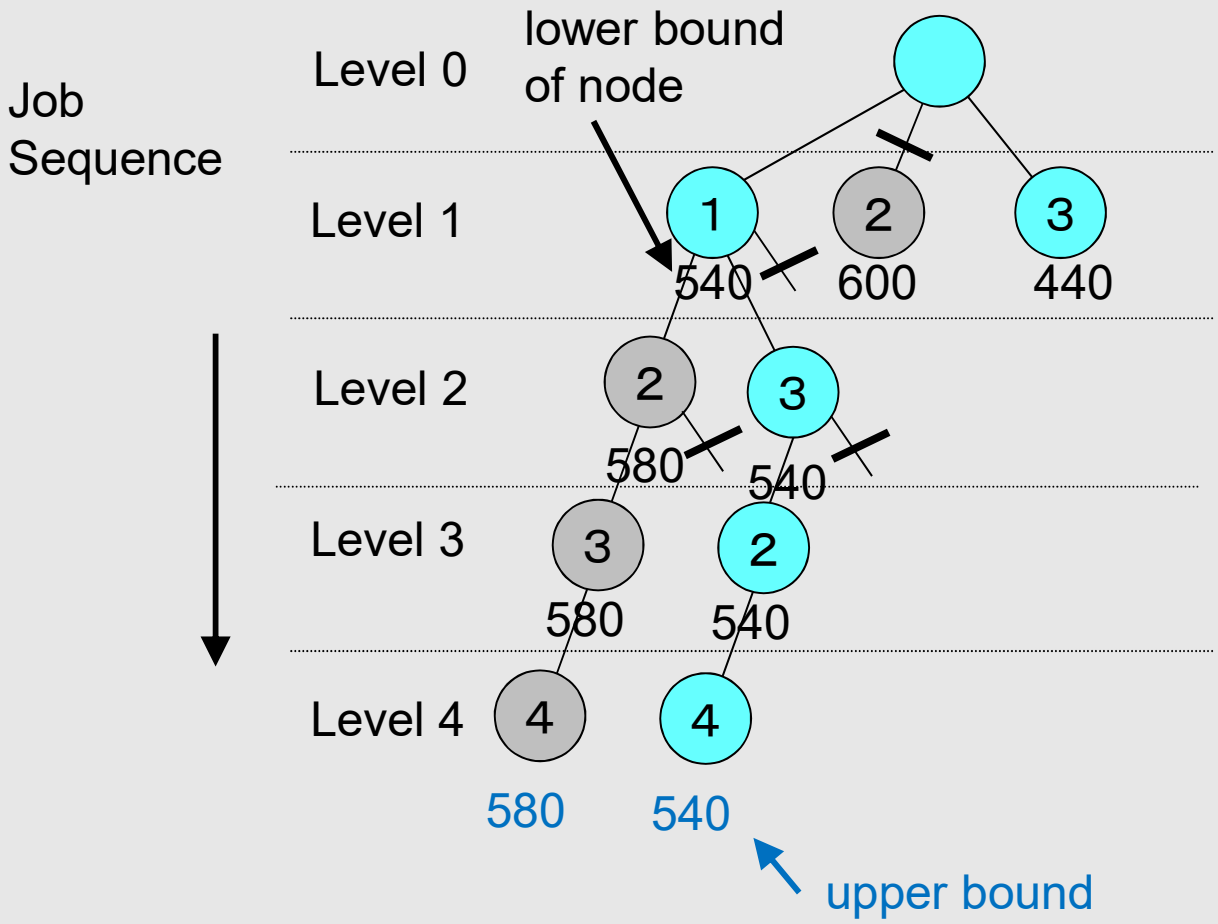


Lower Bound Calculation

lower bound ＝maximum value for all operation stages

(①Latest Ending time of the operations on the operation stage of the scheduled jobs

＋②Total processing time of the operations on the operation stage of the unscheduled jobs

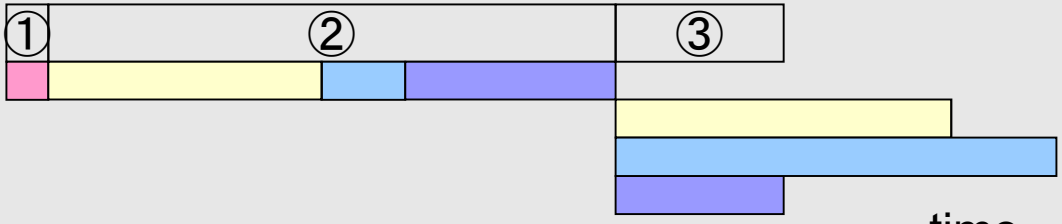
＋③Minimum value of the total processing time of the operations remaining after the operation stage for each job)

lower bound of job 1 in Level 1 =

max (1st stage: 20 + (140+40+100)+min(160,200,80) = 380

2nd stage: 200+(120+40+20)+min(40,160,60) = 420

3rd stage: 280+(40+160+60)+0 = 540) = 540



Job	Processing Time		
	Ope1	Ope2	Ope3
1	20	180	80
2	140	120	40
3	40	40	160
4	100	20	60

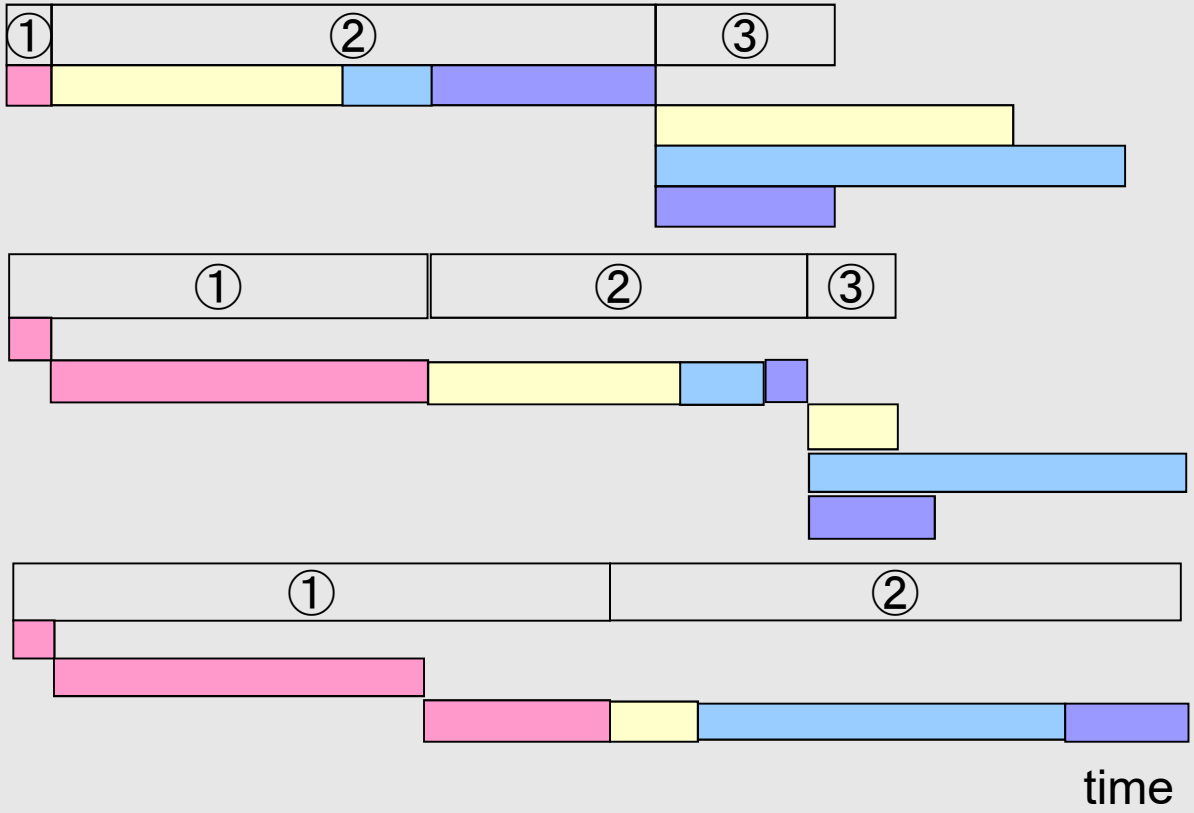
Lower Bound Calculation

lower bound of job 1 in Level 1 =

max (1st stage: 20 + (140+40+100)+min(160,200,80) = 380

2nd stage: 200+(120+40+20)+min(40,160,60) = 420

3rd stage: 280+(40+160+60)+0 = 540) = 540



Job	Processing Time		
	Ope1	Ope2	Ope3
1	20	180	80
2	140	120	40
3	40	40	160
4	100	20	60

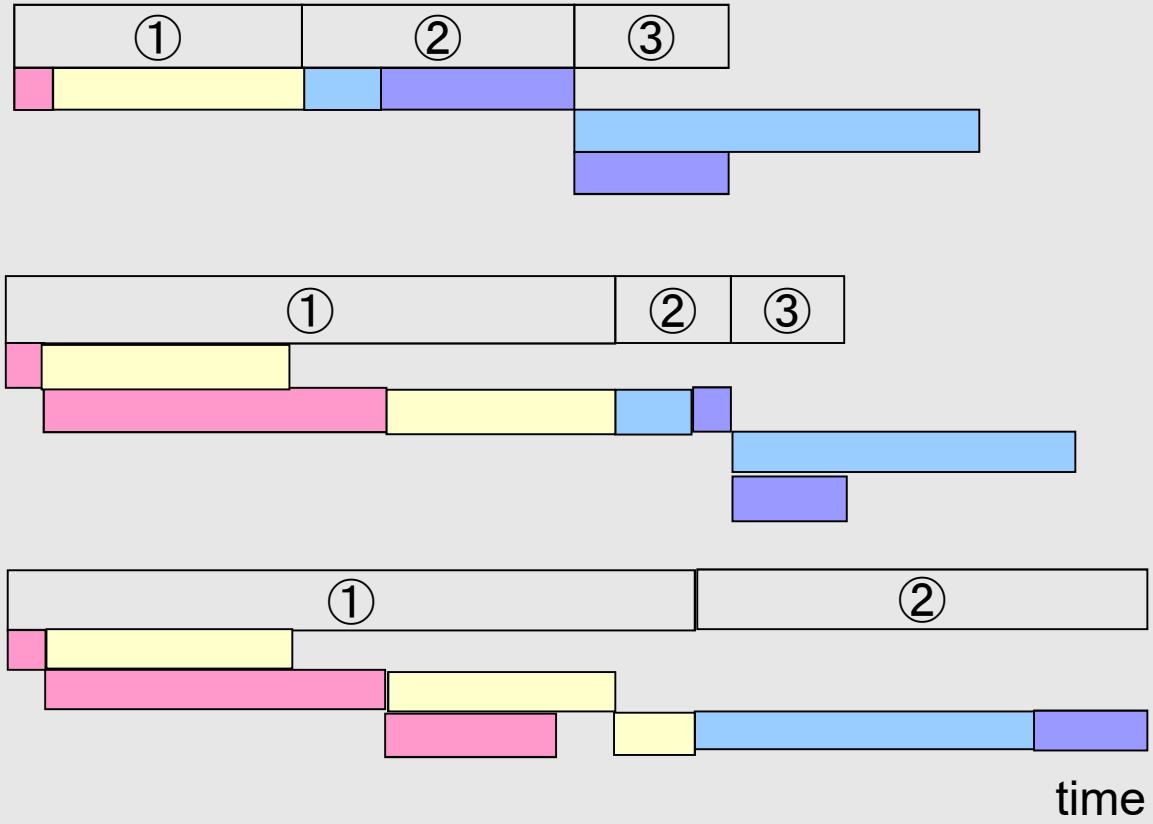
Lower Bound Calculation

lower bound of job 2 in Level 2 =

max (1st stage: 160 + (40+100) + min(200,80) = 380

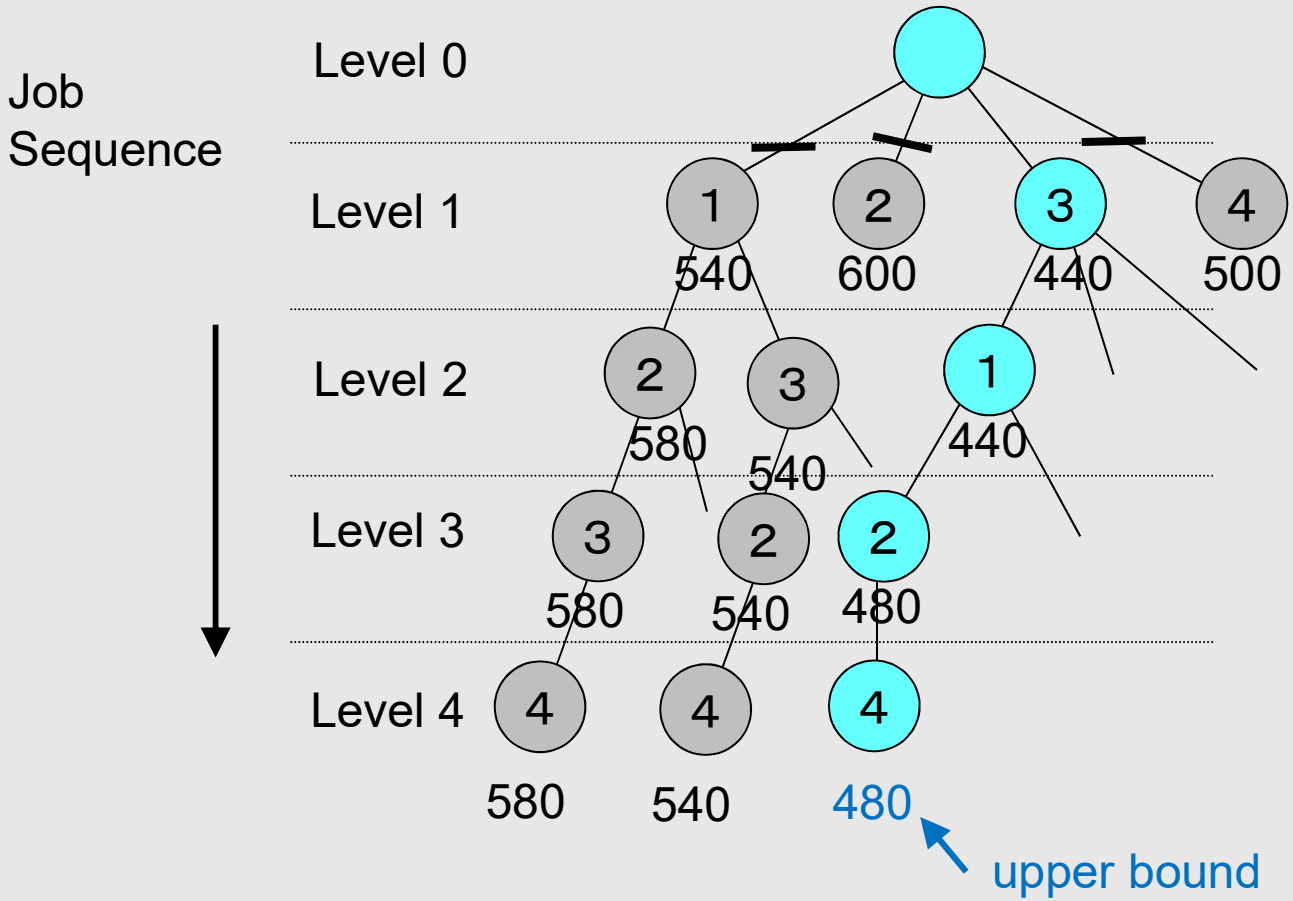
2nd stage: 320 + (40+20) + min(160,60) = 440

3rd stage: 360 + (160+60) + 0 = 580) = 580

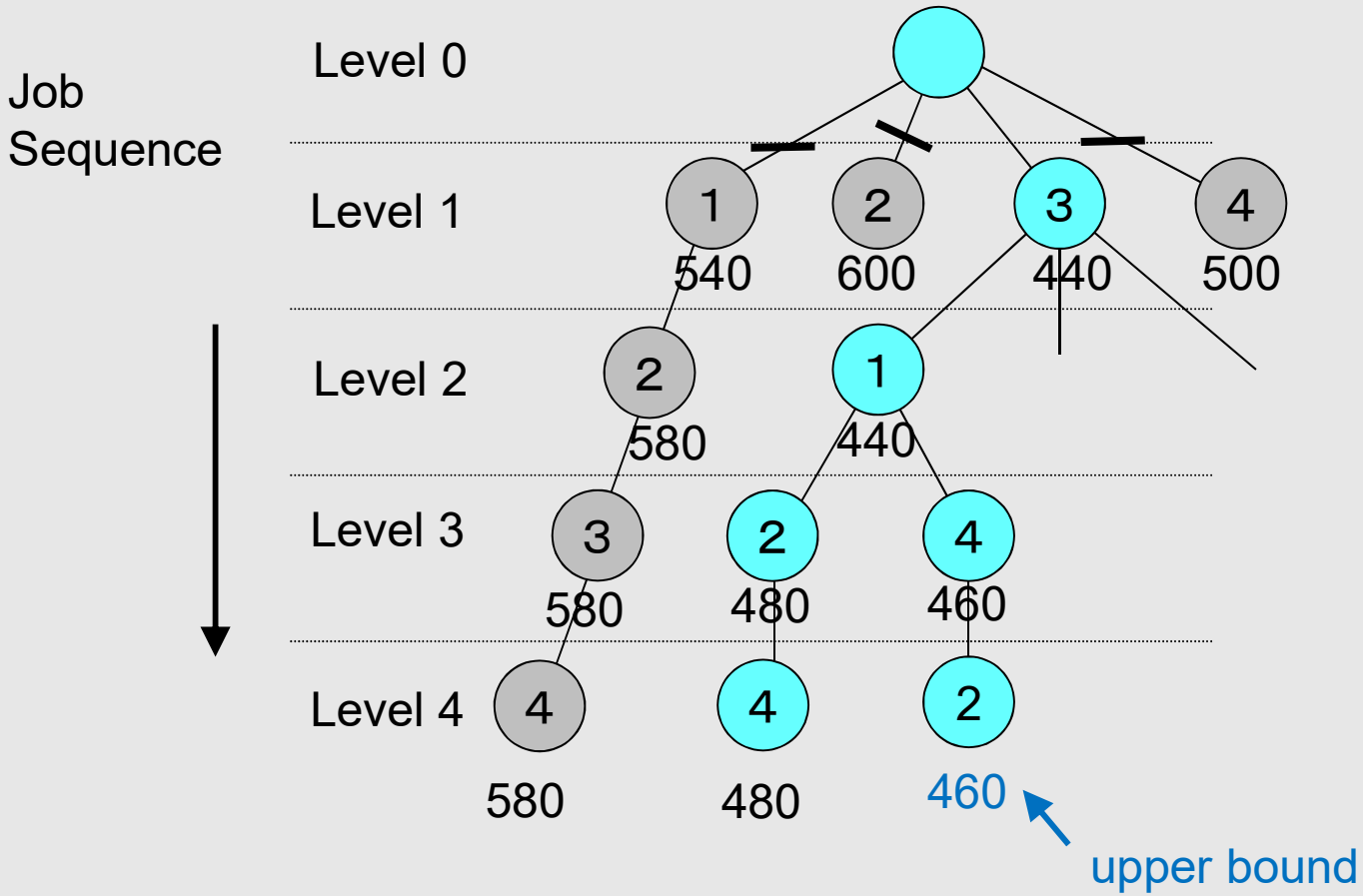


Job	Processing Time		
	Ope1	Ope2	Ope3
1	20	180	80
2	140	120	40
3	40	40	160
4	100	20	60

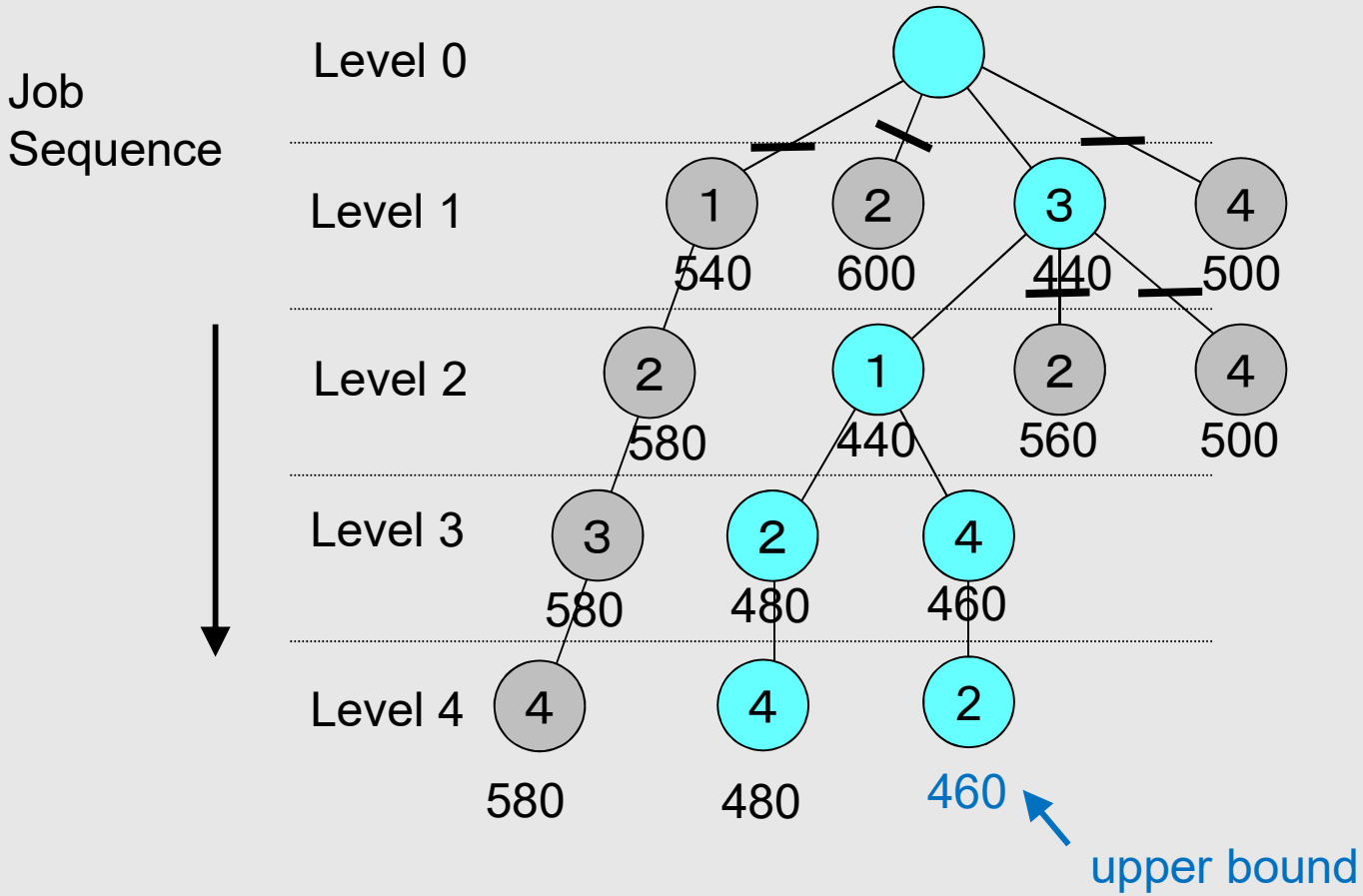
Search Tree for Branch and Bound Method



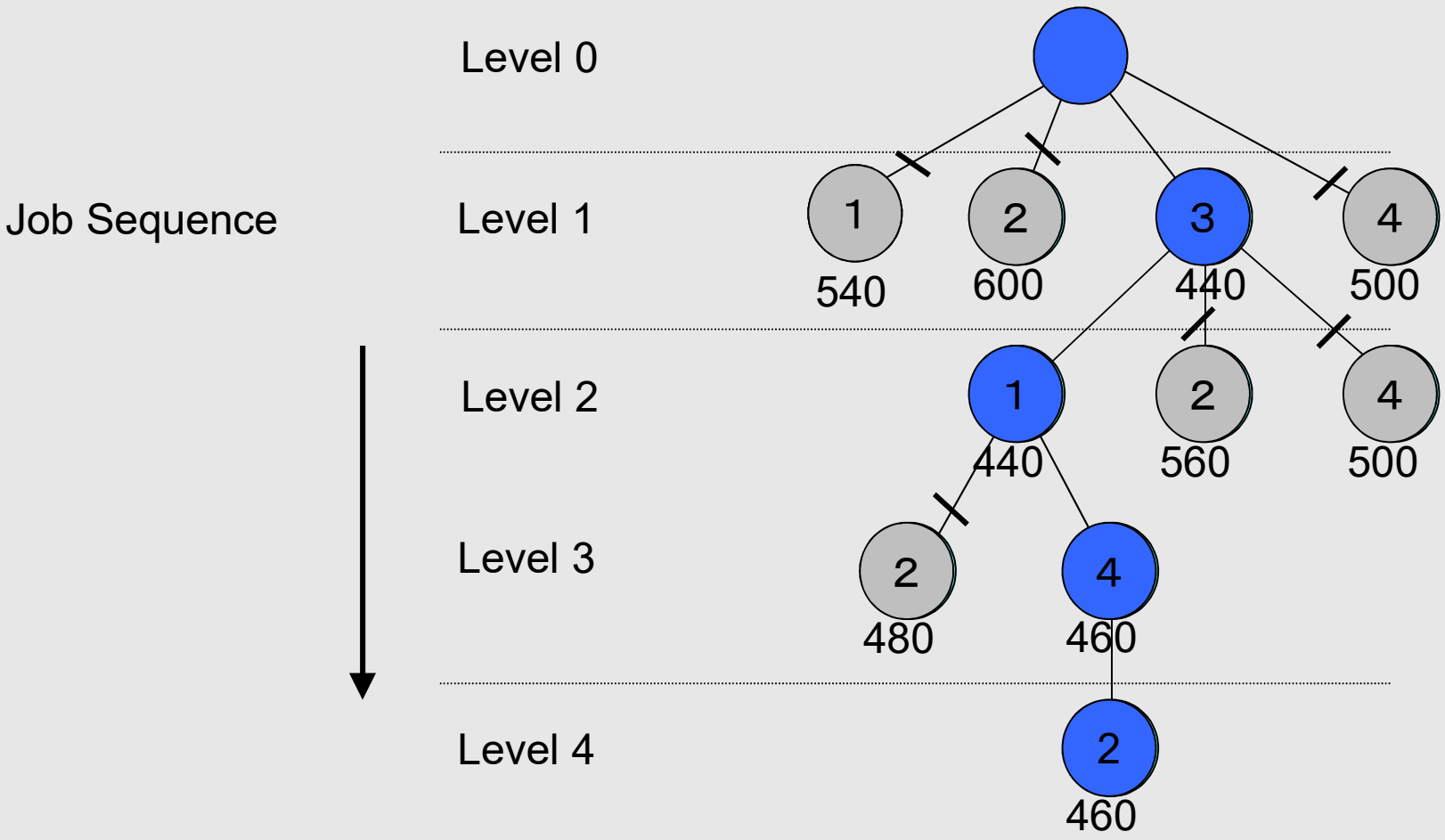
Search Tree for Branch and Bound Method



Search Tree for Branch and Bound Method



Searched by Best First Search



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Thank you