SNS COLLEGE OF ENGINEERING

Coimbatore-107

COURSE NAME: ANALYSIS OF ALGORITHM

II YEAR/ IV SEMESTER

UNIT – V

BRANCH& BOUND ALGORITHM

Topic

Assignment Problem

Unit V

video : Mumigan Tech World

Branch & Bound Technique

Assignment problem

Branch & Bound Algorithm gener State space Tree to obtain Best optimal value from current node of the decisio tree. It is applicable to optimization problem.

Procedure for Assignment problem:

1. Specified by n x n cost matri
2. Select 1 element from each ro Such that no two selected ele belong to same column.
3. Calculate lower bound value by adding smallest element in each row.
4. Select most promising node,
5. Generate childdrens of promi nodes
6. Last two steps are repeat until all the jobs are assigned to a person.

Note:

⇒ No jobs are assigned to th or more persons.

⇒ No persons can be assigned mo

1 Job = 1 person

Step 1: Find Lower Bound value.

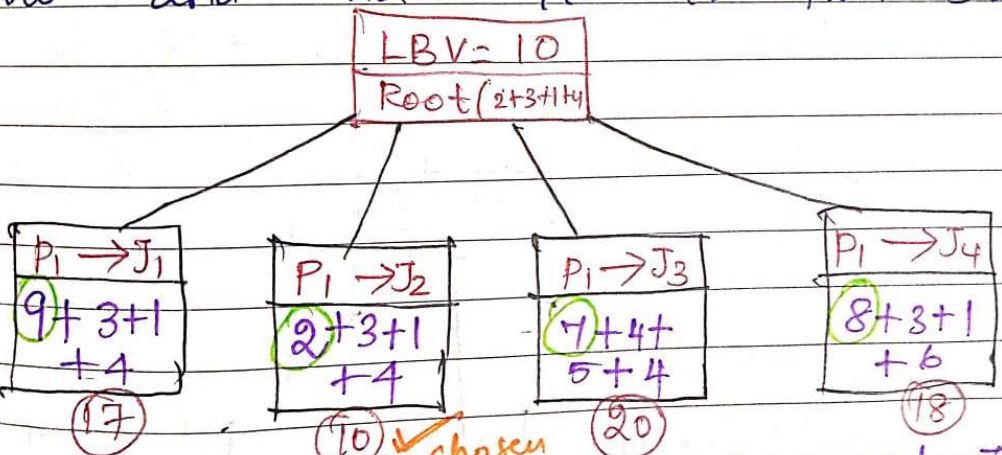
Example:

	J_1	J_2	J_3	J_4
P_1	9	2	7	8
P_2	6	4	3	7
P_3	5	8	1	8
P_4	7	6	9	4

(LBV)

(i) Lower Bound Value = 2 + 3 + 1 + 4 = 10

Take Smallest value from Each row and Add it to find LBV



Step 2: Assign P_1 with minimum value Job

Only Constraint (~~X~~) (1). First value for all Jobs is picked from Table.

i.e. $P_1 \rightarrow J_1$: First value is 9 (J_1); $P_2 \rightarrow J_2$: First value is 2 (from J_2). Likewise $P_3 \rightarrow J_3$: 7, $P_4 \rightarrow J_4$ = 8

② Consider remaining values of least value from each row

i.e. $P_1 \rightarrow J_1$: 3 from Row 2
1 from Row 3
4 from Row 4

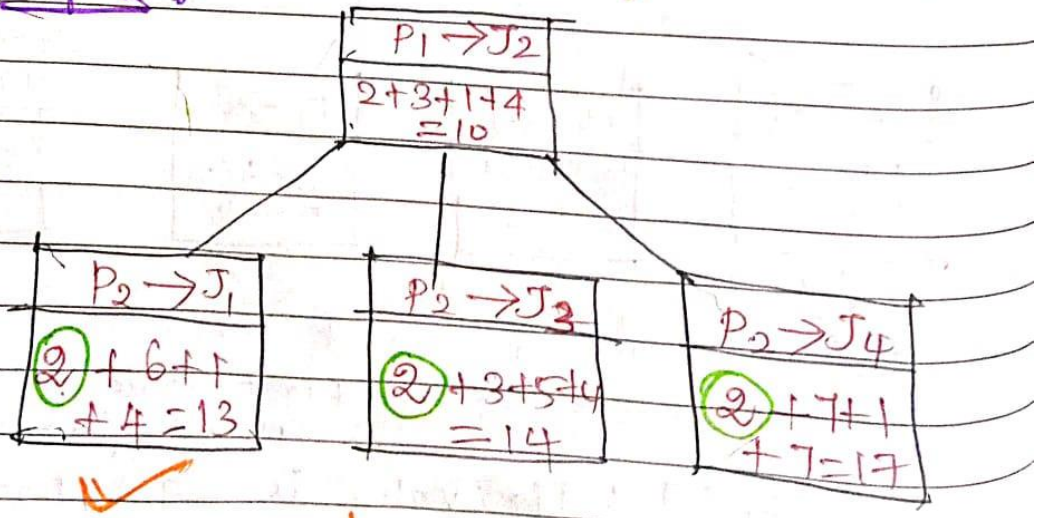
Note : (X)

While choosing minimum element Consider that it should not be present in same column.

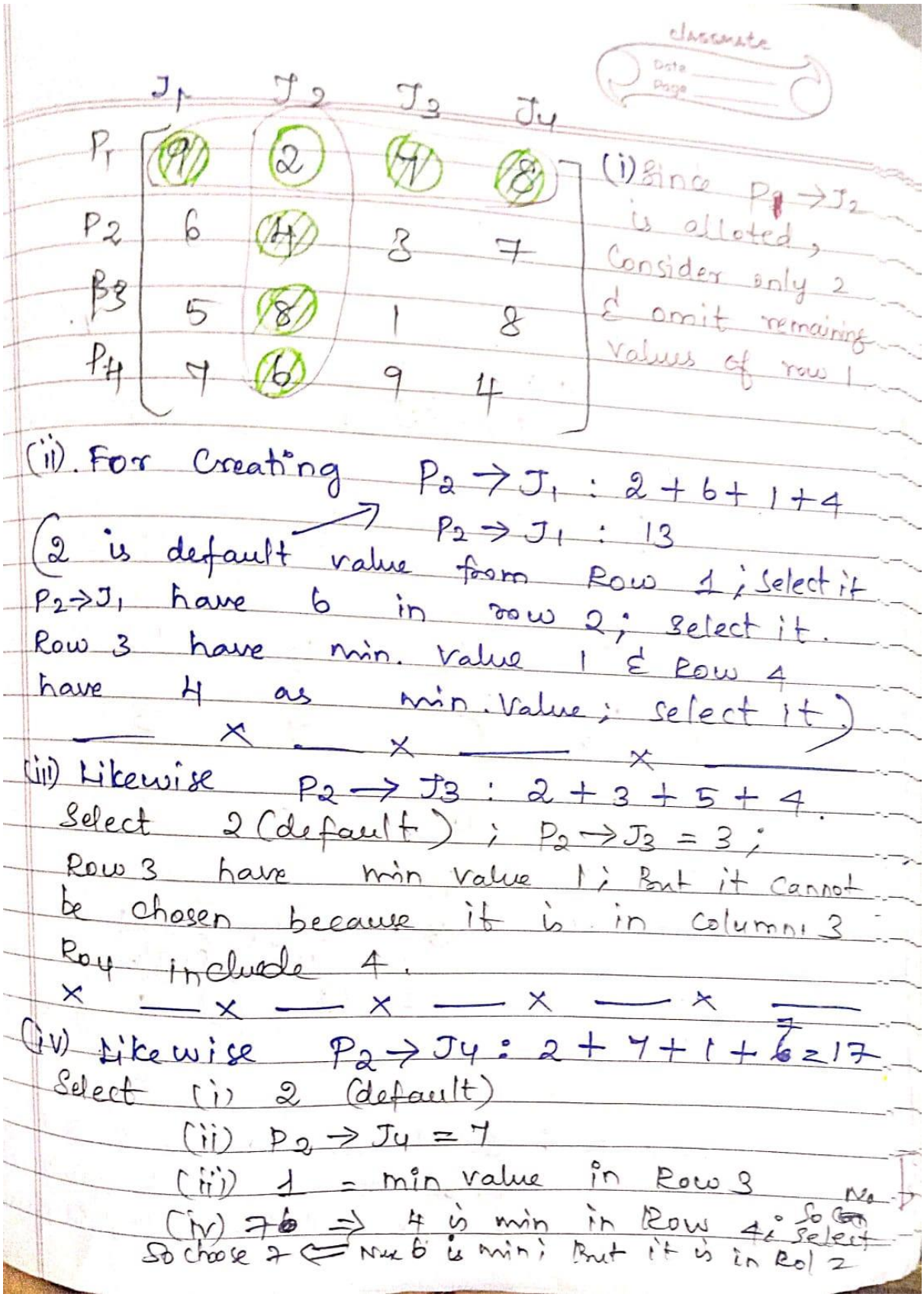
Eg: $P_1 \rightarrow J_4$: 8+3+1+6 is Choosen. Instead of '4' use '6' because 4 (min value) is present in same 4th column

From Step 1 : $P_1 \rightarrow J_2$ is assigned permanently because of minimum value

Step 2 :



Chosen 13 because it is min.



	J_1	J_2	J_3	J_4
P_1	9	2	7	8
P_2	6	4	3	7
P_3	5	8	1	8
P_4	7	6	9	4

(i) Since $P_2 \rightarrow J_2$ is alloted, Consider only 2 & omit remaining values of row 1

(ii). For Creating $P_2 \rightarrow J_1 : 2 + 6 + 1 + 4$

$P_2 \rightarrow J_1 : 13$

(2 is default value from Row 1; Select it $P_2 \rightarrow J_1$ have 6 in row 2; Select it. Row 3 have min. value 1 & Row 4 have 4 as min. Value; select it)

(iii) Likewise $P_2 \rightarrow J_3 : 2 + 3 + 5 + 4$.

Select 2 (default); $P_2 \rightarrow J_3 = 3$;

Row 3 have min value 1; But it cannot be chosen because it is in column 3 Row 4 include 4.

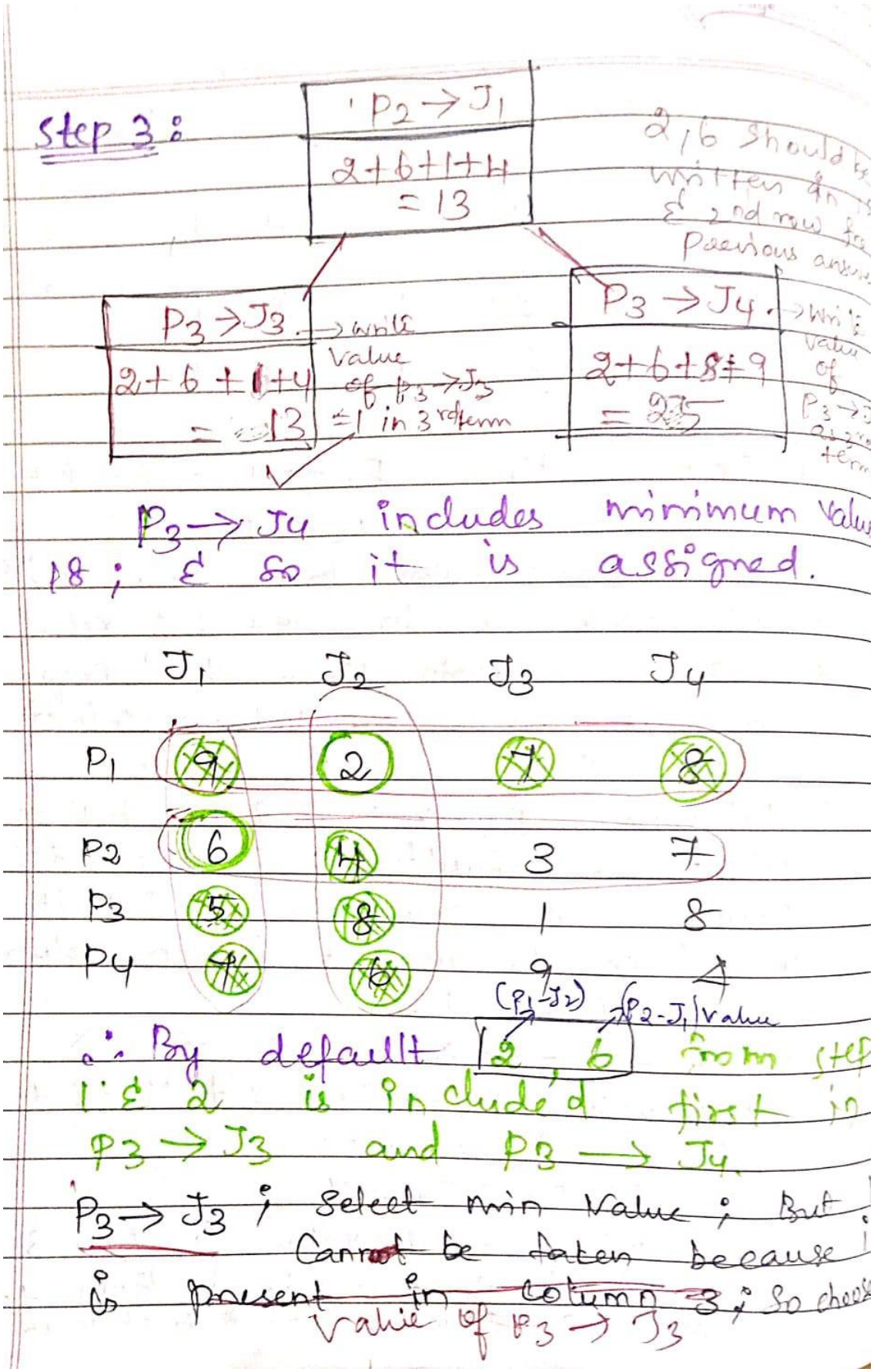
(iv) Likewise $P_2 \rightarrow J_4 : 2 + 7 + 1 + 6 = 17$

Select (i) 2 (default)

(ii) $P_2 \rightarrow J_4 = 7$

(iii) 1 = min value in Row 3

(iv) 6 ⇒ 4 is min in Row 4; So Select So choose 7 ⇐ Not 6 is min; But it is in Col 2


Step 3:
P2 → J1
2+6+1+4 = 13
2,6 should be written in 1st & 2nd row for previous answer
P3 → J3
2+6+1+4 = 13
write value of P3 → J3 = 1 in 3rd term
P3 → J4
2+6+8=9 = 25
P3 → J4 includes minimum value 18; & so it is assigned.
J1 J2 J3 J4
P1 9 2 7 8
P2 6 4 3 7
P3 5 8 1 8
P4 9 6 9 4
(P1-J2) (P2-J1) value
∴ By default 2, 6 from step 1 & 2 is included first in P3 → J3 and P3 → J4.
P3 → J3 ; Select min value ; But cannot be taken because is present in column 3 ; So check value of P3 → J3

for
$P_3 \rightarrow J_4$: (1) 2 & 6 from previous steps in Row 1 & Row 2 respectively. $P_3 - J_4$ ✓

(2) Row 3 ; minimum Value '8' is choosen.

(3) Row 4 have min value '4' in 4th column; So choose '4' & not 4

Note: Final solution is $P_3 \rightarrow J_3$
13 (minimum)
= 13 is choosen and It is assigned.

⇒ So we conclude with P_4 is assigned with J_4

```
Algorithm BranchAssign(level, currentcost)
{ if (level == n) {
  if (currentcost < finalcost)
  finalcost = currentcost
  return }
for(j=0; j<n; j++)
{ if (assigned[j])
  { assigned[j]=1;
  temp= currentcost + cost[level][j];
  if (temp < finalcost
  BranchAssign (level+1, temp);
  assigned[j]=0 }
```

Time complexity

For 'n' workers; there are n! possible assignments. (worst case)

*Best case (Good Pruning) much less than n!

Space complexity:

Recursive version → O(n)

Priority Queue → $O(n^2)$.