SNS COLLEGE OF TECHNOLOGY, COIMBATORE –35

Knapsack Problem

Knapsack Problem

- The 0/1 knapsack problem is to find the most valuable subset of the items that fits into the knapsack, where we are allowed either to take an item in its entirety or not to take it at all.
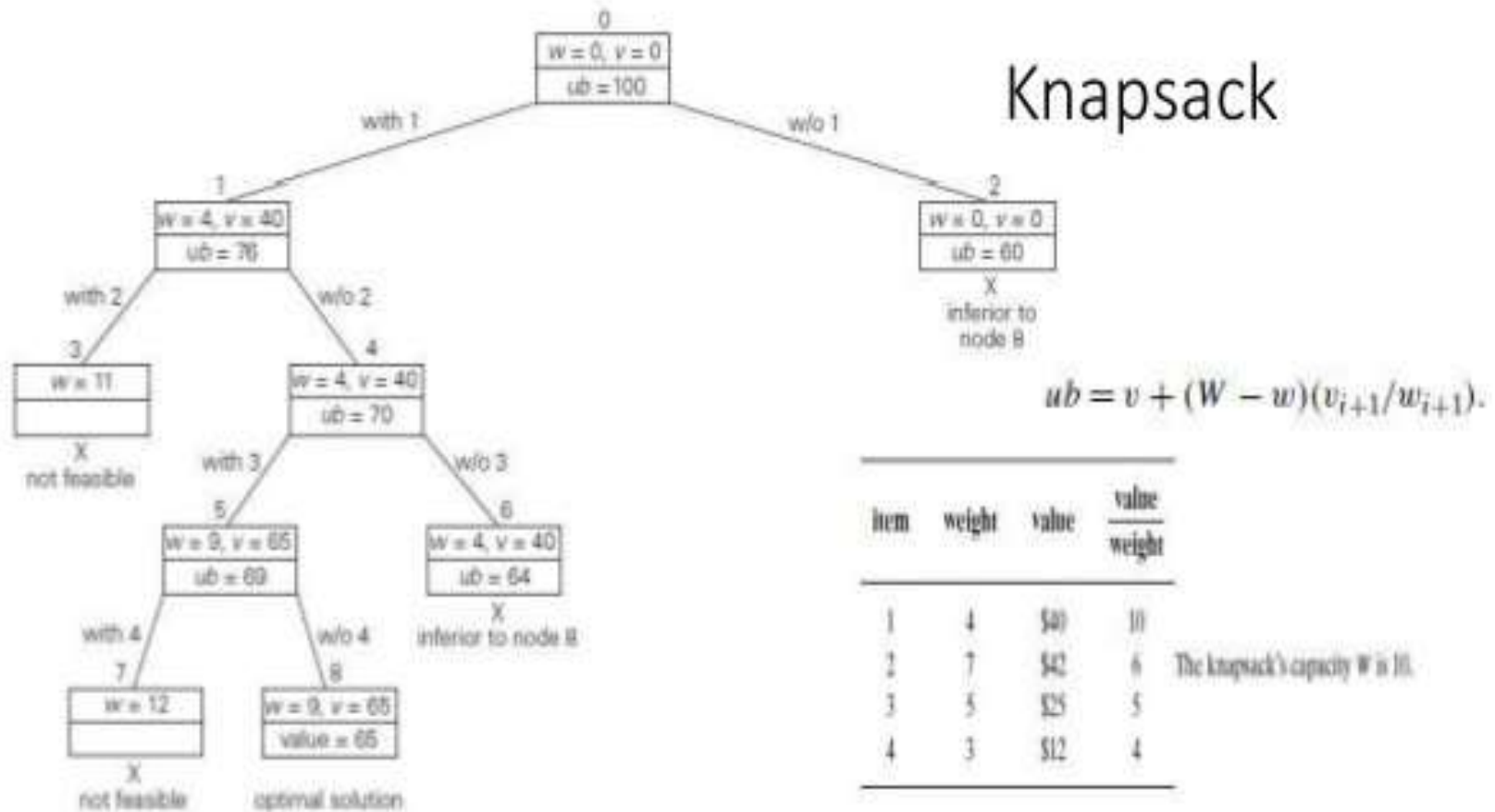- Example:

item	weight	value
1	7	$42
2	3	$12
3	4	$40
4	5	$25

$W = 10$

4

Knapsack Problem

Knapsack

$$ub = v + (W - w)(v_{i+1}/w_{i+1}).$$

0
$w = 0, v = 0$
$ub = 100$

with 1 — w/o 1

1
$w = 4, v = 40$
$ub = 76$

2
$w = 0, v = 0$
$ub = 60$
X
inferior to node 8

with 2 — w/o 2

3
$w = 11$
X
not feasible

4
$w = 4, v = 40$
$ub = 70$

with 3 — w/o 3

5
$w = 9, v = 65$
$ub = 69$

6
$w = 4, v = 40$
$ub = 64$
X
inferior to node 8

with 4 — w/o 4

7
$w = 12$
X
not feasible

8
$w = 9, v = 65$
value = 65
optimal solution

item	weight	value	value/weight
1	4	$40	10
2	7	$42	6
3	5	$25	5
4	3	$12	4

The knapsack's capacity W is 10.

FIGURE 12.8 State-space tree of the best-first branch-and-bound algorithm for the instance of the knapsack problem.