

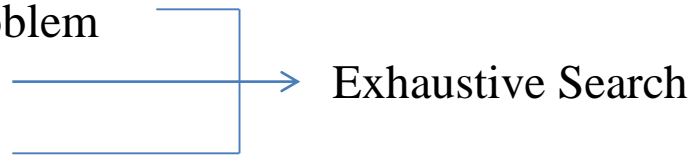
UNIT II – Brute Force and Divide and Conquer

- **Brute Force Design Technique**

- Selection Sort
- Bubble Sort
- Sequential Search
- Closest pair and Convex hull problem
- Travelling Salesman problem

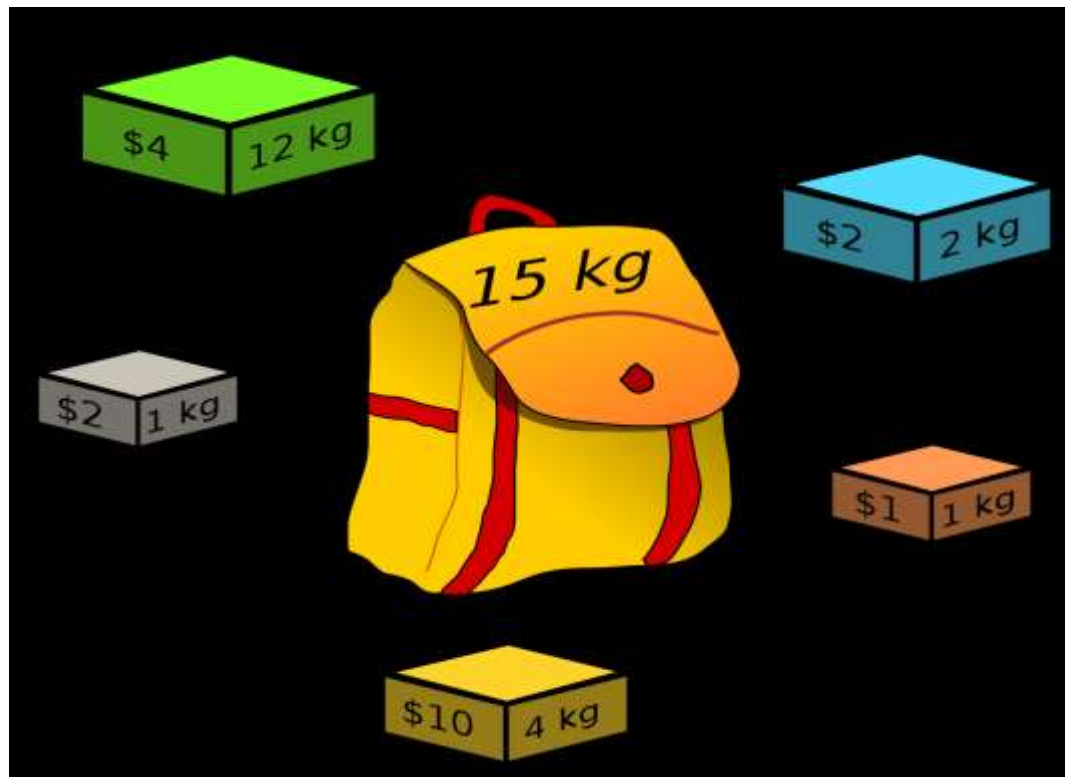
- **Knapsack problem**

- **Assignment problem**



Knapsack problem

- Given n items of known weights w_1, w_2, \dots, w_n and values v_1, v_2, \dots, v_n and a knapsack of capacity W , find the most valuable subset of the items that fit into the knapsack.



Weight: 100 gms
Value: 1.5 Kg Honey



1

Weight: 150 gms
Value: 3 Kg Honey



2

Weight: 500 gms
Value: ???



Weight: 2000 gms
Value: 3 Kg Honey

4

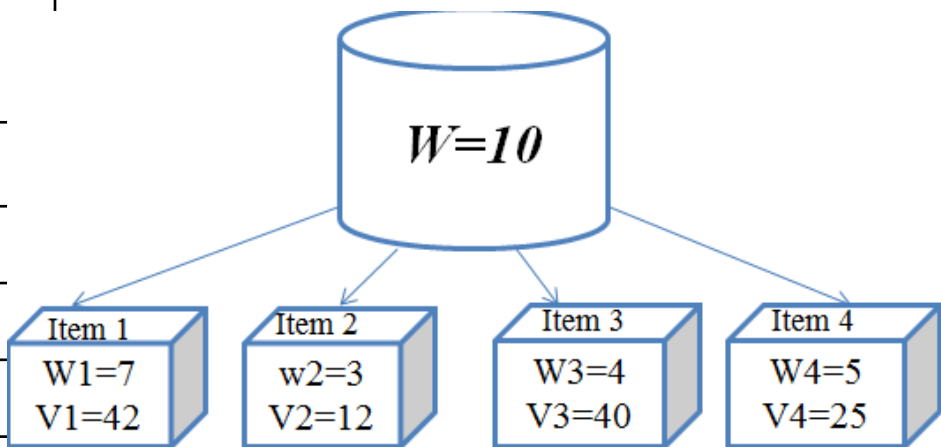


Weight: 350 gms
Value: 3.5 Kg Honey

3

Knapsack Problem - Example

SUBSET	Total Weight	Total Value
{null}	0	0
{1}	7	42
{2}	3	12
{3}	4	40
{4}	5	25
{1,2}	10	54
{1,3}	11	Not feasible
{1,4}	12	Not feasible
{2,3}	7	52
{2,4}	8	37
{3,4}	9	65
{1,2,3}	14	Not feasible
{2,3,4}	12	Not feasible
{1,2,4}	15	Not feasible
{1,3,4}	16	Not feasible
{1,2,3,4}	19	Not feasible



Analysis:

1. Problem size – Total no of item
2. Basic Operation
3. Count for basic Operation

No of subsets = 2^n

EX: n=4 , 16 possible subsets are available

What is the feasible solution?

Items	1	2	3	4
Weights	5	4	6	3
Values	10	40	30	50

Capacity : 10

Assignment Problem

- n people need to be assigned to n jobs, one person per job. Each person is assigned exactly one job and each job is assigned to exactly one person

P \ Jobs	Job 1	Job 2	Job 3	Job 4
Person 1	9hrs	2hrs	7	8
Person 2	6	4	3	7
Person 3	5	8	1	8
Person 4	7	6	9	4

- The possibilities for allocating n jobs for n person is $n!$
- Here $n=4$, $4!=24$ possibilities.
- From these possibilities have to take a feasible solution.
- Small instance. When no of instances grow it is not practical.

Assignment Problem

P \ Jobs	Job 1	Job 2	Job 3	Job 4
Person 1	9hrs	2hrs	7	8
Person 2	6	4	3	7
Person 3	5	8	1	8
Person 4	7	6	9	4

Possibilities of
job assignment to persons

$\{1,2,3,4\}=9+4+1+4=18$	$\{2,1,3,4\}=13$	$\{3,1,2,4\}=25$	$\{4,1,2,3\}=31$
$\{1,2,4,3\}=9+4+8+9=30$	$\{2,1,4,3\}=25$	$\{3,1,4,2\}=27$	$\{4,1,3,2\}=21$
$\{1,3,2,4\}=9+3+8+4=24$	$\{2,3,1,4\}=14$	$\{3,2,1,4\}=20$	$\{4,2,1,3\}=26$
$\{1,3,4,2\}=9+3+8+6=26$	$\{2,3,4,1\}=20$	$\{3,2,4,1\}=26$	$\{4,2,3,1\}=20$
$\{1,4,2,3\}=9+7+8+9=33$	$\{2,4,1,3\}=23$	$\{3,4,1,2\}=25$	$\{4,3,1,2\}=22$
$\{1,4,3,2\}=9+7+1+6=23$	$\{2,4,3,1\}=17$	$\{3,4,2,1\}=29$	$\{4,3,2,1\}=26$

Assignment Problem using Hungarian Method

- Row Detection
- Column Detection
- Optimality Test
- Redesigning Matrix

P	Jobs	Job 1	Job 2	Job 3	Job 4
Person 1		9hrs	2hrs	7	8
Person 2		6	4	3	7
Person 3		5	8	1	8
Person 4		7	6	9	4

1.Row Detection

7	0	5	6
3	1	0	4
4	7	0	7
3	2	5	0

2.Column Detection

4	0	5	6
0	1	0	4
1	7	0	7
0	2	5	0

3.Optimality Test

4	0	5	6
0	1	0	4
1	7	0	7
0	2	5	0

$J1 \rightarrow P2, J2 \rightarrow P1, J3 \rightarrow P3, J4 \rightarrow P4$

$P1, P2, P3, P4 = J2, J1, J3, P4 = \{2, 1, 3, 4\}$

Assignment Problem using Hungarian Method - Example

Jobs ↙

Machines					
5hrs	11	10	12	4	
2	4	6	3	5	
3	12	5	14	6	
6	14	4	11	7	
7	9	8	12	5	