



# SNS College of Engineering Coimbatore - 641107



## KNAPSACK PROBLEM

AP/IT

# Example 2: Knapsack Problem

Given  $n$  items:

- weights:  $w_1 w_2 \dots w_n$
- values:  $v_1 v_2 \dots v_n$
- a knapsack of capacity  $W$

Find most valuable subset of the items that fit into the knapsack

Example: Knapsack capacity  $W=16$

<u>item</u>	<u>weight</u>	<u>value</u>
1	2	\$20
2	5	\$30
3	10	\$50
4	5	\$10

# Knapsack Problem by Exhaustive

## Search

Subset    Total weight    Total value

{1}	2	\$20
{2}	5	\$30
{3}	10	\$50
{4}	5	\$10
{1,2}	7	\$50
{1,3}	12	\$70
{1,4}	7	\$30
{2,3}	15	\$80
{2,4}	10	\$40
{3,4}	15	\$60
{1,2,3}	17	not feasible
{1,2,4}	12	\$60
{1,3,4}	17	not feasible
{2,3,4}	20	not feasible
{1,2,3,4}	22	not feasible

**Efficiency:**  $\Theta(2^n)$

Each subset can be represented by a binary string (bit vector, Ch 5).