DESIGN AND ANALYSIS OF ALGORITHMS
UE19CS251

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Knapsack Problem

Major Slides Content: Anany Levitin

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Knapsack Problem

Given n items:

- weights: w_1 w_2 … w_n
- values: v_1 v_2 … v_n
- a knapsack of capacity W

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

Knapsack Problem

Example

Knapsack Capacity W = 16

Item	Weight	Value
1	2	20
2	5	30
3	10	50
4	5	10

Knapsack Problem

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

Knapsack Problem by Exhaustive Search

Knapsack Problem

- The Exhaustive Search solution to the Knapsack Problem is obtained by generating all subsets of the set of n items given and computing the total weight of each subset in order to identify the feasible subsets
- The number of subsets for a set of n elements is 2^n
- The Exhaustive Search solution to the Knapsack Problem belongs to $\Omega(2^n)$

THANK YOU

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