

VASAVI COLLEGE OF ENGINEERING(AUTONOMOUS)

IBRAHIMBAGH: HYDERABAD-500031

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

POGIL Activity

Course: Design and Analysis of Algorithms

Date on which Activity conducted: 1/4/2023

Class: B.E 2/4 CSE-B

Semester: IV

Timings: 11.40 AM to 12.40 PM

Academic Year: 2022-23

Concept: Fractional Knapsack Problem using Greedy method

Problem Statement:

- Given the weights and profits of **N** items, in the form of **{profit, weight}** put these items in a knapsack of capacity **W** to get the maximum total profit in the knapsack. In **Fractional Knapsack**, we can break items for maximizing the total value of the knapsack.

$(p_1, p_2, p_3) = (25, 24, 15)$

$(w_1, w_2, w_3) = (18, 15, 10)$

01/04/2023

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129Knapsack Problem:

Given a Knapsack or a bag, you are required to fill the knapsack with the items such that maximum profit is achieved. Each item is associated with a weight and a profit. Constraints to be followed are:

$$\text{to maximize the profit } \max \sum_{0 \leq i < n} P_i x_i; \quad \sum_{0 \leq i < n} w_i x_i \leq m.$$

Consider the items: $n=3$, $m=20$; $(P_1, P_2, P_3) = (25, 24, 15)$
 $(w_1, w_2, w_3) = (18, 15, 10)$

For the above knapsack instance (i) consider the 3 items in decreasing order of profits.

(ii) considers including the items in increasing order of weights

(iii) considers including the items in decreasing order of P/w ratio

And what are the items included?

(iv) In which of the above mentioned strategies, what are feasible solutions and what are the optimal solutions?

(v) What is the strategy we have to follow to maximize the profit; and what items are to be included in the solution?

Solns:

(i)	x_1	x_2	x_3
	1	2/15	0
	P_1	P_2	P_3

$$\text{profit} = 1 \times 25 + \frac{2}{15} \times 24 = 28.2$$

(ii)	x_1	x_2	x_3
	0	10/15	1
	P_1	P_2	P_3

$$\text{profit} = 1 \times 10 + \frac{10}{15} \times 24 = 26 \quad \therefore \frac{10}{15} \times 24 + 1 \times 15 = 31$$

(iii)

	x_1	x_2	x_3
$\frac{P}{W}$	$\frac{20}{18}$	$\frac{24}{15}$	$\frac{15}{10}$
	$= 1.38$	$= 1.6$	$= 1.5$

$$x_1 < x_3 < x_2$$

x_1	x_2	x_3
0	1	5/10

$$\Rightarrow 1 \times 24 + \frac{5}{10} \times 15$$

$$= 24 + 7.5$$

$$= 31.5$$

(iv) Considers including the items in decreasing order of P/W ratios, this is the optimal solution.

(v) when in decreasing order of P/W ratios, profit is maximized.