

# SPPU-BE-COMP-CONTENT - KSKA Git

000

classmate

Date :

Page :

## ASSIGNMENT-3

Q1

### APPLICATIONS :

#### 1. Resource Allocation in Cloud Computing

Fractional knapsack principle is used to allocate limited computing resources to various tasks so that the overall performance or profit is maximised.

#### 2. Investment & Portfolio optimisation

Investors can distribute a limited budget across multiple projects/assets based on their profit to cost ratio similar to selecting items with best value/weight ratio.

#### 3. Cargo Loading & shipping:

When space / weight capacity is limited fractional knapsack helps decide how much of each product to load & to maximise total value.

Q2

Fractional knapsack problem aims to maximise profit by selecting items that fit into a knapsack of limited capacity where items can be divided into smaller fractions.

greedy Approach selects items based on highest value to weight ratio first.

# SPPU-BE-COMP-CONTENT - KSKA Git

classmate

Date :

Page :

Given example:

Item	Weight	Value	Value/weight
1	5	30	6.0
2	10	40	4.0
3	15	45	3.0
4	22	77	3.5
5	25	90	3.6

Step 1: Sort items in descending order of value/weight ratio

So final sorted order based on ratio

Item 1 (6.0), item 2 (4.0), item 5 (~~3.6~~ <sup>3.6</sup>), item 4 (3.5), item 3 (3.0)

Assume knapsack capacity (W) = 50 kg

Step 2:

Take item 1 (5 kg): Value = 30 → Remaining = 45

Take item 2 (10 kg): Value = 40 → Remaining = 35

Take item 5 (25 kg): Value = 90 → Remaining = 10

Take fraction of item 4 ( $10/22$ ) =  $77 \times \frac{10}{22}$  → Remaining = 35

Total Value = 30 + 40 + 90 + 35 = 195

Max Profit = 195.



Q3

Let  $n$  be no. of items.

- 1) calculating value / weight ratio  $\rightarrow O(n)$
- 2) Sorting items by ratio  $\rightarrow O(n \log n)$
- 3) Selecting items until capacity filled  $\rightarrow O(n)$

~~T~~ Time complexity:

$O(n \log n)$

Space Complexity

$O(1)$

if sorting is done in place

otherwise  ~~$O(n)$~~   $O(n)$