Fractional Knapsack Problem

Input Data

Item	Value (Profit)	Weight	Value/Weight Ratio
1	25	5	5.0
2	24	4	6.0
3	15	6	2.5
4	40	12	3.33
5	30	6	5.0
6	20	8	2.5
7	10	10	1.0
8	10	3	3.33

Steps

1. **Compute the Value/Weight Ratio**

2. The Value/Weight Ratio for each item is computed as:

$$VWR = \frac{Value}{Weight}$$

Ratios are shown in the table above.

3. **Sort Items by Value/Weight Ratio**

Items are arranged in decreasing order of their Value/Weight Ratio:

Item	Value	Weight	Value/Weight Ratio
2	24	4	6.0
1	25	5	5.0
5	30	6	5.0
4	40	12	3.33
8	10	3	3.33
3	15	6	2.5
6	20	8	2.5

7	10	10	1.0

4. **Fill the Knapsack**

The knapsack has a maximum weight of **20**. Items are added until the weight limit is reached.

a. **Item 2**: Weight = 4 (entire item fits), Value = 24.
   Remaining Capacity = 20 – 4 = 16.
b. **Item 1**: Weight = 5 (entire item fits), Value = 25.
   Remaining Capacity = 16 – 5 = 11.
c. **Item 5**: Weight = 6 (entire item fits), Value = 30.
   Remaining Capacity = $11-6=5$.
d. **Item 4**: Weight = 12 (only part fits).
   Fraction Taken = $5/12$.
   Value = $40 \times (5/12) = 16.67$.
   Remaining Capacity = $5 - 5 = 0$.

5. **Total Value:**

$24+25+30+16.67=95.67$

Time Complexity

1. **Compute Value/Weight Ratios**: $O(n)$, where n is the number of items.
2. **Sort Items by Ratio**: $O(n \log n)$.
3. **Fill the Knapsack**: $O(n)$.

Total Time Complexity: $O(n \log n)$.

Final Output

The maximum value of items in the knapsack is **95.67**.

Selected Items:

- Entire Items: **2, 1, 5**
- Fraction of Item: **4 (=5/12)**