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

## Compute the Value/Weight Ratio

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

Ratios are shown in the table above.

## 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 |

## Fill the Knapsack

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

* 1. **Item 2**: Weight = 4 (entire item fits), Value = 24.  
     Remaining Capacity = 20 – 4 = 16.
  2. **Item 1**: Weight = 5 (entire item fits), Value = 25.  
     Remaining Capacity = 16 – 5 = 11.
  3. **Item 5**: Weight = 6 (entire item fits), Value = 30.  
     Remaining Capacity = *11−6=5*.
  4. **Item 4**: Weight = 12 (only part fits).  
     Fraction Taken = *5 / 12*.  
     Value = *40 × (5/12) = 16.67* .  
     Remaining Capacity = *5 - 5 = 0*.

## 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**: .
3. **Fill the Knapsack**: *O(n)*.

**Total Time Complexity**: .

# 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)**