

Fractional Knapsack Problem

- Given a set of n objects where object i has value v_i and weight w_i and a knapsack capacity C , determine the fractional amount f_i of each object i to be included in the knapsack such that the profit is maximized while the weight of the included objects does not exceed the knapsack capacity.

Maximize $\sum v_i f_i$
– such that $\sum w_i f_i \leq C$
– where $0 \leq f_i \leq 1$

Greedy Strategy

- Fractional knapsack can be solvable by the greedy strategy
 - Compute the value per pound v_i/w_i for each item
 - Obeying a greedy strategy, we take as much as possible of the item with the greatest value per unit wt.
 - If the supply of that item is exhausted and we can still carry more, we take as much as possible of the item with the next value per unit wt, and so forth until we cannot carry any more
 - $O(n \lg n)$ (we need to sort the items by value per pound)
 - Algorithm ?

Greedy Algorithm for Fractional Knapsack

```
fractionalKnapsack(V, W, capacity, n, Knapsack) {  
    sortByDescendingProfit(V,W,n)  
    Knapsack = 0;  
    capacityLeft = C;  
    for (i = 1; (i <= n) && (capacityLeft > 0); ++i) {  
        if (W[i] < capacityLeft)  
            Knapsack[i] = 1;  
            capacityLeft -= W[i];  
        else  
            Knapsack[i] = capacityLeft/W[i];  
            capacityLeft = 0;  
        }  
    }
```