

Knapsack Problem 1e: Proof

K = Total number of items

n = number of items that cannot be subdivided (0-1 knapsack)

m = number of items that can be divided into fractions (fractional knapsack)

$K = m + n$

V = weight limit

Let:

$n=m=K/2$

W = weight of all items

C = Cost of all items

$V = K/2W$

Prove taking any subset of half the items will provide the maximum value.

Proof by construction:

Maximum value $M = V * C$

Subset of half the items = $K/2$

Weight of subset half the items = $(K/2) * W$

Cost of subset of half the items = $(K/2) * W * C$

$= V * K$

$= M$

$M = \text{maxvalue}$