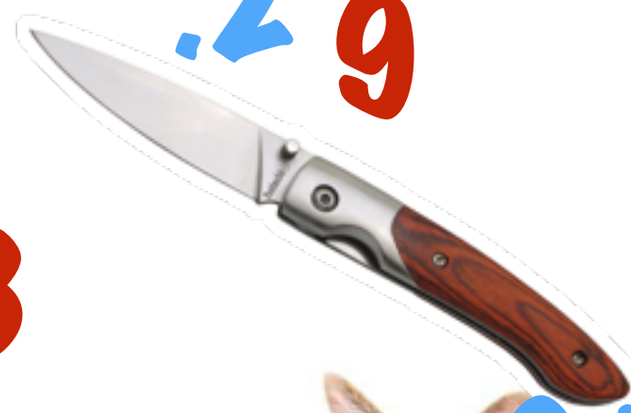
Knapsack and rounding

The knapsack problem: what should you put in your knapsack?

Weight
Value

.3
2

.15
5



.29

4
3

3.5
1

.23

.23

2.5
5

4
3

6.1

.05
1

2
.9

10

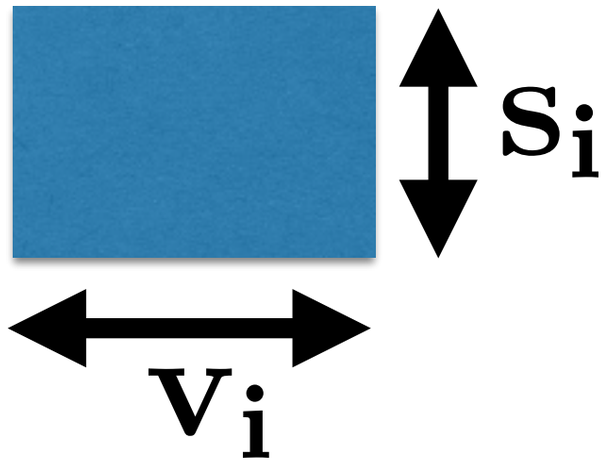
The knapsack problem

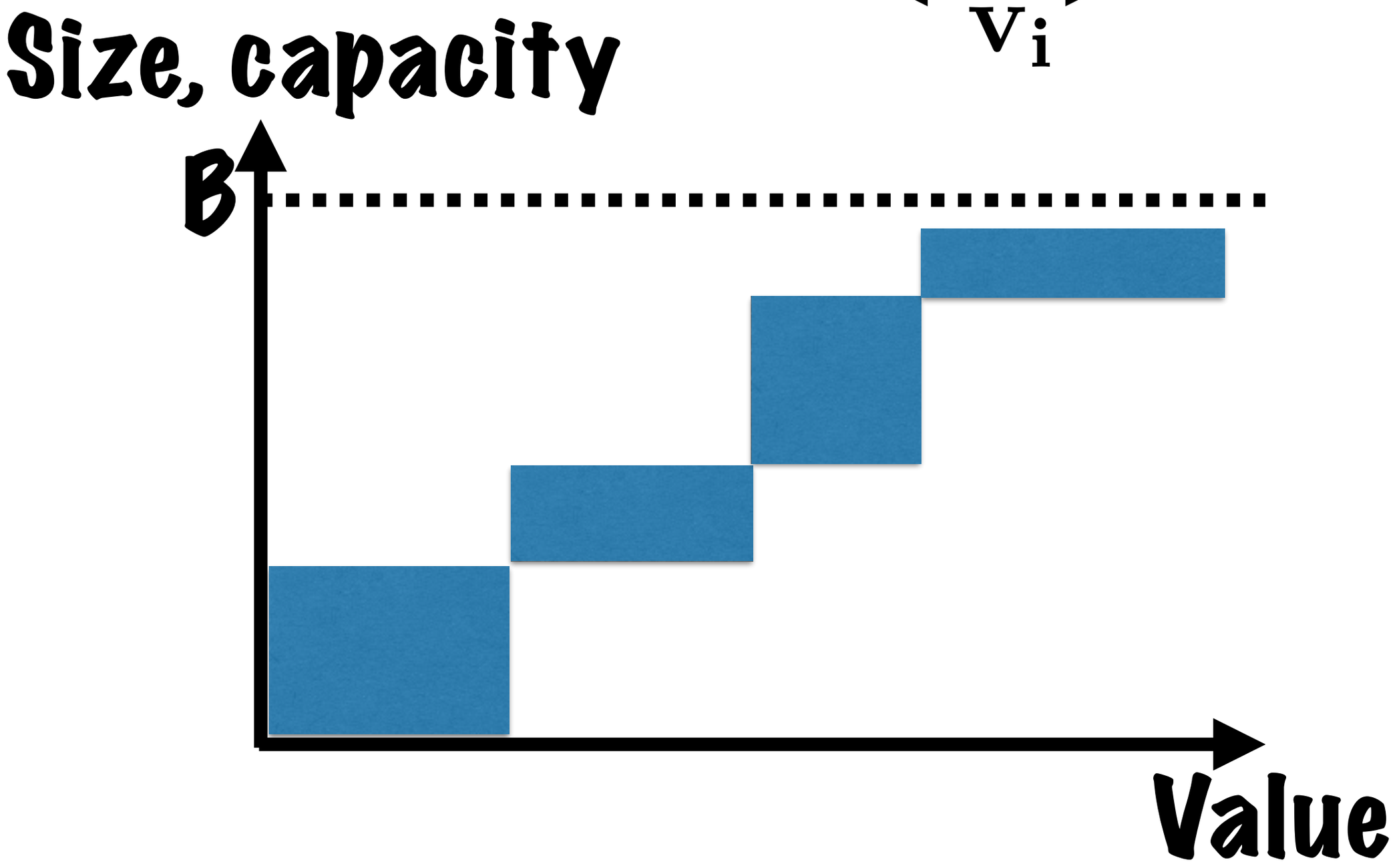
Given: capacity B knapsack, n items, item i has size s_i and value v_i

Place some items in knapsack
Maximize value

NP-hard

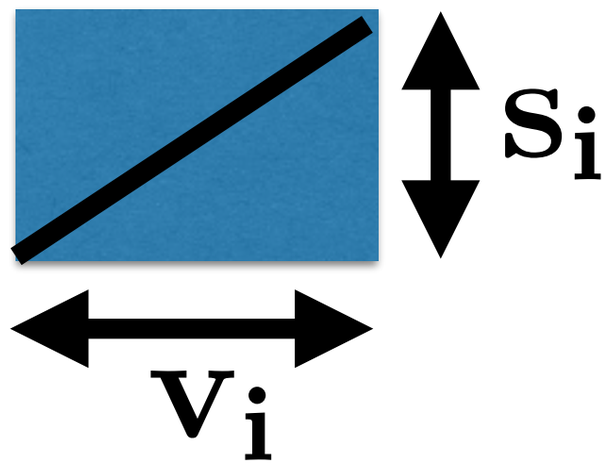
A general recipe: for intuition, graphical representation


S_i
V_i


Size, capacity
B
Value

Desire: small size, high value

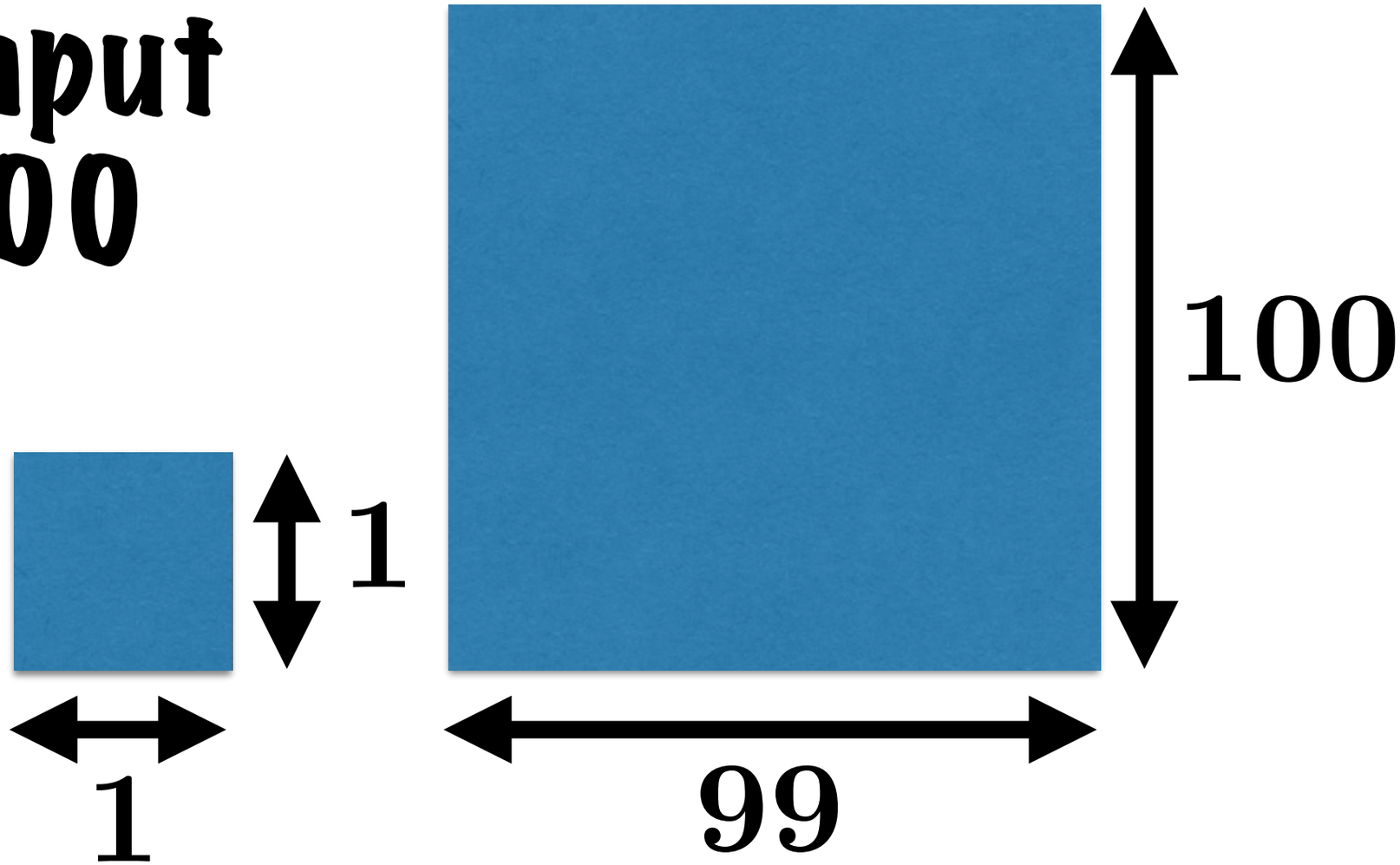
Naive greedy algorithm: take by order of increasing size/value

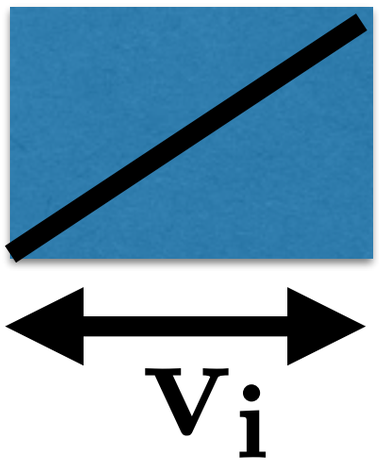


slope $\frac{s_i}{v_i}$

How good is Greedy?

Bad input
B=100





slope $\frac{s_i}{v_i}$

Greedy is bad

Another general recipe: for intuition, try special cases

If all items have the same size...

Greedy is good.

If all items have the same value...

Greedy is good.

If all items have size=value...

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