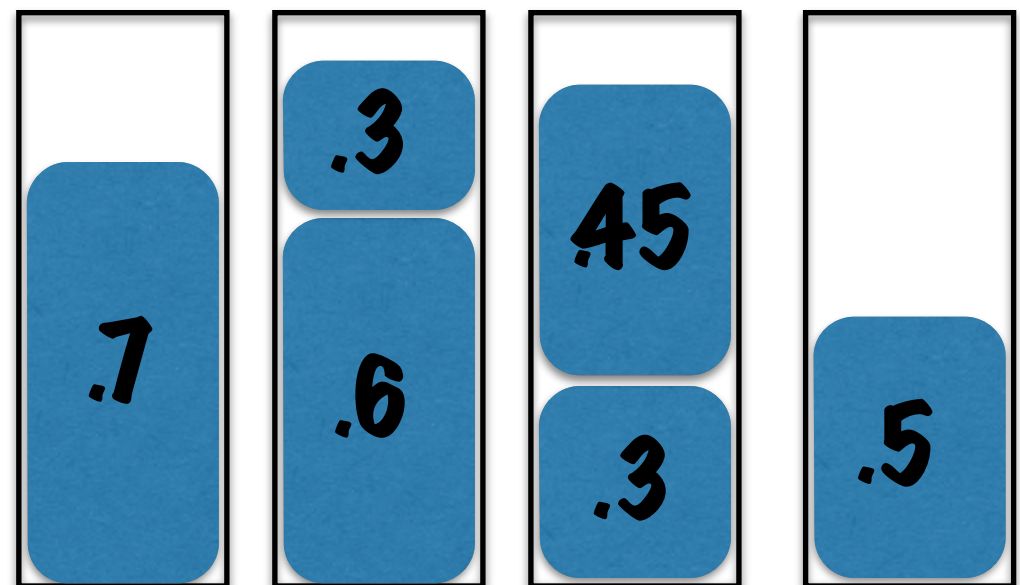
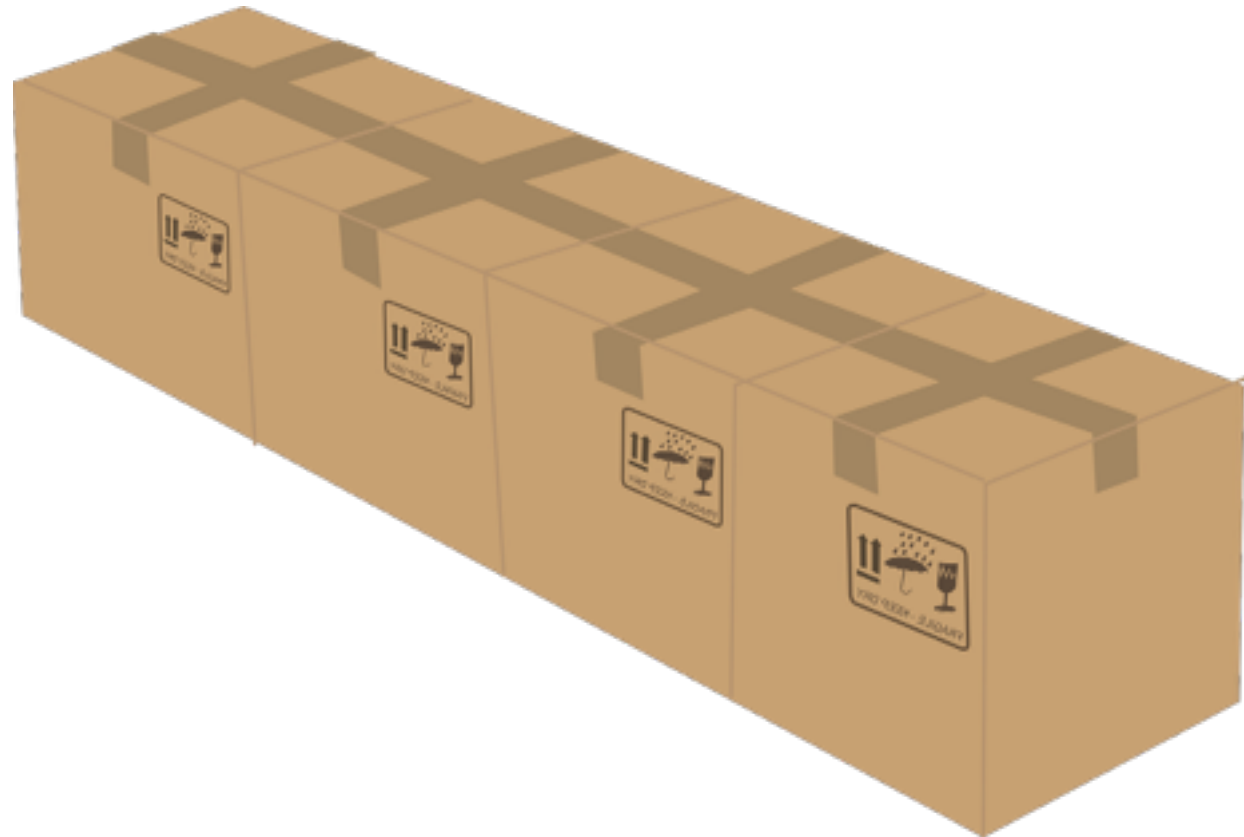


Bin packing, linear programming and rounding



Less special special case

**Large items,
many sizes**

Idea: Rounding

Round sizes

Reduce to special special case

How to round?

Capacity = 100 & Min size > 10:

Attempt:

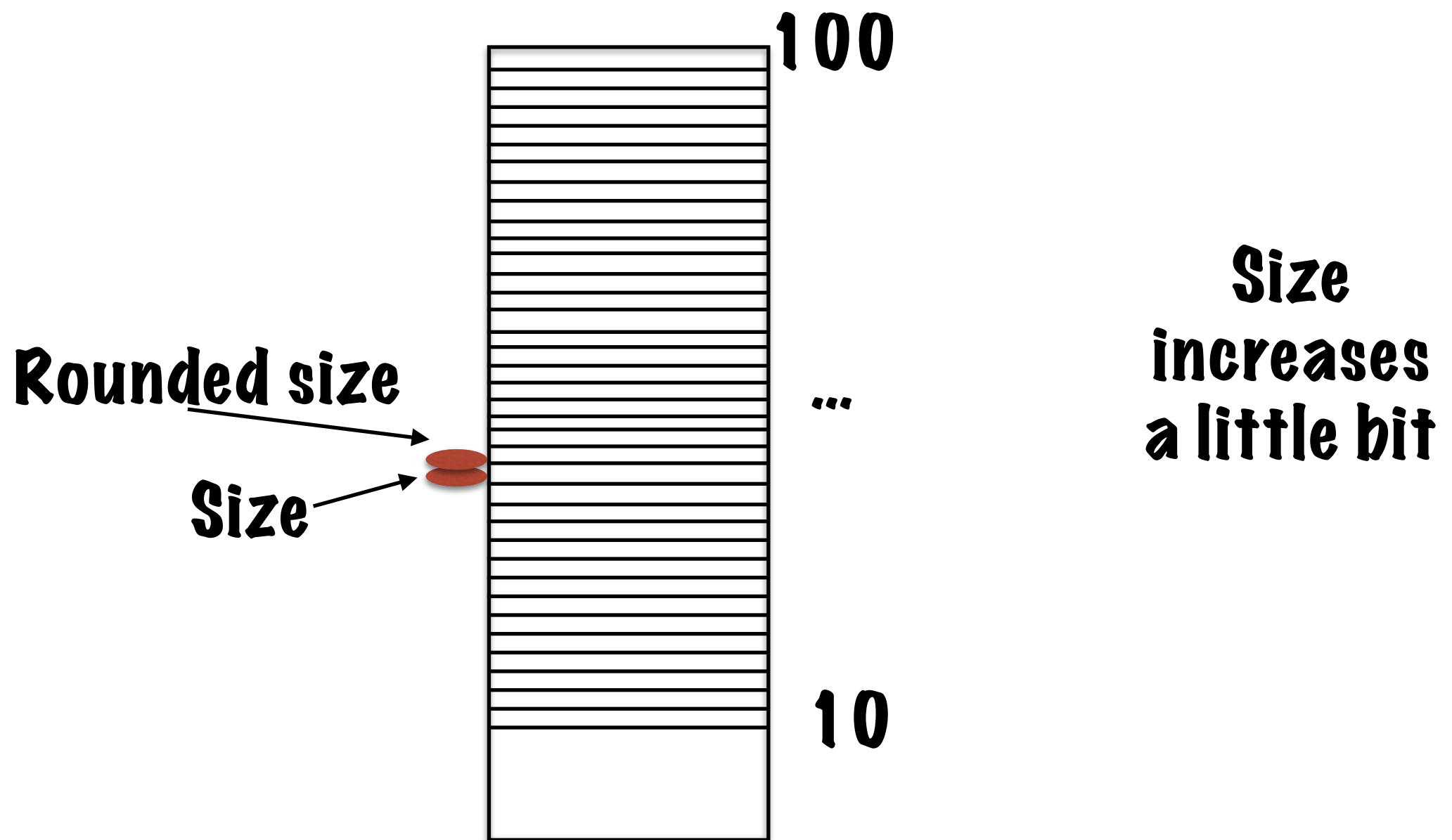
Round sizes **up to nearest integer**

Solve rounded problem

Observe:

It's a solution to original problem

But how good is it?



How much does OPT change?

Input:

Capacity 100

50 items with size $100 \cdot (1/3)$

50 items with size $100 \cdot (2/3)$

OPT=50

Rounded input:

Capacity 100

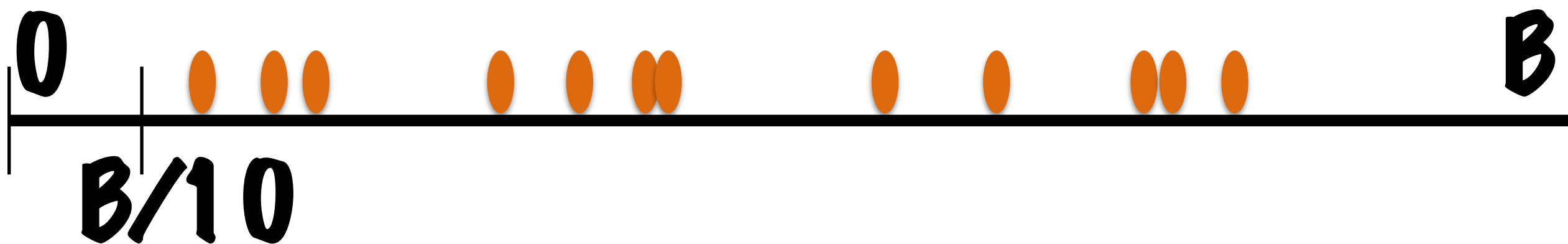
50 items with size 34

50 items with size 67

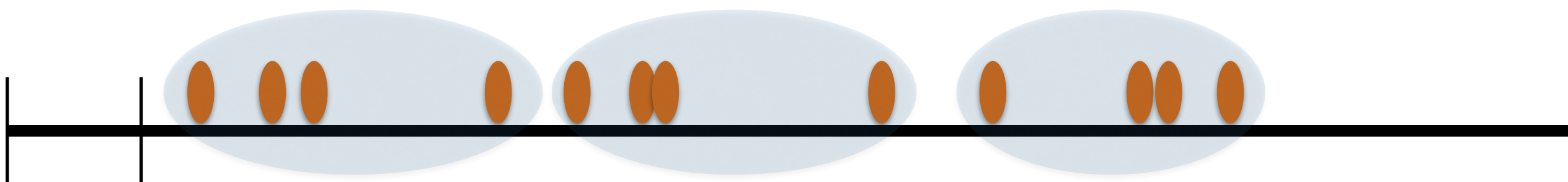
OPT'=75

This rounding fails

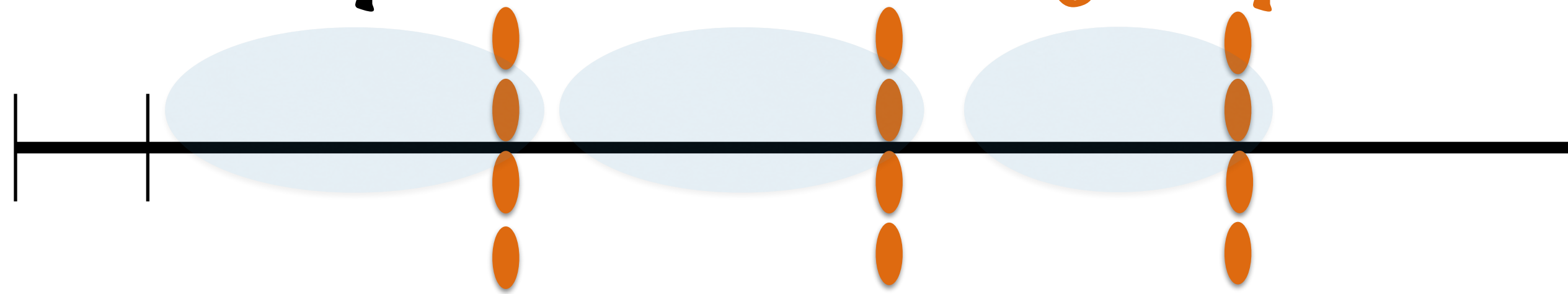
Adaptive rounding



Make groups of equal cardinality



Round up to max size in group



Algorithm - large items

Assume: sizes $>$ capacity $\times \epsilon$

Sort sizes

Make groups of cardinality $n \times \epsilon^2$

Round up to max size in group

Solve rounded problem

Output corresponding packing

Observe: output is a packing

Observe: all sizes are $> \text{Capacity} \times \epsilon$

Observe: #distinct sizes $< 1/\epsilon^2$

Runtime : polynomial

But how good is it?

$$\text{Value}(\text{Output}) \leq \text{OPT} * (1 + O(\epsilon))$$

Bin packing, linear programming and rounding

