HW/SW Codesign
AS 2009

Exercise 8:
Design Space, Pareto Points

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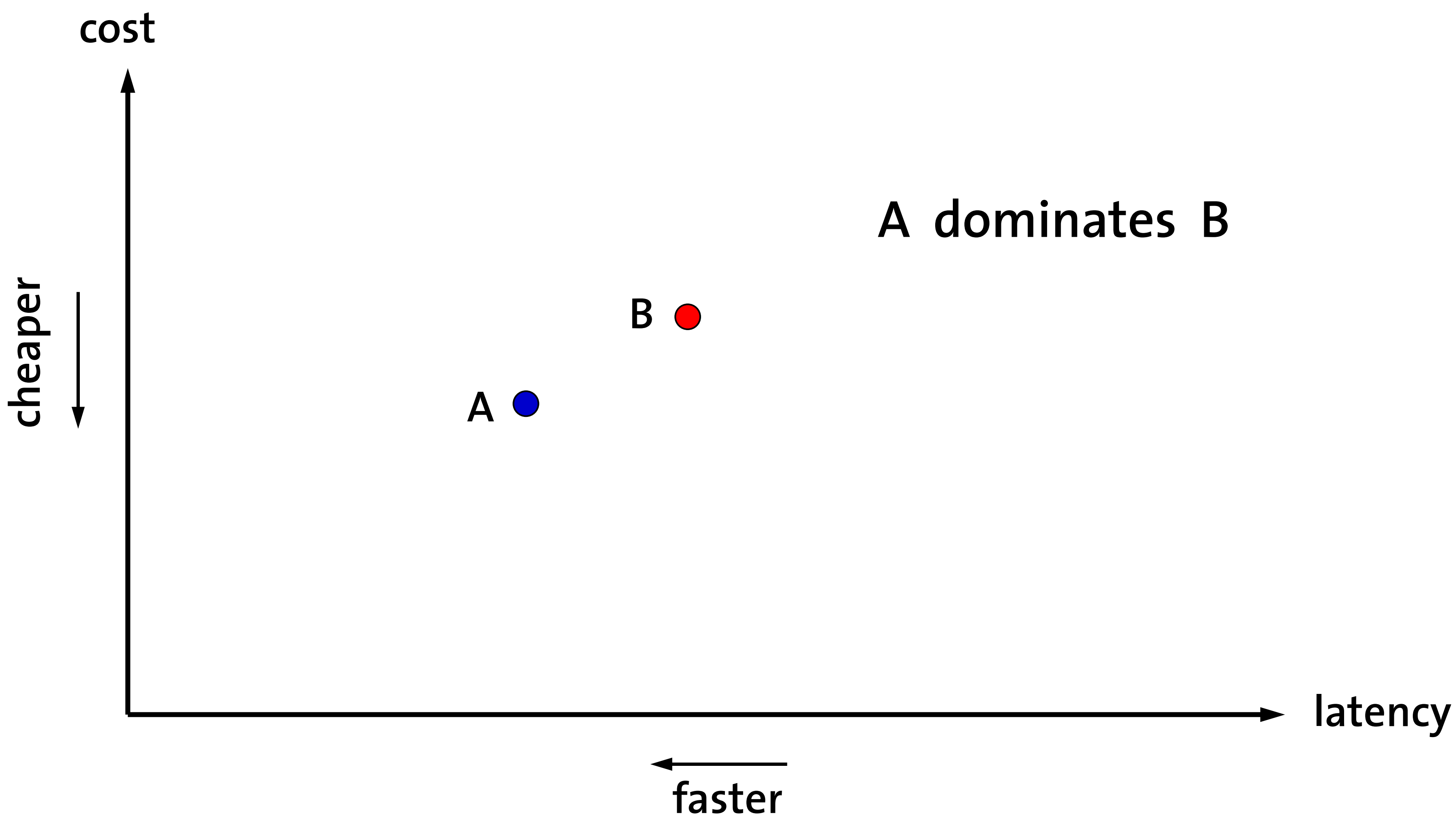
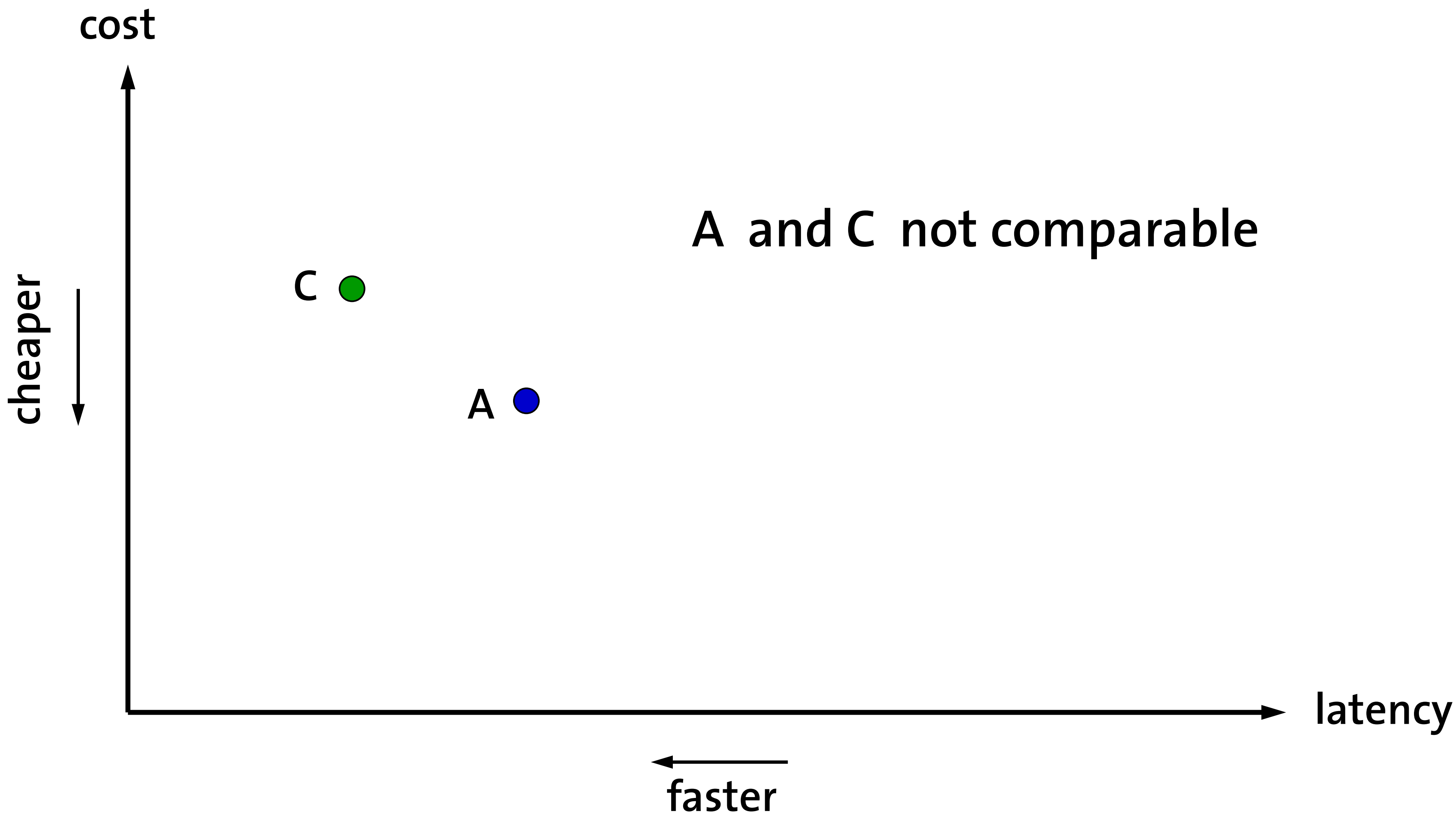
Exercise Topics

- Given a task graph, a number of resource components, and constraints (binding to component, cost of a component, execution times of tasks on a component)
  - Determine all possible resource allocations, bindings of tasks, (and schedules). Calculate cost and total execution time for each design point
- Determine **Pareto points** in the design space

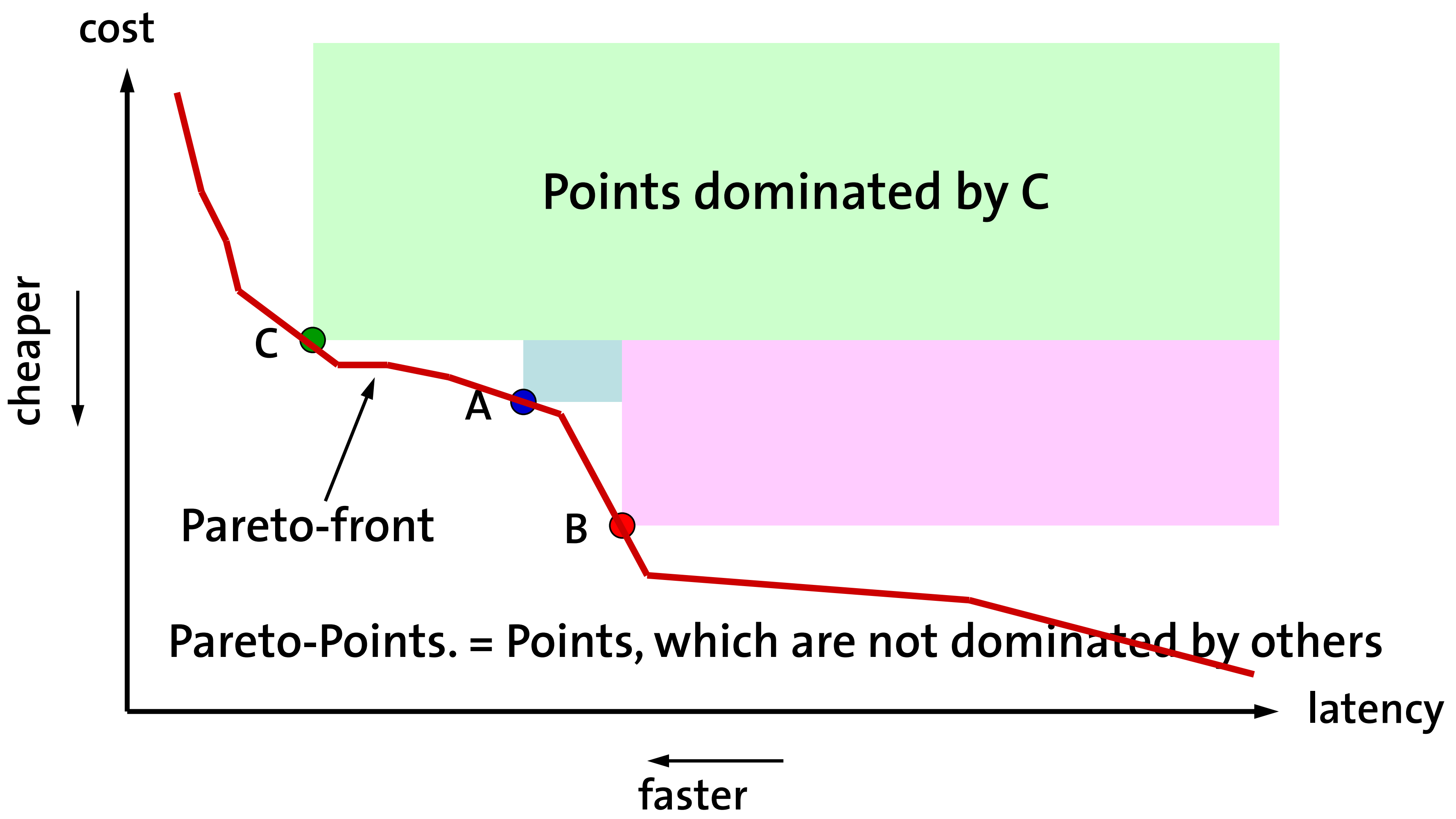
Multi-criteria optimization / Pareto-points



Multi-criteria optimization / Pareto-points



Multi-criteria optimization / Pareto-points

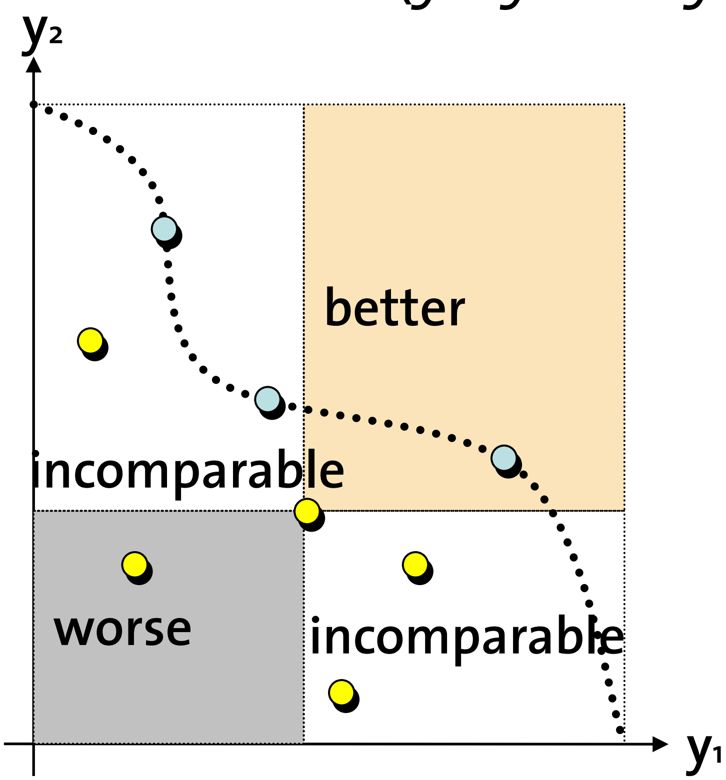


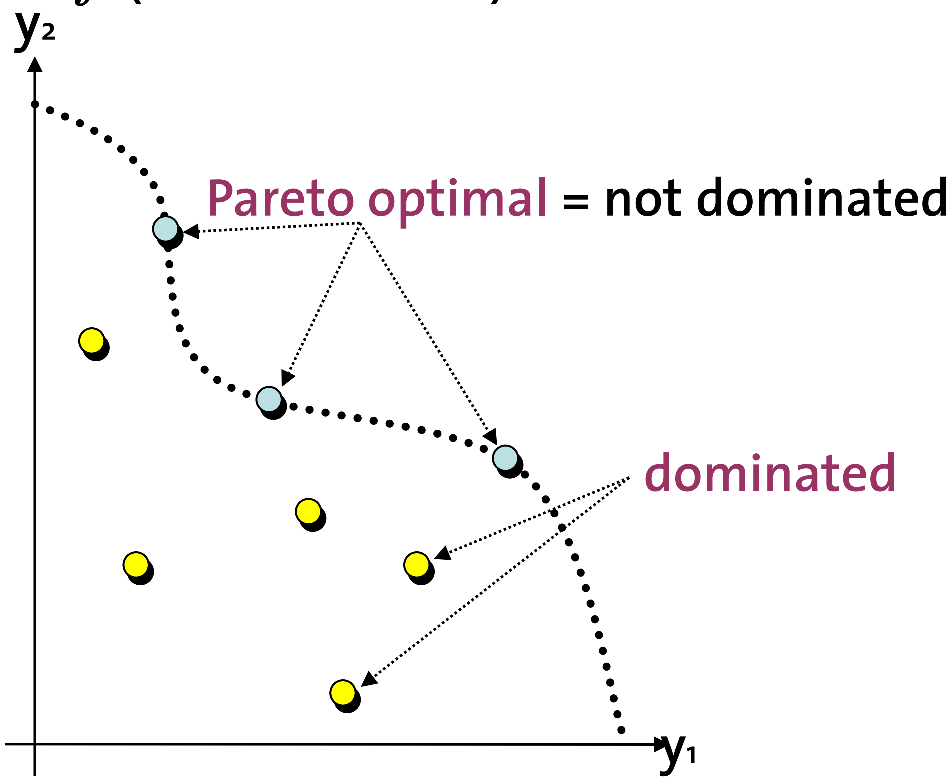
Dominance, Pareto Points

- A (design) point J_k is *dominated* by J_i, if J_i is
  - better or equal than J_k in all criteria and
  - better in at least one criterion.
- A point is Pareto-optimal or a *Pareto-point,* if it is not dominated.
- The domination relation imposes a partial order on all design points
  - We are faced with a set of optimal solutions.

Multiobjective Optimization

Maximize $(y_1, y_2, \ldots, y_k) = f(x_1, x_2, \ldots, x_n)$

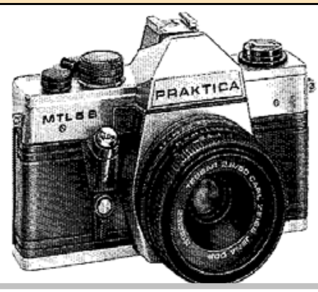


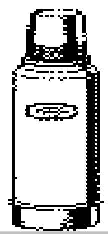
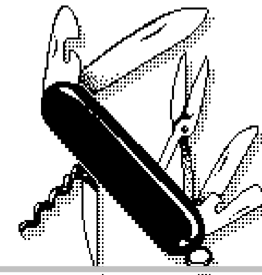
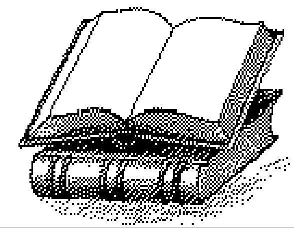


Pareto set = set of all Pareto-optimal solutions

The Knapsack Problem

weight = 750g profit = 5	weight = 1500g profit = 8	weight = 300g profit = 7	weight = 1000g profit = 3



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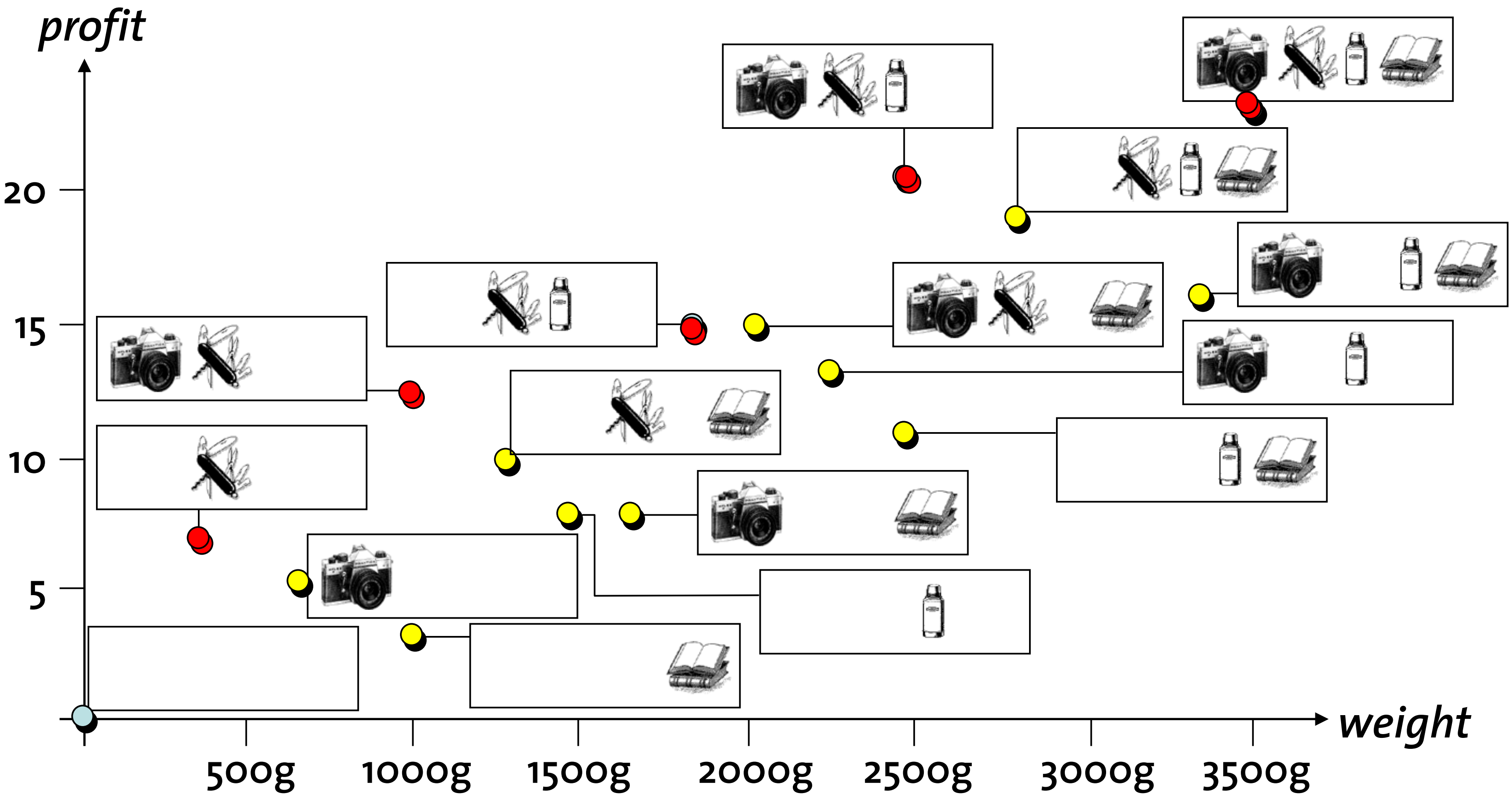
Goal: choose subset that

- maximizes overall profit
- minimizes total weight

The Solution Space



The Trade-off Front

Observations: ❶ there is no single optimal solution, but
❷ some solutions (●) are better than others (●)