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Optimization

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Exercises 6

1. **Bin Packing (NIVEAU I)**

   Consider the following variant of the *bin packing* problem:

   - Pack n items of size $g_i, i = 1, \ldots, n$, into (at most) n bins, each of capacity c.
   - Put the first m items into different bins.
   - Find the minimal number of bins necessary.

   Model the problem in

   - integer linear programming
   - constraint programming (hint: cumulative constraint)

   and compare the two models.

2. **IP (NIVEAU II)**
   Given variables $x_1, ..., x_n \in \{0, 1, ...m\}$
   model in IP: $|x_i - x_j| \geq 2, \forall i \neq j$.

3. **Metaheuristics (NIVEAU I)**

   Given the complete undirected graph $G = (V, E)$ for a set of V of vertices, and a function $w : E \mapsto \mathbb{R}^+$ that assigns a positive weight to each edge. The *Traveling Salesman Problem* (TSP) is to find a cyclic path in G that contains each vertex in V exactly once and has minimal total weight.

   (a) Describe a brute force algorithm for solving the TSP.
   (b) Describe several heuristics to approximate the TSP. Use at least the following techniques:
      - Iterated local search.
      - Simulated annealing.
      - Ant colony optimization.
      - Evolutionary computing.

      You may also evolve your own ideas.
   (c) How can the TSP be formulated as ILP?