Research proposal
Sviluppo di algoritmi esatti e metaeuristici per problemi di routing e packing

Implementation of exact and heuristic algorithms for routing and packing problems

We plan to study variants of single and multiple knapsack problems that arise in real-world applications involving routing aspects.

The main line of the research activity will concern the implementation of exact mathematical models and (meta)heuristic algorithms for a variant of the Multiple Knapsack Assignment Problem that finds application in military logistics:

- a military unit asks to receive a certain number of items of different types (pallets of explosives, medical equipment, food supplies): for each item type $t$, the unit wants to receive at most $u_t$ units;
- each item type $t$ has a unit profit $p_t$ and a unit weight $w_t$;
- there are $r$ military bases in which items are located. Each base $k$ has $n_{kt}$ items of type $t$ available;
- there are $m$ heterogeneous vehicles $i$ (aircrafts, trucks, ...), each associated with a capacity $c_i$, currently located in some depot $d_i$ (a depot may coincide or not with one of the bases);
- the problem is to optimize the assignment of vehicles and items to the military bases. A vehicle will:
  - (i) go from its current location to the assigned basis;
  - (ii) pick up a subset of assigned items;
  - (iii) deliver them to the military unit;
- the assignment of a certain vehicle $i$ to a certain base $k$ has a cost $f_{ik} = \text{cost for going from its current location to the base, plus cost for going from the base to the military unit}$;
- the objective is to maximize the total profit of the transported items minus the total cost for the vehicle movement, in such a way that no vehicle is assigned a set of items whose weight exceeds its capacity.