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OPTIMAL N-QUEENS

search	f	obj
def	12'510'030	956
dWd-rand	17'679'613	720
dWd-rand + restart	10'663'919	676
dWd-rand + restart + LNS	5'694'491	650

-Analyze the results and compare the different search strategies. Note that the obtained solutions may not be optimal.

DWD-RAND

We know from previous experience that random values assignment is fairly effective for the n queens problem. dWd is a fail-first approach and that could be the reason for the higher number of failures compared to the default search strategy. Failing more can be good if we fail early. This could help us explore more solutions within the timeout. More acceptable solutions give us more chances for improvement compared to the default strategy.

+RESTART

Restarting works great in combination with random value selection; it can use the non-determinism of random values and knowledge from previous failures to explore the searchspace more efficiently by avoiding getting stuck in unsolvable sub-trees (with branch and bound, unsolvable subtrees can be acceptable solutions that won't improve the objective function). Indeed we see yet another improvement of the objective value.

+ LNS

Local Search based metaheuristics are effective in finding good-quality solutions but a pure Local Search method can struggle with large neighborhoods.
LNS starts from the solution built using dwd-rand and builds a neighborhood to carry out local search. With many variables fixed and an upper bound provided by previous solutions, strong propagation can take place and we can exploit CP to explore the neighborhood efficiently to find a local optimum.