

Non-Dominated Sorting Genetic Algorithm (NSGA-II) for the Redistricting Problem in Mexico

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Abstract : The electoral zone design problem consists in redrawing the boundaries of legislative districts for electoral purposes in such a way that federal or state requirements are fulfilled. In Mexico, this process has been historically carried out by the National Electoral Institute (INE), by optimizing an integer nonlinear programming model, in which population equality and compactness of the designed districts are considered as two conflicting objective functions, while contiguity is included as a hard constraint. The solution technique used by the INE is a Simulated Annealing (SA) based algorithm, which handles the multi-objective nature of the problem through an aggregation function. The present work represents the first intent to apply a classical Multi-Objective Evolutionary Algorithm (MOEA), the second version of the Non-dominated Sorting Genetic Algorithm (NSGA-II), to this hard combinatorial problem. First results show that, when compared with the SA algorithm, the NSGA-II obtains promising results. The MOEA manages to produce well-distributed solutions over a wide-spread front, even though some convergence troubles for some instances constitute an issue, which should be corrected in future adaptations of MOEAs to the redistricting problem.

Keywords : multi-objective optimization, NSGA-II, redistricting, zone design problem

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