Mathematical models for seats assignment in political elections

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Abstract

In proportional electoral systems with more than one constituency the number of seats allotted to each constituency is generally pre-specified, as well as, the number of seats that each party has to receive at a national level. "Biproportional allocation" (BAP) of seats to parties within constituencies consists of converting the vote matrix V into an integer matrix of seats "as proportional as possible" to V, satisfying constituency and party totals. In the current Italian electoral law this problem is ruled by an erroneous procedure which may produce an infeasible allocation, actually one that is not able to satisfy all the required conditions simultaneously.

In this talk we illustrate different mathematical approaches for the solution of BAP. First we discuss a new class of optimization models based on the minimization of objective functions which measure deviation from 'ideal proportionality'. We also sketch two other approaches: one is based on the theory of (0, 1)-matrices with given line sums, the other applies alternating vector apportionment operations and shortest paths. Although all these methods are valid tools for solving BAP, they are still too 'mathematically sophisticated' to be accepted by politicians and lawmakers. Keeping an eye on the Italian case, we conclude the presentation illustrating the bugs of the current Italian electoral law for the Chamber of Deputies and discussing possible procedures that could be understood by everyone and, eventually, written in the law.