

Theoretical Analysis of Fairness of Voting
District Apportionment

Professor Henri Theil, University of Chicago, has proposed a method of computing a fair apportionment of representation for European type parliamentary elections that is based on the computation of the "entropy" of the distribution of political groups in a country. ("The Desired Political Entropy" in The American Political Science Review, Vol. LXIII, June 1969, No. 2, pp. 521-525). Further research would be required to apply the concept of "entropy" to American political conditions.

The American version of this problem is, given that $p_1, p_2, \dots, \dots, p_n$ are the proportions of the citizens belonging to different political, racial, and other categories of groups in a given state; and $q_1, q_2, \dots, \dots, q_n$ are the proportions of the assemblymen in the state legislature representing groups 1, 2, \dots, n ; then of various ways of apportioning assembly districts, we choose the plan that makes the "entropy of the q -distribution" closest to the "entropy of the p -distribution," where the entropies are defined as follows:

$$\text{entropy of the } p\text{-distribution: } H_p = - \sum_{i=1}^n p_i \log p_i ;$$

$$\text{entropy of the } q\text{-distribution: } H_q = - \sum_{i=1}^n q_i \log q_i ;$$

where "log" means logarithm.

If such a theoretical analysis procedure were perfected, it would be appropriate to have such analyses administered by the reapportionment commission proposed by SCA 1.

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