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Exact Results on Potts Model in a Generalized External Field YAN XU, Department of Physics at Florida State University, ROBERT ELLSWORTH SHROCK, C. N. Yang Institute for Theoretical Physics at Stony Brook University — The q-state Potts model is a spin model that has been of longstanding interest as a many-body system in statistical physics. A natural generalization is to consider this model in a generalized external field that favors or disfavors spin values in a subset $I_s = \{1, ..., s\}$ of the total set of q-state spin values. We obtain a powerful exact formula (Shrock formula) for the partition function of this generalized Potts model on various families of graphs G, $Z(G, q, s, v, w)$, where v and w are temperature- and field-dependent Boltzmann variables. An important property of this formula is that it expresses $Z(G, q, s, v, w)$ in a graph-theoretic manner as a sum of contributions from spanning subgraphs G' of the graph G, rather than as a sum over spin configurations. Using this general formula, we derive a number of exact properties of $Z(G, q, s, v, w)$. We also analyze an interesting special case of the zero-temperature Potts antiferromagnet, corresponding to a set-weighted chromatic polynomial $Ph(G, q, s, w) \equiv Z(G, q, s, -1, w)$ that counts the number of colorings of the vertices of G subject to the condition that colors of adjacent vertices are different, with a weighting w that favors or disfavors colors in the interval I_s.

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