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Inherent Choice in the Search Space of Constraint Satisfaction Problem Instances

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Abstract:	Constructive methods obtain solutions to constraint satisfaction problem instances by iteratively extending consistent partial assignments. In this research, we study the solution paths in the search space of constructive methods and examine their distribution among the assignments of the search space. By properly employing the entropy of this distribution, we derive measures of the average amount of choice available within the search space for constructing a solution. The derived quantities directly reflect both the number and the distribution of solutions, an ”open question” in the phase transition literature. We show that constrainedness, an acknowledged predictor of computational cost, is an aggregate measure of choice deficit. This establishes a connection between an algorithm-independent property of the search space, such as the inherent choice available for constructing a solution, and the algorithm-dependent amount of resources required to actually construct a solution.