

Equal Treatment of Equals and Efficiency in Probabilistic Assignments

Yasunori Okumura

Department of Logistics and Information Engineering, Tokyo University of Marine Science
and Technology (TUMSAT)

Abstract

This paper studies general multi-unit probabilistic assignment problems involving indivisible objects, with a particular focus on achieving the fundamental fairness notion known as equal treatment of equals (ETE) and ensuring various notions of efficiency. We extend the definition of ETE so that it accommodates a variety of constraints and applications. We analyze the ETE reassignment procedure, which transforms any assignment into one satisfying ETE, and examine its compatibility with three efficiency concepts: ex-post efficiency, ordinal efficiency, and rank-minimizing efficiency. We show that while the ETE reassignment of an ex-post efficient assignment remains ex-post efficient, it may fail to preserve ordinal efficiency in general settings. However, since the ETE reassignment of a rank-minimizing assignment preserves rank-minimizing efficiency, the existence of assignments satisfying both ETE and ordinal efficiency can be established. Furthermore, we propose a computationally efficient method for constructing assignments that satisfy both ETE and ordinal efficiency under general upper bound constraints, by combining the serial dictatorship rule with appropriately specified priority lists and the ETE reassignment.

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