Modelling variants of the Stable Marriage Problem with Communicating Answer Set Programming[*]

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Abstract

The Stable Marriage Problem (SMP) is a well-known matching problem first introduced and solved by Gale and Shapley. Starting from (i) a set of n men and n women, (ii) for each man a ranking of the women as preferred partners, and (iii) for each woman a ranking of the men as preferred partners, the SMP searches for a set of n couples (marriages) such that there are no man and woman who are in different marriages but both prefer each other to their actual partners. Due to its practical relevance in more realistic contexts, countless variants on the SMP have been investigated, making the problem assumptions more applicable for a wider range of applications. Our goal is to use Communicating Answer Set Programming (CASP) to formalise and solve some variants of the SMP in a transparant, practicable and easily extendable way. CASP is an extension of Answer Set Programming (ASP) in which several ASP programs can exchange information by communicating with each other, which makes it a powerful tool to compute all the answer sets of a problem instance using off-the-shelf answer set solvers. We can use these generic and efficient ASP solvers to find stable matches in a number of variants which can easily be described in CASP with little adjustment, sparing ourselves the task of developing a new algorithm for each problem variant. Moreover, encoding in ASP has the advantage of easily adding extra constraints to the problem, for instance demanding the presence or absence of a certain matched pair in the solution.