House-swapping with divorcing and engaged pairs

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Models of exchange of indivisible goods have commonly been studied under the name *housing market*, where the term *house* has been adopted as a synonym for the indivisible good in question. In these models, there is usually a set of n agents, each one owns one unit of an indivisible good and each one wants to end up again with one unit of this good, perhaps a better one than his original. The situation can be represented by a directed graph $G = (V, A)$, where agents correspond to vertices and an arc (i, j) means that agent i finds the house owned by agent j acceptable. An exchange corresponds to a vertex-disjoint cycle packing in G.

A maximum size exchange can be found efficiently by a method that is now a folklore and that transforms the cycle packing to the maximum weight perfect matching in a certain bipartite graph. However when a restriction on the maximum length k of involved cycles is included, this problem becomes intractable for any $k \geq 3$ (NP-hard, or even APX-complete).

In this talk we deal with another modification of the house allocation problem, brought about by the existence of divorcing couples and engaged pairs. We show that the problem of finding a new house for the maximum number of agents is inapproximable, but fixed parameter tractable if parameterized by the number of divorcing and engaged pairs.