CS390 Computational Game Theory and Mechanism Design July 10, 2013

Handout 5: Problem Set 4

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Due by Wednesday, July 17, 2pm.

Problem 1 (10pt). For any small constant ϵ, find an ϵ-Nash equilibrium that is not a Nash equilibrium, in the 6-player star-shape matching pennies game introduced in class.

Problem 2 (10pt). Work out the algorithm TreeNash for the same game in Problem 1. That is, write out (or give compact description) of all the tables and witness lists generated by the algorithm. Then describe all the NEs of this game, following the top-down procedure.

Problem 3 (10pt). Prove that for any finite game G, any finite convex combination of CEs is still a CE of G. (If $\sigma^1, \ldots, \sigma^k \in \Delta(S)$, and if $\lambda_1, \ldots, \lambda_k$ are non-negative reals with $\sum_i \lambda_i = 1$, then the convex combination of $\sigma^1, \ldots, \sigma^k$ under $\lambda_1, \ldots, \lambda_k$ is the distribution $\lambda_1\sigma^1 + \cdots + \lambda_k\sigma^k$.)

Notice that this problem is related to Proposition 46.2 of OR94. The notion of CE is defined in OR94 in a way different from ours, but the two definitions are equivalent. One way to solve this problem is to understand the definition in OR94 and its relation with ours, and then rewrite their proof of Proposition 46.2 under our definition.