CS390 Computational Game Theory and Mechanism Design July 8, 2013

Handout 4: Problem Set 3

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Due by Monday, July 15, 8am.

Problem 1 (10pt). (NRTV07, Exercise 17.1.) Suppose that we modify Pigou's example so that the lower edge has cost function $c_2(x) = (x/n)^d$ for some $d \geq 1$. What is the price of anarchy of the resulting selfish routing network when n goes to infinity, as a function of d? What does the price of anarchy become when d goes to infinity? (That is, first compute the PoA for any fixed d with $n \to +\infty$, and then compute the limit of this function as $d \to +\infty$.)

Problem 2 (10pt). (NRTV07, Exercise 19.9.) Prove that in any Shapley network design game, the price of anarchy can never exceed n, the number of players.

Problem 3 (10pt). (NRTV07, Exercise 17.3.) Consider minimizing the following objective function in the scheduling game with n players and n machines: for any pure strategy profile s, $f(s) = \sum_i c_i(s)$, and for any mixed strategy profile σ, $f(\sigma) = \mathbb{E}_{s\sim\sigma} f(s)$. Compute the price of anarchy, taking into consideration all mixed NEs.