Game Theory: Algorithms and Applications
CS 539

Spring 2018
HomeWork 5
Due 11:59pm, April 25th
Total: 100 points

1. Given that the price of anarchy for pure equilibria on instances of the load balancing game with two tasks and two machines with possibly different speeds corresponds to the golden ratio $\phi = (1+\sqrt{5})/2$. Show that there is a game instance G admitting an equilibrium assignment A with $cost(A) = \phi \cdot opt(G)$.

2. In the market equilibrium model where traders are endowed with money, let M be a market with n traders and m goods, with each trader i having utility $v_i x_{ij}$ for good j where $v_i \in \mathbb{Z}^+$, and $x_{ij} \in \mathbb{R}^+$,i.e., each trader has the same utility for all the goods. Can you provide a solution for the market equilibrium in this case?

3. A reverse auction is when an item is to be bought at the lowest cost from a set of bidders. Suppose you want to buy k identical items, when each bidder can only supply one item. Design an incentive compatible mechanism to run this auction. Proofs required.