

# Assignment: Algorithmic Game Theory

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1. Let  $f : \Theta \rightarrow \mathcal{X}$  be a social choice function such that we have the following for every  $\theta \in \Theta$

$$\sum_{i=1}^n u_i(f(\theta), \theta_i) \geq \sum_{i=1}^n u_i(x, \theta_i) \quad \forall x \in \mathcal{X}$$

Show that  $f$  is ex-post efficient.

2. Consider the set of outcomes  $\mathcal{X}$  to be the set of integers in the range from 0 to 100. There are  $n$  players. The type of player  $i$  is  $\theta_i$  and the utility of player  $i$  is  $u_i(x) = -|x - \theta_i|$  for every  $x \in \mathcal{X}$ . Design  $n$  social choice functions  $f_1, \dots, f_n : \times_{i \in [n]} \Theta_i \rightarrow \mathcal{X}$  each one of which is non-dictatorship as well as DSIC.