

Algorithmic Game Theory

Winter Term 2020/21

Exercise Set 12

Exercise 1: (3 Points)

Recall the setting for Cake Cutting from Lecture 23. Show that if valuations are identical, i.e. $v_i(\cdot) = v_j(\cdot)$ for all $i, j \in N$, then the notions of Proportionality, Envy-Freeness and Equitability coincide.

Exercise 2: (3 Points)

Consider the algorithm (which is also known as the *moving-knife algorithm*) given in Section 4 of Lecture 23 that determines a proportional allocation for any number of agents n .

Show that even in the case of three agents the allocation of the algorithm might not be envy-free.

Exercise 3: (3+4 Points)

The *participation criterion* requires that the addition of a voter who strictly prefers candidate A to B should not change the winner from candidate A to candidate B.

- (a) Prove that plurality voting satisfies the participation criterion.
- (b) Show that instant runoff voting does not satisfy the participation criterion.

Hint: It's possible to solve subtask (b) in two steps: First, state a counterexample in which you add a couple of voters in order to show that the property is violated. Then, you can think of sequentially adding those voters to the original instance and detecting the point in which the winner changes from candidate A to B.