INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR
Algorithmic Game Theory 2020-21: Fourth Class Test

Date of Examination: 14 November 2020
Duration: 50 minutes (for writing answers) + 10 minutes (for taking photos, concatenating, and uploading to moodle)
Full Marks: 20
Subject No: CS60025
Subject: Algorithmic Game Theory
Department/Center/School: COMPUTER SCIENCE AND ENGINEERING
Special instruction (if any): You do not need to prove anything that is already proven in the class.

Answer all the questions.

1. Consider a public project problem with two agents $N = \{1, 2\}$. Let the cost of the public project be 50 units of money. Let the type sets of the two players be given by $\Theta_1 = \Theta_2 = \{20, 60\}$, i.e., each agent either has a low willingness to pay, 20, or a high willingness to pay, 60. Let the set of project choices be $K = \{0, 1\}$, with 1 indicating that the project is taken up and 0 indicating that the project is dropped.

   Assume that if $k = 1$, then the two agents will equally share the cost of the project by paying 25 units of money each. If $k = 0$, the project is not taken up and agents do not pay anything. Consider the valuation function: $v_i(k, \theta_i) = k(\theta_i - 25)$. Compute the Clarke payment function for this problem.

   [10 Marks]

2. Consider a social choice function $f : \mathcal{L}(\mathcal{X})^n \to \mathcal{X}$ (recall that we defined social choice functions like this in the Gibbard-Satterwaite Theorem). Prove that if f is an onto function and DSIC, then f is unanimous.

   [10 Marks]