IIT PALAKKAD

COMPUTER SCIENCE AND ENGINEERING
Indian Institute of Technology, Palakkad
CS4501: Game Theory
Test I (11 September, 2018)

Time: 08:00 — 09:00 hrs | Max Marks: 20

1. There is a communication channel of maximum capacity 1 *unit*. There are n users who simultaneously use this channel. User i wishes to send $x_i \in [0, 1]$ units of data on this channel. The payoff of user i has the following form

$$u_i(x_i, x_{-i}) = \begin{cases} 1 + x_i(a - \sum_{j=1}^{n} x_j) & \text{if } \sum_{j=1}^{n} x_j \leq a \\ 0 & \text{otherwise} \end{cases}$$

where $a \in [0, 1]$ is fixed by the network operator to cap the amount of data transmitted by the users.

   (a) Does the above problem have a *pure strategy Nash equilibrium (PSNE)* for all values of $a \in [0, 1]$? Compute the *PSNE* when it exists. [10]

   (b) Does the above problem have a *dominant strategy equilibrium* for any value of a? Provide proper steps/arguments to justify your answer. [4]

2. Given an example for each of the following

   (a) A 2-player game with ***one*** *dominant strategy equilibrium* and ***no*** *pure strategy Nash equilibrium.* [2]

   (b) A 2-player game with ***two*** *pure strategy Nash equilibrium* and ***no*** *dominant strategy equilibrium.* [2]

   (c) A 2-player game with ***at-least*** *one mixed strategy Nash equilibrium* and ***no*** *pure strategy Nash equilibrium.* [2]

End of exam