Microeconomics 3: Game Theory
Spring 2021

Problem Set 1

1. What are the Nash Equilibria of these games?

(a)

	L	R
U	$4,4$	$0,2$
D	$1,0$	$3,3$

(b)

	L	M	R
T	$2,2$	$0,1$	$5,-1$
C	$0,3$	$4,4$	$7,1$
B	$1,1$	$1,1$	$1,8$

(c) There are three players playing the following simultaneous move game. Player 1 and 2 choose the row action and column action respectively, player 3 chooses whether payoffs are determined by the left or right payoff matrix.

	L	R
U	$2,2,2$	$-1,3,3$
D	$3,-1,-1$	$3,3,-1$

	L	R
U	$-1,-1,3$	$-1,3,3$
D	$3,-1,3$	$0,0,0$

2. There are two consumers, one private good, x_i, and one public good, y. Consumers have utility $u_i(x_i, y) = \ln x_i + \ln y$. Each consumer is intially endowed with one unit of the private good, and no units of the public good. Consumers have access to a technology that converts any amount of the private good into the same amount of public good.

   Each consumer simultaneously chooses an amount $y_i \in [0,1]$ of public good to produce and then consume the private and public good (so consumers i's payoffs is $\ln(1-y_i) + \ln(y_1+y_2)$).

   (a) What is the set of Pareto efficient allocations?

   (b) What are the Nash Equilibria of this game?

3. There are two players who choose a real number in the unit interval, i.e. strategy spaces are $S_i = [0,1]$, $i = 1,2$. A player wants to choose a number as close as possible to the other player's choice, so that payoffs are given by

$$u_i(s_i, s_j) = -|s_i - s_j|, \; i,j = 1,2, \; i \neq j.$$

   (a) Which strategies are rationalizable?

   (b) Does the game have any mixed strategy equilibria?

   (c) How does your answer change if the payoff function is modified to

$$u_i(s_i, s_j) = -(s_i - s_j)^2, \; i,j = 1,2, \; i \neq j.$$