

## Problem Set 1: Zero-sum games (2019)

Prepared by:

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1. (Payoffs are shown from Row's point of view.)
  - a. Determine (if possible) the "value" of the zero-sum game shown below.
  - b. What is the optimal way for each player to play this game if playing the game is to be repeated many times? When each player plays optimally, what is the payoff to Row, and what is the payoff to Column?

Row/Column	C I	C II	C III
R 1	1	4	-5
R 2	10	7	-3
R 3	-2	-4	1

2.

- a. Determine the value(s) of  $x$  (if any) in the zero-sum game (payoffs from Row's point of view) so that if the game is played many times the game will be fair. For the value(s) of  $x$  you find what is the optimal way for Row and Column to play the game?

Row/Column	C I	C II
R 1	16	-2
R 2	-8	x

b. Briefly discuss what it means for a zero-sum matrix game which is played many times to be fair.

3. (Required for doctoral students; extra-credit for others)

Row/Column	C I	C II
R 1	16	-2
R 2	x	y

a. Determine the value(s) of x and y (if any) in the zero-sum game (payoffs from Row's point of view) above so that if the game is played many times the game will be fair.

b. If there are values of y for which the game is fair, determine if possible the optimal play for Row and Column when y is as small a positive integer as possible.