

## MP305 Practical 2021/2022 – Game Theory

- The Python notebook `Game_Theory` that can be accessed via any web browser. See the **MP305 Blackboard** web page for details and instructions.
- Solutions to **all** questions with (\*) have to be submitted as a pdf document through Blackboard. You must include some text commentary (in Python notebook Markdown cells) to explain your answers to the questions asked.
- This practical is worth 3% of your final grade.

1. (\*) Analyse the following matrix games and determine whether or not a saddle point solution exists.

(a)

	$B_1$	$B_2$
$A_1$	1	2
$A_2$	0	-2

(b) The two coin game:

	$B_1$	$B_2$
$A_1$	1	-1
$A_2$	-1	1

(c)

	$B_1$	$B_2$	$B_3$	$B_4$
$A_1$	1	2	4	0
$A_2$	0	-2	-3	4

(d)

	$B_1$	$B_2$	$B_3$	$B_4$
$A_1$	1	0	4	1
$A_2$	-1	-4	-3	4

(e) The game of "odd-even":

	$B_1$	$B_2$	$B_3$
$A_1$	0	2	-1
$A_2$	-2	0	3
$A_3$	1	-3	0

(f)

	$B_1$	$B_2$	$B_3$	$B_4$
$A_1$	0	13	-5	1
$A_2$	-13	0	8	-12
$A_3$	5	-8	0	6
$A_4$	-1	12	-6	0

2. (\*) Analyse the previous games (c) and (d) where  $A$  has two strategies  $A_1$  and  $A_2$  chosen with probability  $p$  and  $1 - p$  respectively.
- (a) Find the average payoff  $U_j(p)$  against strategy  $B_j$  for each  $j = 1, \dots, n$ .
  - (b) Find the optimal choice of  $p$  by diagrammatic means.
  - (c) Find two strategies that  $B$  must play to minimize their loss.
  - (d) Find the optimal mixed strategy for  $B$ .