

MATH 1340, HOMEWORK #10

DUE THURSDAY, APRIL 27

Please *show your work* in the problems that require calculations. For the short answer questions, write in complete sentences. All assertions must be justified to get full credit.

0. (For participation credit.) Answer the response question on Piazza. This time, please submit your own response *or* respond to a classmate's answer.

PURE AND MIXED STRATEGIES

1. Consider the following 2×2 zero-sum game:

	C	N
C	-1	5
N	3	-5

- (a) What is Row's minimax strategy?
- (b) What is Column's minimax strategy?
- (c) What is the expected value of the game for Row (assuming that Row and Column adopt their respective minimax strategies)?
- (d) Suppose that Column is forced to adopt its minimax strategy, but Row is free to choose any strategy (pure or mixed), what is the highest possible expected value that Row can get? The lowest?
- (e) I mentioned in class that deviating from the minimax strategy is "suboptimal" in a certain sense. This question will try to nail down precisely what that means.

Suppose you took what I said in the most literal sense: that this leads to worse outcomes (i.e. lower utility). Now suppose that both Row and Column deviate from their minimax strategy. But this is a zero-sum game, so it cannot be the case that *both* Row and Column lose utility, because any loss for Row is a gain for Column, and vice versa.

What is going on here? In other words, what does the minimax theorem actually guarantee about the minimax strategy? Is there any reason why Row or Column should deviate from their minimax strategies?

- 2. (a) [TP 10.13] (Look to the previous problem for the definition of saddle point.)
- (b) For the last game in [TP 10.13], show that the saddle point is a Nash equilibrium (in pure strategies), that is, neither player can unilaterally improve their utility by changing their strategy.
- (c) [TP 10.12]

3. [TP 10.14] (Note that this is *not* a zero-sum game.)

APPORTIONMENT AND FAIRNESS

- 4. [TP 5.4]
- 5. [TP 5.5]
- 6. [TP 5.9]