Exam #2 cheat sheet

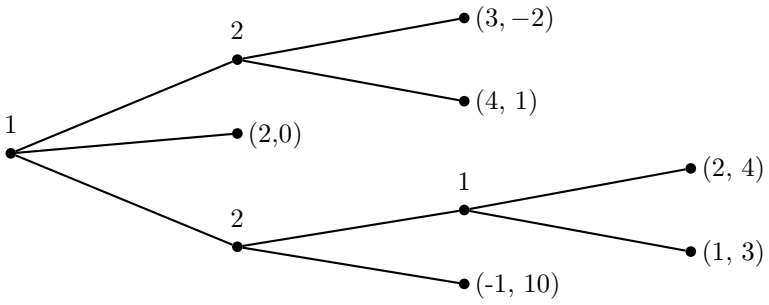
- The space provided below each question should be sufficient for your answer. If you need additional space, use additional paper.
- You are allowed to use a calculator, but only the basic functions. Use of advanced formulas (e.g., if your calculator does present value) or of material that you have programmed into your calculator is not allowed and will be considered cheating.
- You are encouraged to show your work for partial credit. It is very difficult to give partial credit if the only thing on your page is "$x = 3$".
- **Expected value** is given by summing likelihood times value over all possible outcomes:

$$\text{Expected Value} \quad = \sum_{\text{Outcomes } i} \text{Probability}(i) \cdot \text{Value}(i).$$

- A **fair bet** is a bet with an expected value of zero.
- A **Pareto efficient** (or **Pareto optimal**) allocation or outcome is one in which it is not possible find a different allocation or outcome in which nobody is worse off and at least one person is better off. An allocation or outcome B is a **Pareto improvement over A** if nobody is worse off with B than with A and at least one person is better off.
- A (strictly) **dominant strategy** is a strategy which yields higher payoffs than any other strategy regardless of the other players' strategies.
- In an **ascending price auction**, the price starts out at a low value and the bidders raise each other's bids until nobody else wants to bid. In a **descending price auction**, the price starts out at a high value and the auctioneer lowers it until somebody calls out, "Mine." In a **first-price sealed-bid auction**, the bidders submit bids in sealed envelopes; the bidder with the highest bid wins, and pays an amount equal to his or her bid (i.e., the highest bid). In a **second-price sealed-bid auction**, the bidders submit bids in sealed envelopes; the bidder with the highest bid wins, but pays an amount equal to the *second-highest* bid.

(5 points) Name:

1. Analyze the following sequential move game using backward induction.



   (a) (5 points) Identify (e.g., by circling) the likely outcome of this game.

   (b) (5 points) Is this outcome Pareto efficient? Yes No (Circle one. If it is not Pareto efficient, identify, e.g., with a star, a Pareto improvement.)

2. "A Pareto efficient outcome may not be good, but a Pareto inefficient outcome is in some meaningful sense bad."

   (a) (5 points) Give an example or otherwise explain, as if to a non-economist, the first part of this sentence, "A Pareto efficient outcome may not be good."

   (b) (5 points) Give an example or otherwise explain, as if to a non-economist, the second part of this sentence, "A Pareto inefficient outcome is in some meaningful sense bad."

3. Narrowly defined, a "Prisoners' Dilemma" situation involves the following: (1) a symmetric, simultaneous-move game featuring two players; (2) the existence of a dominant strategy for each player; and (3) a predicted outcome that is Pareto inefficient.

   (a) (5 points) Draw a payoff matrix that describes such a situation. (It may help to remember the following conventions about payoff matrices: player 1 chooses the row, player 2 chooses the column, and an outcome of (x, y) indicates that player 1 gets x and player 2 gets y.) *You do not need to write any explanation*, but if you cannot draw a payoff matrix then some words might get you some partial credit.

   (b) (5 points) Define what it means for a player in a game to have a **dominant strategy**.

   (c) (5 points) What is the relationship between the Prisoners' Dilemma and the Tragedy of the Commons?

   (d) (5 points) Give a real-life example of the Tragedy of the Commons and describe its key features.

4. (The Public/Private Investment Game) You are one of 10 students in a room, and all of you are greedy income-maximizers. Each student has $1 and must choose (without communicating with the others) whether to invest it in a private investment X or a public investment Y. The deal for each of you is this: If you put your $1 into the private investment X, the payoff is $2, all of which goes to you. If you put your $1 into the public investment Y, the payoff is $10, which is shared equally among all the students, so that you (and all the other students in the room, even those who chose to invest their own money privately) get $1.

   (a) (5 points) What outcome do you predict in the simultaneous-move game, i.e., if all the students must write down their investment decisions at the same time?

   (b) (5 points) Is this outcome Pareto efficient? Yes No (Circle one. If not, identify a Pareto improvement.)

   (c) (5 points) "The central difficulty here is that the students must decide without knowing what the other students are doing. If you knew what the other students decided, you would behave differently." Do you agree with this argument? Circle one (Yes No) and explain briefly.

   (d) (5 points) If communication were possible, what sort of mechanism do you suggest for reaching the optimal outcome in this game? Hint: Make sure to think about enforcement!

5. Consider the following version of a game called the Ultimatum Game: Player 1 begins by proposing a take-it-or-leave-it division of ten $1 bills between himself and Player 2. (For the sake of simplicity, assume that he has only three options: he can keep $9 himself and offer $1 to Player 2, or he can keep $5 himself and offer $5 to Player 2, or he can keep $1 himself and offer $9 to Player 2.) Player 2 then either accepts or rejects the offer. If she accepts the offer, the players divide up the money and the game ends; if she rejects the offer, both players get nothing.

   (a) (5 points) Draw a game tree for this game.

   (b) (5 points) *Assuming that each player's sole motivation is to get as much money as possible*, backward induction predicts that the outcome of this game will be for Player 1 to choose the first option (keeping $9 for himself and offering $1 to Player 2) and for Player 2 to accept his offer. Explain—as if to a non-economist—the underlying logic here, either in words or using the game tree. (Note: if you think backward induction predicts a different solution, well, explain that one.)

(c) Daniel Kahneman and Vernon Smith won the 2002 Nobel prize in economics for exploring how real people actually make decisions in games like these. (Amos Tversky would have won the prize, too, but he died in 1996.) In classroom experiments, Player 1 sometimes offered Player 2 more than $1, and—in situations where Player 1 did offer Player 2 only $1—Player 2 sometimes rejected the offer. For each of the following statements, indicate whether it is true or false *on the basis of these experimental results* and provide a brief sentence of explanation.

i. (5 points) These experiments showed that some of the Player 2's were not motivated solely by getting as much money as possible.

ii. (5 points) These experiments showed that some of the Player 1's were not motivated solely by getting as much money as possible.

iii. (5 points) These experiments showed that the basic assumption of economics (that decisions are made by optimizing individuals) is wrong.

(a) (5 points) In which type of sealed-bid auction will bidders *shade their bids*? Circle one (1st price / 2nd price) and explain. Make sure to define what *shading a bid* means.

(b) (5 points) In which type of sealed-bid auction do bidders have a dominant strategy of bidding their *true values*? Circle one (1st price / 2nd price) and explain. Make sure to define what *true value* means.