Exam #2 (100 Points Total) **Answer Key**

1. "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."

   A Pareto efficient allocation of resources may not be good because of equity concerns or other considerations. For example, it would be Pareto efficient for Bill Gates to own everything (or for one kid to get the whole cake), but we might not find these to be very appealing resource allocations.

   (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."

   A Pareto inefficient allocation is in some meaningful sense bad because it's possible to make someone better off without making anybody else worse off, so why not do it?

2. (5 points) "If situation A is Pareto efficient and situation B is Pareto inefficient, situation A must be a Pareto improvement over situation B." Do you agree with this claim? If so, explain. If not, provide a counter-example or otherwise explain.

   The claim that any Pareto efficient allocation is a Pareto improvement over any Pareto inefficient allocation is not true. For example, giving one child the whole cake is a Pareto efficient allocation, and giving each child one-third of the cake and throwing the remaining third away is Pareto inefficient, but the former is not a Pareto improvement over the latter.

3. (5 points) In analyzing fair division problems (such as the division of cake, or the allocation of fishing permits in an ITQ system), economists tend to place a great deal of importance on providing opportunities to trade (e.g., allowing the buying and selling of fishing quotas). Briefly explain why this is.

   When people trade they bring about Pareto improvements—why would any individual engage in a trade unless it made him or her better off? Pareto improvements are a good thing in and of themselves, and if you get enough of them then you end up with a Pareto efficient allocation of resources.

4. (5 points) "Even if there are opportunities to trade, the initial allocation of resources (e.g., the determination of who gets the fishing quotas in an ITQ system) is important because it helps determine whether or not

we reach *the* Pareto efficient allocation of resources." Do you agree that initial allocations are important for the reason given, or do you think that they're important for a different reason, or do you think that they're not important? Support your answer and otherwise comment on this quote.

Initial allocations are a matter of equity; economists tend to focus on efficiency. As long as there are opportunities to trade, a Pareto efficient outcome will result *regardless of the initial allocation.*

5. (Overinvestment as a barrier to entry) Consider the following sequential move games of complete information. The games are between an incumbent monopolist (M) and a potential entrant (PE). You can answer these questions without looking at the stories, but the stories do provide some context and motivation.

   Story #1 (See figure 1): Firm M is an incumbent monopolist. Firm PE is considering spending \$30 to build a factory and enter the market. If firm PE stays out, firm M gets the whole market. If firm PE enters the market, firm M can either build another factory and engage in a price war or peacefully share the market with firm PE.

   (a) (5 points) Identify (e.g., by circling) the likely outcome of this game. Backward induction predicts an outcome of (M: 35, PE: 5).

   (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.) Yes.

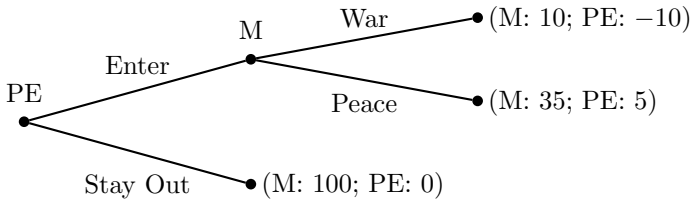

Figure 1: Story #1

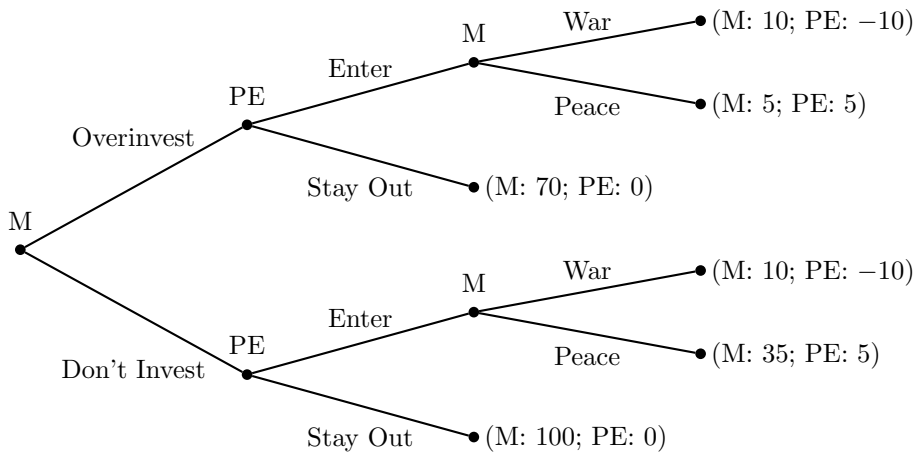

Figure 2: Story #2

Story #2 (See figure 2): The monopolist (firm M) chooses whether or not to overinvest by building a second factory for $30 even though one factory is more than enough. Firm PE (the potential entrant) sees what firm M has done and decides whether to enter or stay out, and if PE enters then M decides whether or not to engage in a price war.

(a) (5 points) Identify (e.g., by circling) the likely outcome of this game. Backward induction predicts an outcome of (M: 70, PE: 0).

(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.) No; a Pareto improvement is (M: 100, PE: 0).

6. Catalytic converters are devices that reduce the amount of pollution produced by motor vehicles. Imagine that each of the 500,000 residents of Seattle (including you) owned a car without a catalytic converter, and that each of you had to decide whether or not to purchase one. Imagine further that (1) it would cost you $100 to purchase and install a catalytic converter; (2) the extra pollution caused by *not* having a catalytic converter on any given car would impose health costs of one-tenth of one penny ($0.001) on you and every other resident of the city; and (3) like your fellow Seattle residents, you just want to do whatever has the lowest cost for you personally.

   (a) (5 points) If you and other Seattle residents were each allowed to choose whether or not to purchase a catalytic converter, what would you expect the outcome to be?

   A good prediction is that everybody would choose to not purchase a catalytic converter. For any given driver, purchasing the device would cost $100; doing without it would impose health costs *on that driver* of only $.001.

(b) (5 points) Is this outcome Pareto efficient? Explain briefly, e.g., by identifying a Pareto improvement if the outcome is Pareto inefficient.

This outcome is not Pareto efficient. With each resident bearing health costs of \$.001 for each of the 500,000 cars in Seattle, the total health cost for each resident is \$500. A Pareto improvement would be for everyone to buy the catalytic converters, in which case each resident would only bear \$100 in costs.

(c) (5 points) "The central difficulty here is that each resident must decide what to do without knowing what the other residents are doing. If you knew what the others decided, you would behave differently." Do you agree with this argument?

The central difficulty is *not* that you don't know what others are going to do; you have a dominant strategy, so the other players' strategies are irrelevant for determining your optimal strategy.

(d) (5 points) In "The Tragedy of the Commons", Garrett Hardin makes a distinction between two different ways of trying to reach the optimal outcome in this type of situation: "appeals to conscience" and "mutual coercion, mutually agreed upon". Give an example of each in the context of the current problem.

A reasonable mechanism might be passing a law that everybody has to purchase a catalytic converter or pay a large fine.

7. It just so happens that eBay is currently running an auction for a collection of *all five* *NSYNC bobblehead dolls. Imagine that your value for such a collection is \$20.

(a) (5 points) In a first-price sealed bid auction, should you bid an amount b that is (less than equal to more than) your true value (\$20)? Circle one and explain briefly. It may help to write down an expected value calculation.

You should bid less than your true value. Otherwise your expected value from the auction will never be more than zero (and will be less than zero if you bid more than your true value):

$$\text{EV} = \text{Prob(Win)} \cdot (20 - b) + \text{Prob(Lose)} \cdot (0).$$

(b) (5 points) In a second-price sealed bid auction, explain why it makes sense to bid your true value (i.e., \$20). In other words, explain why bidding your true value is a dominant strategy. *Hint:* Consider the highest bid *excluding* your own bid. If that bid is more than \$20, can you do better than bidding your true value? If that bid is less than \$20, can you do better than bidding your true value?

If the highest bid excluding your own bid is $x >$ \$20, you cannot do better than bid \$20 (and lose the auction); the only way to win

the auction is to bid more than x, but if you do that then you'll end up paying x, which is more than your true value. On the other hand, if the highest bid excluding your own is $x < \$20$, you cannot do better than bid \$20 (and win the auction, paying $\$x$); raising your bid cannot help you, and lowering your bid doesn't reduce the amount you'll pay, but does increase your risk of losing the auction when you would have liked to have won it.

(c) (5 points) Your friend Ed needs some cash, so he decides to auction off his prized collection of *NSYNC bobblehead dolls. You suggest a second-price sealed bid auction, to which he says, "Second price? Why should I accept the *second-highest* price when I can do a first-price sealed bid auction and get the *first-highest* price?" Write a response. *Hint:* Think about your answers to the first two auction questions above.

Yes, in a first-price sealed bid auction you'll get the first-highest price; but we showed above that bidders will bid less than their true value. In contrast, bidders will bid an amount equal to their true value in a second-price sealed bid auction. So even though you only get the second-highest bid, the bid values will be higher than in a first-price auction. (A deeper result here is the revenue equivalence theorem, which says that these two types of auctions have the same expected payoff for seller.)

8. Consider the following version of 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.

   Player 1 moves first and has three options; in each case, Player 2 has two options (accept or reject). So there are 6 different possible outcomes.

   (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.)

   If Player 2 is motivated solely by money, Player 1 can anticipate that Player 2 will accept any offer that he makes. If Player 1 is motivated

solely by money, he will therefore offer Player 2 the minimum amount ($1) required in order to get her to accept, thereby maximizing his financial payoff.

(c) (5 points) 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. Which of the following statements is true? (Provide a sentence of explanation for each.)

- This experiment showed that the basic assumption of economics (that decisions are made by optimizing individuals) is wrong. The basic assumption may or may not be wrong, but this experiment didn't show that it is wrong because optimizing individuals may not be solely motivated by money.
- This experiment showed that some of the Player 2's were not motivated solely by getting as much money as possible. This is true; otherwise, Player 2 would always have accepted Player 1's offer.
- This experiment showed that some of the Player 1's were not motivated solely by getting as much money as possible. This is false. Player 1's generosity (offering more than $1) might be motivated by altruism, but it might also be motivated by a desire for money: if Player 1 thinks that Player 2 will turn down a lower offer, it's in Player 1's financial interest to offer more.

9. (5 points) For the sake of simplicity, let us assume the following about the Great Classroom Auction Experiment of 2003: (1) each student made the minimum bid of $.01, and the $99 prize was divided equally among the students; and (2) given that all the other students had bid $.01, no student wanted to change his or her bid.[1] Which of the following statements is true? (Provide a sentence of explanation for each.)

   - From the perspective of the students (i.e., ignoring the instructor), the outcome was Pareto efficient. This is true. There's no way to make one student better off without making another student worse off.
   - From the perspective of the class as a whole (i.e., including the instructor), the outcome was Pareto efficient. This is also true! Redistributing wealth (which is basically what happened) has no impact on Pareto efficient. Again, the key question is whether it's possible to make someone better off without making anyone else worse off.

[1] Incidentally, this is a good example of a **Nash equilibrium**, the idea that won John Nash a share of the 1994 Nobel prize in economics

- The information above shows that bidding $.01 was a dominant strategy for each student. This is false because there's not enough information. A dominant strategy is one that you follow *no matter what the other players do*, and all we know here is what each player would do if the other players all bid $.01. In fact, at least one student (Simon) said that he would have changed his bid if another student had bid $50; this indicates that bidding $.01 was not a dominant strategy for Simon.
- This experiment showed that some of the students were not motivated solely by getting as much money as possible. This is true. Students motivated solely by money would have changed their bid to $.02 when given the opportunity.