

Spring 2005 Final Exam (100 Points Total)

- 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:

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

- A **fair bet** is a bet with an expected value of zero.
- The **future value of a lump sum payment** of $\$x$ invested for n years at interest rate s is $FV = x(1 + s)^n$. The **present value of a lump sum payment** of $\$x$ after n years at interest rate s is $PV = \frac{x}{(1 + s)^n}$. (Note that this formula also works for values of n that are negative or zero.)
- The present value of an **annuity** paying $\$x$ at the end of each year for n year at interest rate s is

$$PV = x \left[\frac{1 - \frac{1}{(1 + s)^n}}{s} \right].$$

The present value of the related **perpetuity** (with annual payments forever) is

$$PV = \frac{x}{s}.$$

- The **inflation rate**, i , is the rate at which prices rise. The **nominal interest rate**, n , is the interest rate in terms of dollars. The **real interest rate**, r , is the interest rate in terms of purchasing power. These are related by

$$1 + r = \frac{1 + n}{1 + i}.$$

When the inflation rate is small, we can approximate this as

$$r \approx n - i.$$

- 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.
- **Total revenue** is price times quantity: $TR = pq$.
- The **price elasticity of demand at point A** measures the percentage change in quantity demanded (relative to the quantity demanded at point A) resulting from a 1% increase in the price (relative to the price at point A). The formula is

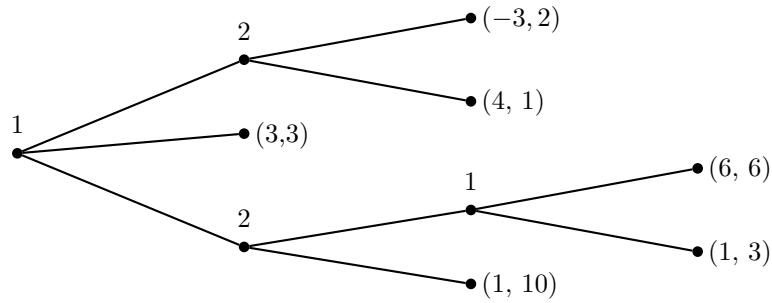
$$\varepsilon(A) = \frac{\% \text{ change in } q}{\% \text{ change in } p} = \frac{\frac{\Delta q}{q_A}}{\frac{\Delta p}{p_A}} = \frac{\Delta q}{\Delta p} \cdot \frac{p_A}{q_A} = \frac{q_B - q_A}{p_B - p_A} \cdot \frac{p_A}{q_A}.$$

In English If, at point A, a small change in price causes the quantity demanded to increase by a lot, demand at point A is elastic; if quantity demanded only changes by a little then demand at point A is inelastic; and if quantity demanded changes by a proportional amount then demand at point A has unit elasticity.

In math If, at point A, the price elasticity of demand is less than -1 (e.g., -2), then demand at point A is elastic; if the elasticity is greater than -1 (e.g., $-\frac{1}{2}$), then demand at point A is inelastic; if the elasticity is equal to -1 then demand at point A has unit elasticity.

(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.

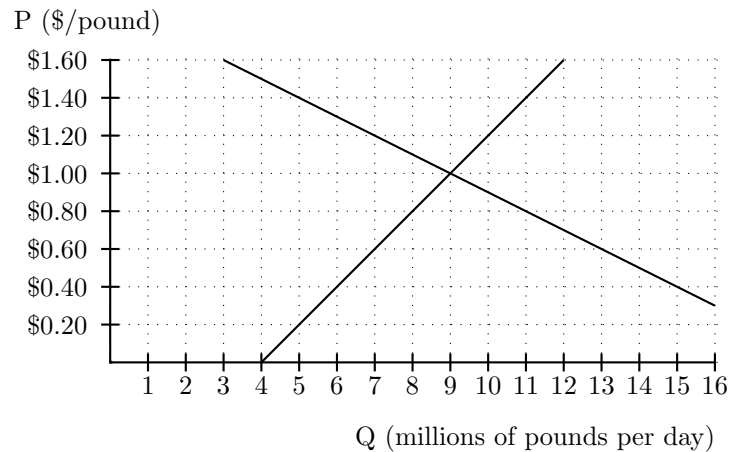
(b) (5 points) A slightly broader definition of “Prisoners’ Dilemma” would include situations featuring more than two players. Provide an example of one such situation—you can describe one we’ve discussed in class, or make up your own—and briefly explain what the strategies are, what the predicted outcome is, and what would be a Pareto improvement over that predicted outcome.

4. (5 points) Explain, as if to a non-economist, why the intersection of the market supply curve and the market demand curve identifies the market equilibrium.

5. Assume that you've just bought a new carpet. The good news is that the carpet will last forever. The bad news is that you need to steam-clean it at the end of every year (i.e., one year from today, two years from today, etc.). What you need to decide is whether to buy a steam-cleaner or just rent one every year. *You can use the bank to save or borrow money at a 5% interest rate.*
- (a) (5 points) Will the amount you paid for the carpet affect your decision regarding renting versus buying?
- (b) (5 points) One year from today (i.e., when you first need to clean the carpet), you'll be able to buy a steam-cleaner for \$500; like the carpet, the steam-cleaner will last forever. Calculate the present value of this cost.
- (c) (5 points) The alternative to buying is renting a steam-cleaner, which will cost you \$20 at the end of every year forever. Calculate the present value of this cost. Is it better to rent or buy? (*Circle one.*)
- (d) (5 points) Imagine that your friend Jack calls to tell you that steam-cleaners are on sale (today only!) for \$450: "You'd have to be a moron to pay \$20 every year forever when you can just pay \$450 today and be done with it!" Write a brief response explaining (as if to a non-economist) why you do or do not agree.

6. (5 points) Consider a market with a demand curve of $q = 220 - 20p$ and a supply curve of $q = 60p - 100$. Determine the price and quantity at the market equilibrium and then show how (if at all) a 25% sales tax on the buyers will affect both the equation for the supply curve and the equation for the demand curve.

7. Below is a hypothetical market for oranges.



Suppose that the government decides to impose a per-unit tax of \$0.60 per pound on the buyers of oranges.

- (a) (5 points) Show the impact of this tax on the supply and demand curves above and explain why the tax shifts the curves the way it does. Your answer here must be quantitative, i.e., must explain not only the *direction* of the curve shift(s) but also the *amount* of the curve shift(s).

(b) (5 points) Calculate the economic incidence of the tax, i.e., the amount of the tax burden borne by the buyers (T_B) and the amount borne by the sellers (T_S). Then calculate their ratio $\frac{T_B}{T_S}$.

(c) (5 points) Calculate the price elasticity of supply, ε_S , at the original (pre-tax) equilibrium. Then calculate the price elasticity of demand, ε_D , at the original (pre-tax) equilibrium. Then calculate their ratio, $\frac{\varepsilon_S}{\varepsilon_D}$. How does this ratio compare to the ratio of the tax burdens?

(d) (5 points) Imagine that the government imposes a 50% tax on the buyers instead of a \$.60 per-unit tax. Use the graph below to show how this changes the supply and demand curves. You do not need to explain.

