ECON 0100
Fall 2022
Midterm 1
October 3, 2022
Time Limit: 60 Minutes

Name (Print): _____

Penn ID number: _____
(8 digits)

- This exam contains 7 pages (including this cover page) and 9 questions. The last page (page 8) is blank, you can use it as scrap paper (just don't detach it).

- Do not remove any pages or add any pages. No additional paper is supplied

- The exam is scheduled for 1 hour.

- The total score is 26 points.

- This is a closed-book, closed-note, no calculator exam.

- Answer each multiple-choice question by filling in the bubble for the answer you select. Make sure that the bubble is clearly filled in, or it will be marked incorrect.

- Write your answers to the short answer questions in the spaces provided for them. Do not write your answers outside of the lines or boxes.

- Show your work when asked. Label all graphs carefully.

- This exam is given under the rules of Penn's Honor system.

My signature certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this examination.

Please sign here _____ Date _____

Multiple Choice Questions (best 6 out of 7: 12 points)

1. (2 points) Lennon recently bought a computer monitor for $300, and found that the screen is larger than expected. Lennon is considering returning the monitor for a full refund, but it would cost him $10 shipping fee. Kevin has suggested buying Lennon's monitor, and promised to give $280 in return if he agrees. What is Lennon's opportunity cost of selling the monitor to Kevin?

   ○ $590
   ○ $310
   √ **$290**
   ○ $280

2. (2 points) For every cup of tea, Alice buys two scones. The price of a cup of tea is $5 while the price of a scone is $2.5. Alice has $20 in income. Which of the following is true?

   I. Alice consumes 2 cups of tea and 4 scones.
   II. If the price of a cup of tea increases, she will consume more scones.

   √ **I. only**
   ○ II. only
   ○ I. and II.
   ○ Both I. and II.
   ○ Neither I. nor II.

3. (2 points) Rob is a fan of Wrexham A.F.C. and is deciding which games to attend live. Prices are $50 for all games. Initially, Rob decides to purchase 2 home game and 4 away game tickets, spending his whole budget. The next day, Rob's friend, Ryan, decides to pay for half of each home game ticket Rob buys, bringing the price of home games down to $25 each. This causes Rob to change his plans: he will now purchase 4 home game tickets and 4 away game tickets. Which of the following must be true?

   I. Home game tickets are an inferior good.
   II. Rob's demand for away game tickets is perfectly inelastic.

   ○ I. only
   ○ II. only
   ○ Both I. and II.
   √ **Neither I. nor II.**

4. (2 points) When Alfred went to the local downtown supermarket last week, the price of a box of baby formula was $20 and the price of a bottle of goat milk was $20. After a national shortage, however, the price of baby formula increases and is now $40 per box (the price of goat milk hasn't changed). He talks to the store manager, who tells him that last week they sold 100 boxes of baby formula and 30 bottles of goat milk, but this week they sold 60 boxes of baby formula and 20 bottles of goat milk. Which of the following statements is correct?

   I. Demand for baby formula is price-elastic
   II. Baby formula and goat milk are complements

   ○ I. only
   √ **II. only**
   ○ Both I. and II.
   ○ Neither I. nor II.

5. (2 points) Andy operates an ice cream shop in a perfectly competitive market, with the following cost functions (in dollars): $VC(q) = 12q + q^2$, $MC(q) = 12 + 2q$. Suppose that the price of ice cream is P $= \$20$, and that Andy's profit maximizing quantity is in the *decreasing* part of his average total cost. All of a sudden the ice cream machine breaks, halting production entirely. Assume that repairing the ice cream machine costs \$10. What should Andy do in the short run? And in the long run? *(hint: drawing a graph might be helpful)*

    ○ Andy should repair the ice cream machine to continue production in the short run and continue producing in the long run.

    √ **Andy should repair the ice cream machine to continue production in the short run but exit the market in the long run.**

    ○ Andy should not repair the machine and he should exit

    ○ Not enough information.

6. (2 points) Suppose the market for apples is perfectly competitive, with a downward sloping demand and upward sloping supply. A new widely publicized study stresses the health benefits of apples. However, at the same, a new disease is killing many of the apple trees in the area. What *must* be true at the new equilibrium?

    I. Price increases

    II. Price decreases

    III. Quantity increases

    IV. Quantity decreases

    √ **I. only**

    ○ II. only

    ○ III. only

    ○ IV. only

    ○ I. and IV.

    ○ II. and III.

    ○ None

7. (2 points) Suppose that demand for eggs is perfectly price inelastic and the supply is upward sloping. Suppose shipping costs (which are variable) soared due to lockdowns and strains on logistics networks. Which of the following must be a consequence of this change?

    ○ Equilibrium price increases but equilibrium quantity decreases

    √ **Consumers now spend more on eggs**

    ○ Deadweight loss increases

    ○ Producer surplus increases

Short Answer Questions (14 points total)

To get any point you must show your work

8. (a) Harry and Sally are two consumers who spend all their income on sandwich and beer. Harry's income is $36 and Sally's income is $23. At Katz's Deli, Harry orders 2 sandwiches and 4 beers whereas Sally orders 1 sandwich and 3 beers.

   The price of a sandwich is $P_s =$ ___**8**___ .

   The price of a beer is $P_b =$ ___**5**___ .

   > **Solution:** Harry's budget constraint is $2 \times P_s + 4 \times P_b = 36$. Sally's budget constraint is $1 \times P_s + 3 \times P_b = 23 \Leftrightarrow P_s = 23 - 3 \times P_b$. Combining both equations yields $2 \times (23 - 3 \times P_b) + 4 \times P_b = 36 \Rightarrow 46 - 6 \times P_b + 4 \times P_b = 36$. So
   > $10 = 2 \times P_b \Rightarrow P_b = 5$, and $P_s = 8$.

   (b) After Harry and Sally leave Katz's Deli, they both still feel very hungry. With no money left, they go to the next ATM and each of them withdraws $320. To satisfy their cravings, they decide to have steak and wine at the Café Luxembourg. The price of steak is $40 and the price of a glass of wine is $20. Harry wants to consume 5 steaks and 6 glasses of wine. Sally wants to consume 3 steaks and 10 glasses of wine.

   On each figure below, quantity of steak is on the x-axis and wine is on the y-axis:

   - Draw Harry's budget constraint on the left hand side and Sally's budget constraint on the right hand side. *Label all intercepts.*
   - Mark their optimal consumption bundles H and S, respectively.
   - For each of them, draw the indifference curve that is consistent with the optimal choice, assuming they like both goods and have typical downward sloping convex indifference curves.

   Solution:
   Budget constraint: steak intercept is $320/$40 = 8$ and wine intercept is $320/$20=16$.
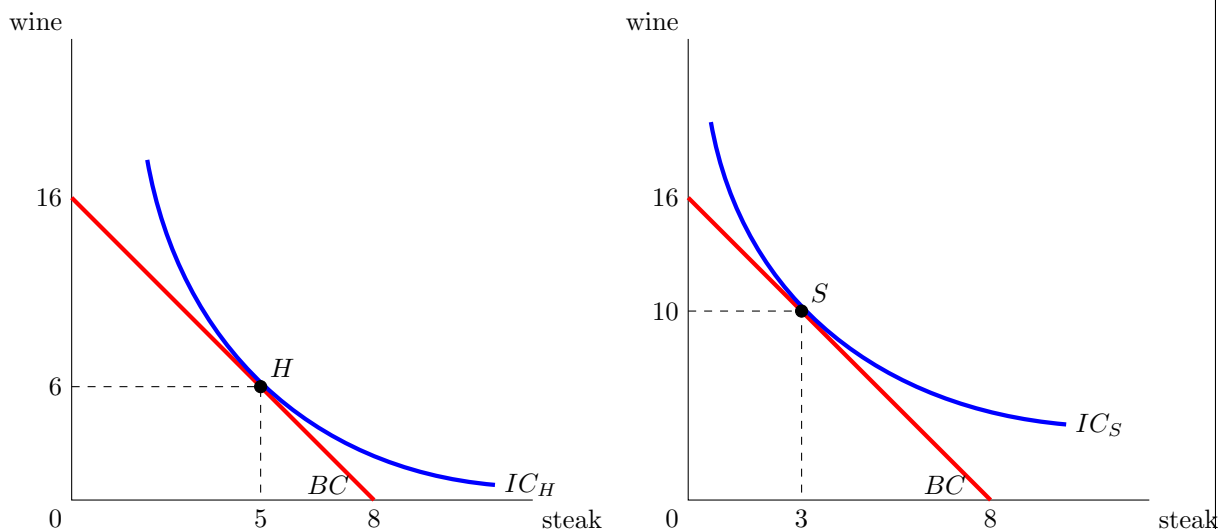
(c) At the optimal consumption point:

Harry's marginal rate of substitution of steak for wine is $MRS_{xy} = -$_____**2**_____.

Sally's marginal rate of substitution of steak for wine is $MRS_{xy} = -$_____**2**_____.

> **Solution:** At the optimal consumption point, the marginal rate of substitution is equal to the price ratio: $MRS_{xy} = -p_x/p_y = -\$40/\$20 = -2$

(d) The waiter tells Harry and Sally they are out of the house wine, so they have to buy the expensive wine, which costs $40 a glass. The price of steak is still $40. After some contemplation, they change their optimal consumption choices: Harry wants to consume 2 steaks and 6 glasses of wine, while Sally wants to consume 4 steaks and 4 glasses of wine.

Describe the income and substitution effects of the increase in the price of wine on Harry's consumption (fill in the blanks with *"higher"*, or *"lower"*, or *"unchanged"*):

- With the substitution effect:

  - Harry's consumption of steaks is _____**higher**_____

  - Harry's consumption of wine is _____**lower**_____

- With the income effect:

  - Harry's consumption of steaks is _____**lower**_____

  - Harry's consumption of wine is _____**higher**_____

Does Harry consider the goods as normal or inferior?

For Harry, steaks is a(n) _____**normal**_____ good and wine is a(n) _____**inferior**_____ good.

> **Solution:** Harry consumes fewer steaks than before the price change (from 5 to 2 steaks) and the same amount of wine as before (6 glasses). The substitution effect reduces consumption of wine and increases that of steak. The income effect must decrease consumption of steak hence steak is normal. The income effect must increase consumption of wine to cancel out the substitution effect. Hence wine must be inferior.

9. Suppose that Bob owns a farm in Vermont that produces cheese. He has a lease for a creamery which costs him $360/day. His variable inputs are workers and milk, such that his daily variable cost is $VC(q) = 10q^2 + 20q$. Suppose his marginal cost is $MC(q) = 20q + 20$.

(a) Bob's shut-down price is $P_{SD} = \underline{\quad\textbf{20}\quad}$ and his break-even price is $P_{BE} = \underline{\quad\textbf{140}\quad}$.

> **Solution:**
> $AVC(q) = 10q + 20$. Setting $AVC(q) = MC(q)$, we get $q = 0$. Then we plug this back into the AVC to get the shut-down price $p_{SD} = AVC(0) = 20$. Bob's average total cost is given by $ATC(q) = 360/q + 10q + 20$. Setting $ATC(q) = MC(q)$, we get $q = 6$. Plugging this back into the ATC, we get the break-even price $P_{BE} = ATC(6) = 140$.

(b) Suppose there are 10 identical farms in the market (including Bob's). Write the equation of the market short-run supply in the box below.

> **Solution:** Individual supply is the marginal cost equation above the shut-down price: $P = 20q_S + 20$ if $P \geq 20$ (and $q_s = 0$ otherwise). There are 10 firms, so $Q_S = 10q_S$: inverse market supply is $P = 2Q_S + 20$ if $P \geq 20$ (and $Q_s = 0$ otherwise). Market supply is elastic (it starts from the y-axis).

(c) Suppose inverse market demand for cheese is $P = 170 - Q_D$. In the graph below, draw market demand and market supply. *Label all intercepts.*

Solution:
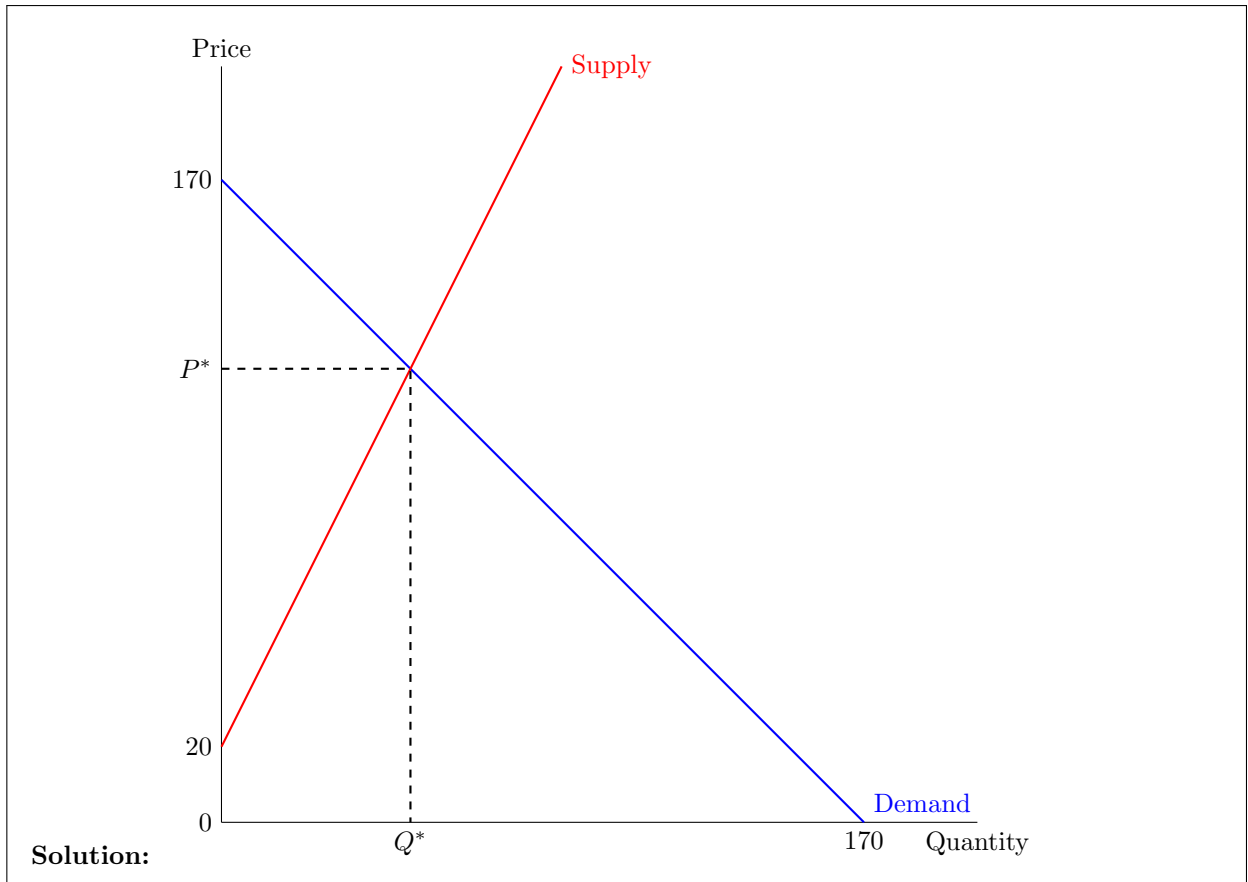
(d) Consider the short-run equilibrium:

   i. Fill-in the blanks:

      - The market quantity is $Q_{SR} = $ _____50_____ pounds per day.

      - The market price is $P_{SR} = $ _____120_____.

      - Each firm produces a quantity $q_{SR} = $ _____5_____ per day.

   ii. Find each firm's profit and each firm's producer surplus. Show your work.

      Solution: The equilibrium between supply and demand is such that $20 + 2Q = 170 - Q \Leftrightarrow Q_{SR} = $ 50. Plugging that equilibrium quantity into inverse supply or inverse demand yields $P_{SR} = 120$. There are 10 firms so each produces $q_{SR} = QSR/10 = 5$. Each firm's profit is $\pi = TR - TC = 5 \times 120 - 20 \times 5 - 10 \times 5^2 - 360 = -110$. Each firm's producer surplus is equal to $ps = \pi + FC = 250$.

   iii. Find the market producer and consumer surplus. Show your work.

      Solution: Market producer surplus is $PS = 10 \times ps = 2500$ (can also be computed as the area below equilibrium price and above market supply). Market consumer surplus is the area below demand above equilibrium price: $CS = 50 \times 50 \times 0.5 = 1250$

(e) Suppose the market is now in the long-run equilibrium:

   i. Fill-in the blanks:
      - The number of firms is _____**lower**_____ *(higher/lower/equal)* than in the short-run equilibrium.

      - The market price is equal to _____**140**_____.

      - Each firm's profit is equal to _____**0**_____.

      - Demand is _____**more**_____ *(more/less/equally)* price-elastic than in the short-run equilibrium.

      Solution: Short-run profits are negative, so firms will exit the market, which will shift market supply to the left: the market price will increase, up to the break-even price of 140, such that profits are 0. As we move to a new equilibrium above the short-run equilibrium on the demand curve, demand becomes more elastic.

   ii. Compared to the short-run equilibrium, what happens to consumer expenditure (i.e. sellers' total revenue) in the market? Explain in the box below.

      Solution: The short-run equilibrium is in the elastic portion of market demand (above the unit-elastic point). The long-run equilibrium is above it, so we remain in the elastic portion of demand. The higher price does not compensate the lower quantity sold so total revenue decreases.