ECON 0100
Spring 2023
Midterm 1
February 14, 2023
Time Limit: 60 Minutes

Name (Print): _____

Penn ID number: _____
(8 digits)

- This exam contains 7 pages (including this cover page) and 10 questions. Check to see if any pages are missing.
- The exam is scheduled for 1 hour.
- The total score is 25 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 boxes.
- Do not remove any pages or add any pages. No additional paper is supplied
- 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 7 out of 8: 10.5 points)

1. (1½ points) In the kindgom of Durin, new mithril mines have been discovered. The king has 3 options: *(i)* assign 1000 workers to the new mines with an expected return of 1000 Castar; *(ii)* assign 100 workers to the new mines with an expected return of 200 Castar; *(iii)* close down the mines which would cost 100 Castar. Labor costs 1 Castar per worker. What is the opportunity cost of closing down the mithril mines?

   ◯ 100 Castar
   ◯ 1000 Castar
   √ **200 Castar**
   ◯ 300 Castar

2. (1½ points) Suppose Will sees guitars and drum sets as complementary goods. Following a drop in the price of guitars, which of the following *must* be true?

   I. Guitars are a normal good
   II. Drum sets are a normal good

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

3. (1½ points) Amanda has the following preferences: she gets the same additional satisfaction from one espresso cup as she does from 3 cups of green tea. Suppose the price of one cup of espresso is $3 and the price of one cup of green tea is $1.50. Which of the following is correct?

   I. Amanda will only buy the cheaper good.
   II. Her marginal rate of substitution between the two goods is constant.

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

4. (1½ points) Leon spends $30 a week in drawing notebooks and pens. The price for a drawing notebook is $6, the price for pens is $4 and he buys 3 drawing books and 3 pens. This week his budget falls to $24, but the price for pens are sale, at $2 per pen. In this situation, what can we say about this week consumption for Leon?

   √ **He could be better off this week**
   ◯ He is worse off this week
   ◯ Consumption of pens will decrease
   ◯ Consumption of drawing notebooks will increase
   ◯ There is not enough information

5. (1½ points) Suppose the market for carpets in Philadelphia to be is in the long run equilibrium. Following flooding in the dorms, Penn decides to buy a large stock of carpet for the affected rooms. At the same time, suppose rent shot up for commercial real estate across Philadelphia. Which of the following is NOT necessarily true in the short-run?

   ◯ Price of carpets will rise.

◯ The quantity of carpets produced in the short run is higher.

◯ The firms' break even price increases.

√ **Profits are negative in the short run.**

6. (1½ points) Consider the market for Halal trucks as being perfectly competitive and in the long-run equilibrium. Say the market price is $P = 12$, market quantity is $Q = 200$, and there are 10 identical firms.

   If $VC = 2q + \frac{1/4}{q^2}$, which of the following is a potential value for FC

   I. 12

   II. 100

   III. 200

   ◯ I. only

   √ **II. only**

   ◯ III. only

   ◯ I. and II.

   ◯ II. and III.

   ◯ All are possible

7. (1½ points) Suppose Phoebe designs t-shirts and faces costs $MC = 2q + 4$, $TC = q^2 + 4q + 4$. If the market price is $P = \$6$, which of the following statements must be true at the optimal production point?

   √ **ATC is decreasing**

   ◯ AVC is decreasing

   ◯ Profits are greater than 0

   ◯ Phoebe should shut down in the short-run

8. (1½ points) Suppose Kathi and Ashley consume apples and donuts. Kathis views them as perfect substitutes (at a rate of 1 for 1), while Ashley views them as perfect complements (at a rate of 1 for 1). Kathi's income is \$15, while Ashley's income is \$10. The price of an apple is $P_A = 5$ and the price of a donut is $p_D = 2$. Which of the following would be a Pareto improvement with respect to the current equilibrium, assuming apples and donuts are indivisible?

   I. Ashley gives Kathi her entire income and consume 0

   II. Kathi gives Ashley half of her income

   III. Ashley gives Kathi \$3

   IV. Kathi gives Ashley \$3

   ◯ Only I

   ◯ Only II

   √ **Only III**

   ◯ Only IV

   ◯ I and III

   ◯ II and IV

   ◯ Not enough information

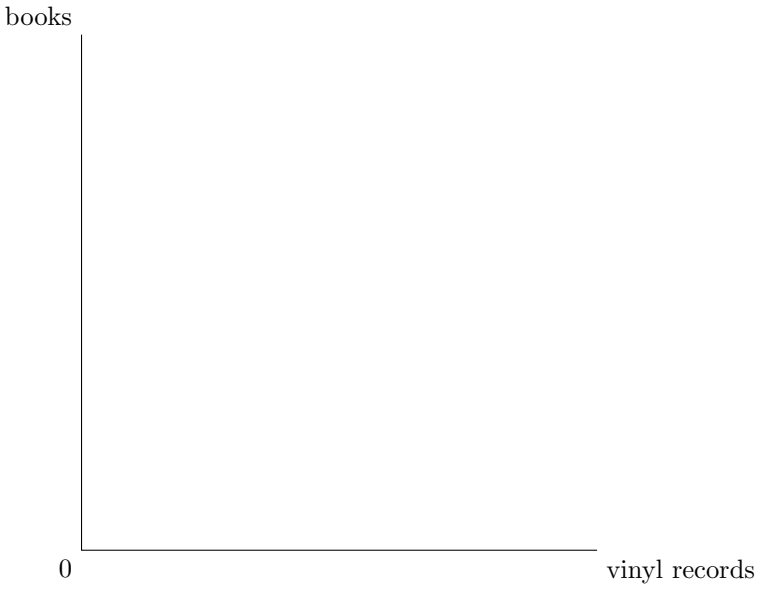
Short Answer Questions (15.5 points total)

To get any point you must show your work

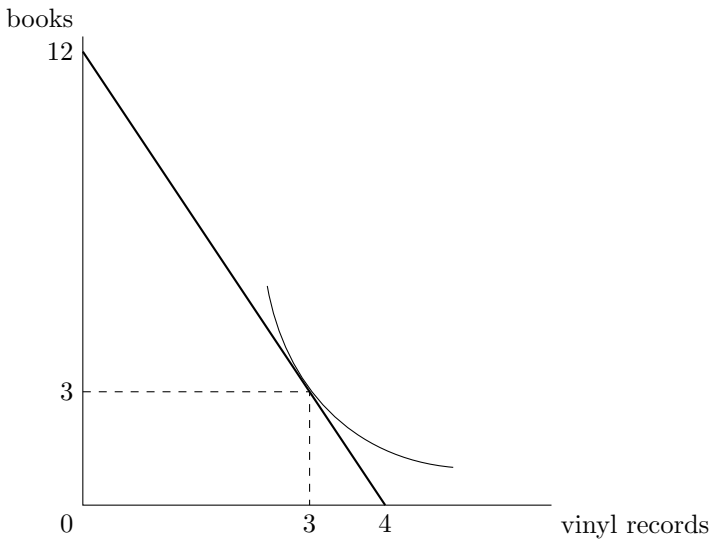
9. Roy spends all his income on books and vinyl records. The price of one book is \$10 and the price of one vinyl record is \$30. Given these prices, Roy's optimal consumption bundle consists of 3 books and 3 vinyl records.

   (a) In the graph below:

   - Draw Roy's budget constraint, labelling all intercepts.
   - Label his optimal consumption bundle (and its x-and y- coordinates)
   - Draw an indifference curve that is consistent with optimal choice.



Solution:
Roy's income is $\$10 \times 3 + \$30 \times 3 = \$120$. The book-intercept of the BC is 12 and the vinyl-intercept of the BC is 4.



(b) At point C, Roy's Marginal Rate of Substitution of vinyl records for books is MRS_{xy} = **3**

Vinyl records are currently on sale at $20. Roy now consumes 4 books and 4 vinyl records.

(c) Compared to his initial consumption point (please fill-in the blanks with *increased / decreased*):

- Roy's marginal utility from books has **decreased**
- Roy's marginal utility from vinyl records has **decreased**

(d) Is Roy's demand for records elastic, inelastic or unit-elastic? Explain in the box below.

Solution: If we calculate the price elasticity of demand: $\epsilon_D = \frac{\%\Delta Q_D}{\%\Delta P} = \frac{(4-3)/3.5}{(20-30)/25} = -\frac{25}{35} < 1$.

(e) Please fill-in the blanks with *increases / decreases / is uncertain:*

- With the substitution effect:
  - Roy's consumption of books **decreases**
  - Roy's consumption of vinyl records **increases**
- With the income effect:
  - Roy's consumption of books **incraeses**
  - Roy's consumption of vinyl records **is uncertain**

(f) Please fill-in the blanks with *must / can / cannot:*

- Books **must** be a a normal good
- Vinyl records **can** be a normal good.

Solution: The substitution effect is negative for books and positive for vinyl. The income effect on books must be positive since the total effect on books is positive and the substitution effect is negative. The income effect on vinyl can be positive or negative. Hence books must be normal whereas vinyl records can be normal or inferior.

(g) Are books and vinyl records substitutes or complements for Roy? Explain in the box below.

Solution: Cross-price elasticity = % change in demand for books / % change in demand for vinyl records = $\frac{(3-4)/3.5}{(30-20)/25} = -\frac{5}{7}$. Because the cross-price elasticity is negative, the two goods are complements. Another explanation is to say that when the price of records decreases, Roy buys more records AND more books, so he uses the goods together, as complements.

10. Consider the kingdom of Durin that produces mineral called mithril. In the market for mithril, each firm faces the following costs: $TC(q) = q^2 + q + 4$, and $MC(q) = 2q + 1$. Suppose demand for mithril is perfectly inelastic: $Q_D = 2000$.

(a) In the long-run equilibrium:

- Each firm produces $q_{LR} =$ **2**
- The market price is $P_{LR} =$ **5**
- The number of firms is $N_{LR} =$ **1000**
- Each firm's profit is $\pi_{LR} =$ **0**
- Each firm's producer surplus is $PS_{LR} =$ **4**

Solution: Long-run equilibrium is defined by $ATC(q_{LR}) = MC(q_{LR})$, such that $q+1+4/q = 2q+1$ and $q_{LR} = 2$. Inserting 2 into the marginal cost function gives us $MC(2) = 5 = P_{LR}$. Since $Q_{LR} = 2000$, we can find $N_{LR} = Q_{LR}/q_{LR} = 2000/2 = 1000$. Long-run equilibrium profits $\pi_{LR} = 0$. Producer surplus is profit plus fixed cost: $PS_{LR} = 4$.

(b) What is the aggregate supply curve (Q_S as a function of P)? Show your work in the box below.

Solution: Each firm's supply is its marginal cost above he shut-down price. The shut down price is the minimum of the AVC, i.e. when AVC intersects MC: $P_{SD} = MC(0) = 1$. Therefore, the firm's supply equation is $P = 2q + 1$ ($\Leftrightarrow q_S = 0.5(P-1)$) when $P \geq 1$, and $q_S = 0$ otherwise. There are 1000 firms in the industry, so $Q_S = 1000 q_S$. Market supply is $Q_S = 1000 \times 0.5(P-1) = 500(P-1)$.

(c) After a series of accidents, the government imposes security measures to make mithril production safer. Each firm is required to buy security material that costs 12 Castars, bringing the fixed costs to 16.

What is the short-run impact on each firms' output decision, and profit? Explain in the box below.

Solution: Each firm's output depends on the marginal cost, which is independent from the fixed cost. So firms' output is not affected. An increase in fixed cost decreases profits, so profits are now negative.

(d) In the long-run, how many firms will remain in the market? Explain in the box below.

Solution: In the new long-run equilibrium, the market price is at the minimum of ATC (where $ATC = MC$): $q + 1 + 16/q = 2q + 1$ and $q'_{LR} = 4$. Since $Q_{LR} = 2000$, there must be 500 firms left (while the others exited the market).