ECON 101, Midterm
Tuesday, June 21, 2016

DO NOT TURN FROM THIS PAGE UNTIL INSTRUCTED TO DO SO!

First name:

Last name:

Exam policies and details:

1. Do not remove staple or separate this booklet.
2. All answers must be written in this booklet.
3. No calculators or communication devices permitted.
4. Cellphones should be switched off and all possessions other than pens must be left at the back of the classroom during the exam.
5. All answers should be written in pen.
6. No speaking during the exam except to the lecturer and proctors.
7. Students more than 15 minutes late may not be let into the examination room.
8. There are 7 questions in this exam, many of which have multiple parts.
9. When asked to explain your answer, you must do so to get full credit.
10. Raise your hand if you need to leave the room for any reason. You may not take the exam or any belongings out of the room.
11. Students taking the exam at 12:30pm will not be permitted to hand their exams in until time is called at 2:15pm.
12. Points will be deducted from students who continue work after time is called.

Honor pledge: I agree to neither give help to nor receive any help from others. I understand that the use of a calculator or communication device on this exam is academic misconduct. I also understand that providing any information about this exam to other students is academic misconduct, as is taking or receiving any information from other students. Thus, I will cover my answers and not expose my answers to other students. It is important to me to be a person of integrity and that means ALL ANSWERS on this exam are my answers. Any violation of these guidelines or the exam policies will result in a penalty of receiving a zero on this exam. You will additionally be reported. **By signing your name here, you agree to the honor pledge and affirm that you have read it and the exam policies above:**

____

Score (*for instructor use only*):

Q	S	Q	S	Q	S
1	/15	4	/16	7	/8
2	/12	5	/21		
3	/20	6	/8	**T**	/100

1. (15 points total, 3 points each) For each of the following statements, state whether it is true or false and explain your answer with 1-2 sentences.

   (a) The following statement is normative: "If the University of Wisconsin raises tuition rates, more students will choose to attend the university." *(Note: I am asking whether it's true that the statement is normative, not about the truth of the statement itself.)*

      Solution:

      False – the statement is positive in that it is about what will happen. The statement is likely untrue, but that doesn't mean it isn't positive!

   (b) A model with unrealistic assumptions can yield only unrealistic predictions.

      Solution:

      False – recall Friedman's model of leaf placement on the tree or the law of falling bodies. In both, the assumptions were unrealistic for certain questions yet we argued that the models were still predictive.

   (c) The marginal rate of substitution, negated, at a point equals the slope of an indifference curve through that point.

      Solution:

      True. By definition.

   (d) If a good is inferior, its demand curve will shift to the left when w increases.

      Solution:

      True. Demand for an inferior good decreases when income increases.

   (e) If demand for a good is elastic, supply of that good must be inelastic.

      Solution:

      False – there is no necessary relationship between elasticities of supply an demand.

2. (12 points total, 3 points each) Suppose there are three alternatives: x, y, and z. For each of the following preference relations, say whether it violates the transitivity assumption, the completeness assumption, both, or neither:

   (a) $\{z \sim y, \quad x \preceq y, \quad z \succeq y, \quad x \sim y\}$

   Solution:

   This violates completeness as there is no comparison between z and x. It satisifies transitivity.

   (b) $\{x \sim z, \quad x \succ y, \quad y \sim z\}$

   Solution:

   This satisfies completeness as it contains a comparison for each of the three pairs. It violates transitivity because $x \succ y$ and $y \sim z$ implies $x \succ z$, by transitivity, and here $x \sim z$.

   (c) $\{x \succeq z, \quad z \preceq y, \quad x \prec y, \quad z \prec x\}$

   Solution:

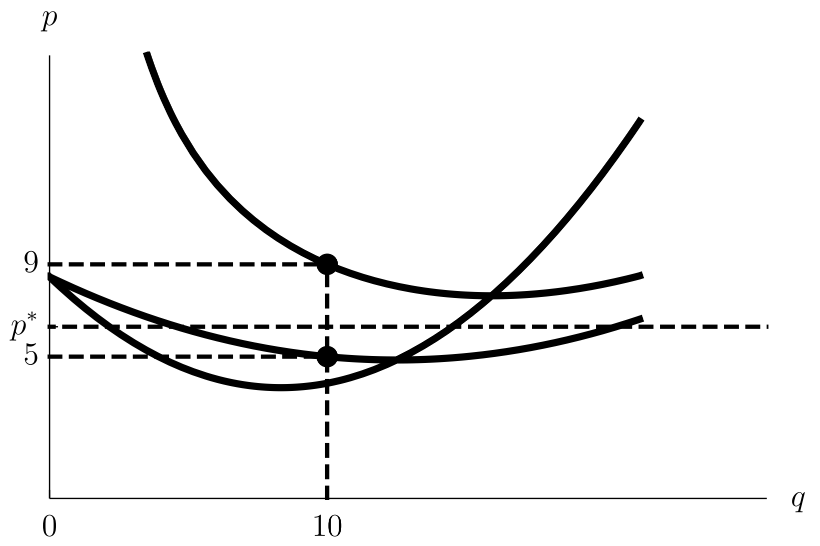
   This satisfies completeness and transitivity. If you were confused by there being four comparisons, note that $x \succ z$ implies $x \succeq z$ but is stronger. So there is redundancy here, but no contradiction of transitivity. Transitivity here does imply that $y \succ z$, but this not contradicted by $y \succeq z$.

   (d) $\{y \prec z, \quad z \succ x, \quad z \succeq y\}$

   Solution:

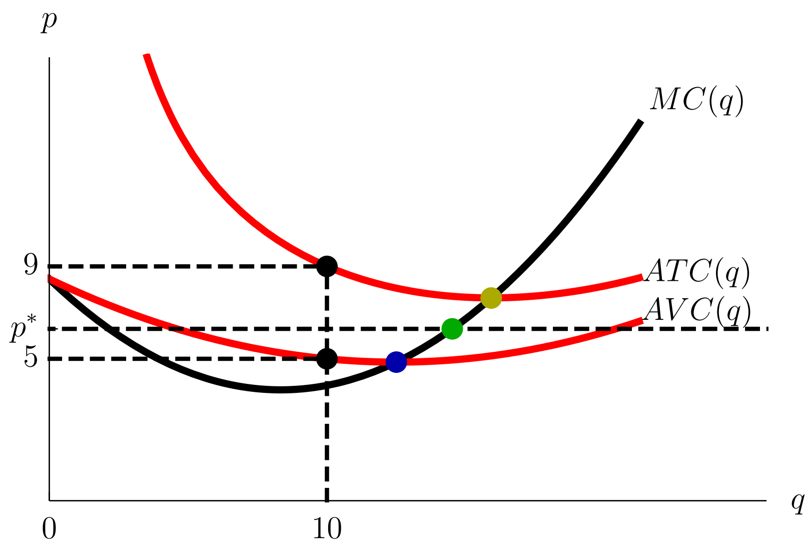
   This violates completeness as there is no comparison between x and y. It satisfies transitivity.

3. (20 points total) For these exercises, assume perfect competition and consider the following graph:



(a) (6 points) Label the three curves on the plot above correctly. *Note: Make sure to think about it first so that you don't need to change your labels, which could make your work hard to read.*

Solution:



(b) (6 points) Draw arrows (with labels at the other end) to the optimal production point, the break-even point, and the shutdown point. *Note: Again, please do this neatly so we can give you as much credit as possible.*

Solution:

See graph in previous solution. The green point (middle) is the optimal production as it is the intersection of p and $MC(q)$. The yellow point (top) is the break-even point as it is at the intersection of $MC(q)$ and $ATC(q)$. Finally, the blue point (bottom) is the shutdown point as it is at the intersection of $MC(q)$ and $AVC(q)$.

(c) (2 points) Is the firm making profits, losses, or breaking even? Explain your answer in one sentence.

Solution:

The firm is making losses because at the optimal production point it is selling for less than its average total cost.

(d) (2 points) Would you expect other firms to enter, this firm to exit in the short-run, or this firm to exit in the long-run, or none of these? Explain your answer in 1-2 sentences.

Solution:

We should expect this firm to remain in the industry in the short run because it is covering its variable costs and some of its fixed costs by staying in business. In the long-run, since it is making losses, we would expect it to exit.

(e) (4 points) What are the firm's total fixed costs? (a specific number)

Solution:

We know $AVC(10) = 5$ and $ATC(10) = 9$. From this, it follows that $AFC(10) = 4$. But $AFC(q) = \frac{TFC}{q}$ so the total fixed costs equal 40.

4. (16 points total) Suppose you like coffee with sugar, but you only enjoy it if there are exactly two teaspoons of sugar per cup of coffee (any other ratio gives you no utility whatsoever). Further, suppose the price per cup of coffee is $p_c = 4$ and the price per teaspoon of sugar is $p_s = 1$. You have $w = 24$ dollars.

   (a) (2 points) Write a correct utility function representation ($u(c, s)$) of these preferences.

   Solution:

   $u(c, s) = \min(2c, s)$. Note that $\min(c, s/2)$ and $\min(4c, 2s)$ and any other combination is also fine as long as the coefficient on c is double the coefficient on s in the min().

   (b) (2 points) What is the name for this type of utility function?

   Solution:

   Perfect complements.

   (c) (6 points) Find optimal consumption, (c^*, s^*).

   Solution:

   We solve two equations simultaneously, the BC and the optimal ratio:

$$\begin{aligned} 4c^* + s^* &= 24 \\ 2c^* &= s^* \end{aligned}$$

   And we get $(c^*, s^*) = (4, 8)$.

   (d) (6 points) Find the formula for the inverse demand curve for coffee.

   Solution:

   Again, we solve two equations simultaneously, the BC and the optimal ratio:

$$\begin{aligned} p_c \cdot c^* + s^* &= 24 \\ 2c^* &= s^* \end{aligned}$$

   Solve both for s^* and then equate so we have $24 - p_c \cdot c = 2c$. Then solve p_c as a function of c^*: $p_c = \frac{24}{c} - 2$ and this is our inverse demand function.

5. (21 points) Suppose market inverse demand is $p = 9 - q$ and market inverse supply curve is $p = q/2$. Remember that the area of a rectangle is the base multiplied by height and the area of a triangle is the base multiplied by height divided by two.

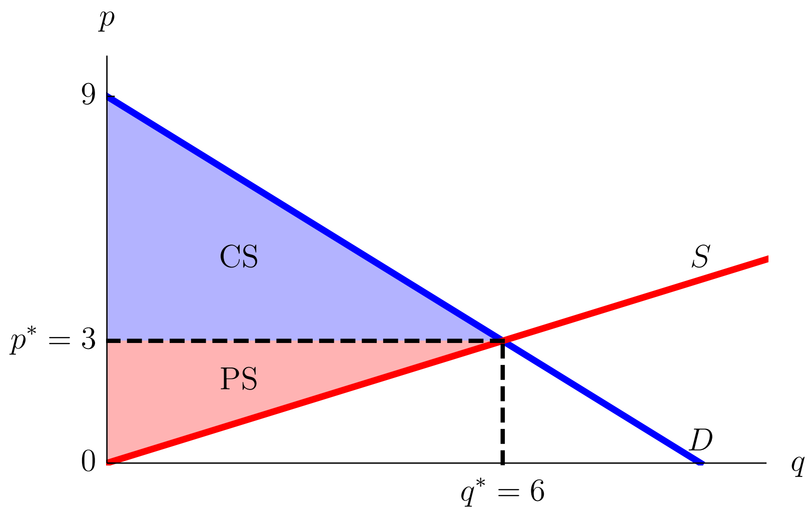
   (a) (2 points) What is the market-clearing price, p^*?

   Solution:

   Solve the two equations simultaneously to get $p^* = 3$.

   (b) (3 points) Plot inverse supply and inverse demand and label producer surplus and consumer surplus.

   Solution:



   (c) (4 points) Calculate consumer and producer surplus.

   Solution:

   Consumer surplus is the area of the triangle with a base of 6 and a height of 6, hence it is 18. Producer surplus is the area of a triangle with a base of 6 and a height of 3, hence it is 9.

   (d) (2 points) If the government mandates a price $p' = 2$, is this a price ceiling or a price floor?

   Solution:

   Since this is below the market price, it is a price ceiling. The government is not allowing the price to rise above the ceiling to the market price.

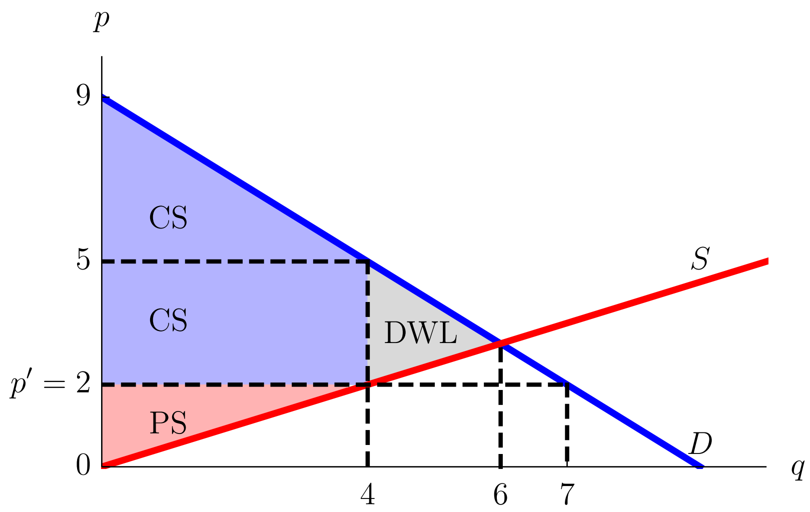
   (e) (2 points) With $p' = 2$, is there oversupply or overdemand (i.e. shortages)?

   Solution:

   There will be overdemand, i.e., shortages.

   (f) (4 points) Draw another plot and label producer surplus, consumer surplus, and deadweight loss with $p' = 2$.

   Solution:



(g) (4 points) Calculate consumer surplus, producer surplus, and deadweight loss.

Solution:

Consumer surplus is the sum of a rectangle with area $4 \cdot 3 = 12$ and a triangle with area $4 \cdot 4 \cdot \frac{1}{2} = 8$ – therefore the consumer surplus is 20. Producer surplus is $4 \cdot 2 \cdot \frac{1}{2} = 4$. Deadweight loss is $2 \cdot 3 \cdot \frac{1}{2} = 3$.

6. (8 points total) Suppose $q = F(K, L) = \sqrt{K} \cdot \sqrt{L}$, $p_K = 1$, and $p_L = 4$. Derive the cost curve, $C(q)$.

Note 1: Remember we switched the letter for output from Y to q but they're the same thing.
Note 2: Useful derivatives:

$$\frac{d}{dK}(\sqrt{K} \cdot \sqrt{L}) = \frac{\sqrt{L}}{2\sqrt{K}} \quad \text{and} \quad \frac{d}{dL}(\sqrt{K} \cdot \sqrt{L}) = \frac{\sqrt{K}}{2\sqrt{L}}$$

Solution:

Equate slopes (or bang per buck) for one equation. For other, use $q = F(K, L)$. So, equating bang per buck we get:

$$\frac{MP_K(K, L)}{p_K} = \frac{MP_L(K, L)}{p_L}$$
$$\frac{\sqrt{L}}{p_K \cdot 2\sqrt{K}} = \frac{\sqrt{K}}{p_L \cdot 2\sqrt{L}}$$
$$p_L \cdot L = p_K \cdot K$$
$$4 \cdot L = 1 \cdot K$$

Combine that with:

$$q = \sqrt{K}\sqrt{L}$$
$$K \cdot L = q^2$$
$$4L \cdot L = q^2$$
$$4L^2 = q^2$$
$$2L = q$$
$$L = q/2$$

And plugging that into the first equation gives $K = 2q$. Therefore, the cost function is $C(q) = p_K \cdot K + p_L \cdot L = 2q + 2q = 4q$.

7. (8 points total) Suppose you get utility from consumption goods and relaxing: $u(c, r) = c \cdot r + 12r$. You earn a wage of $w = 1$ per hour, and the price of consumption goods is $p_c = 1$. How many hours per day (h) should you work?
Hint: Try to get c out of the utility function.
Note: For any number a,

$$\frac{d}{dr}(a \cdot r - r^2) = a - 2r.$$

Solution:

The two constraints are $r + h = 24$ and $h = c$. They both hold with equality because utility is strictly increasing in consumption and time, so both will bind at the optimal solution. Substitute $h = c$ into the first to get $c = 24 - r$ and then substitute that into the utility function:

$$u(r) = (24 - r) \cdot r + 12r = 36r - r^2$$

Then taking the first order condition (using the hint) gives $36 = 2r^*$ or $r^* = 18$. Therefore, $h^* = 6$.