ARE 336 – Midterm exam– Fall 2025

October 8, 2025

You have until the end of class to work on the exam. You may use one sheet of notes for this exam. **If you answer 'False' for any True/False questions, you must provide an explanation for full credit**. Please draw a box around your final answer to each numeric question. Partial credit may be given if you include your work.

This exam has 15 questions, for a total of 100 points (with the possibility to earn up to 5 bonus points).

1. [2 points] ___ In a competitive market for private goods, a tax on producers results in the same equilibrium quantity as a tax on consumers.

2. [2 points] ___ According to scientific consensus, climate change is caused by the "greenhouse effect."

3. [2 points] ___ Correlation necessarily implies causation.

4. [2 points] ___ Imposing a tax on a perfectly competitive market creates deadweight loss.

5. [2 points] ___ The efficient quantity of emissions in the emissions regulation model is always complete abatement.

6. [3 points] Which of the following will *for sure* cause a decreased price?
   A. Increase in demand
   B. Increase in supply
   C. Decrease in demand and increase in supply
   D. Decrease in demand and decrease in supply
   E. None of these will *for sure* cause a decreased price

7. [3 points] Select all of the following statements which are *normative*?
   A. We should subsidize green energy.
   B. Taxing consumers will decrease the quantity consumed.
   C. Taxing producers is better than taxing consumers.
   D. Theoretical models without empirical validation are useless.
   E. Theoretical models lead to conclusions.

8. [3 points] Which of these is NOT a solution to market failure that we have talked about in class?

A. Implement a tax.

B. Allow for Coasian bargaining.

C. Cap-and-trade.

D. Ignore the market failure.

9. [3 points] Which of these historical figures have we NOT talked about in class?

A. John Nash

B. Ellinor Ostrom

C. Garrett Hardin

D. Ronald Coase

E. Arthur Pigou

(a) [2 ½ bonus points] Which of these wrote *The Tragedy of the Commons*?

10. [3 points] Select all of the following which represent an externality?

A. Lost profits due to a neighbor's pollution.

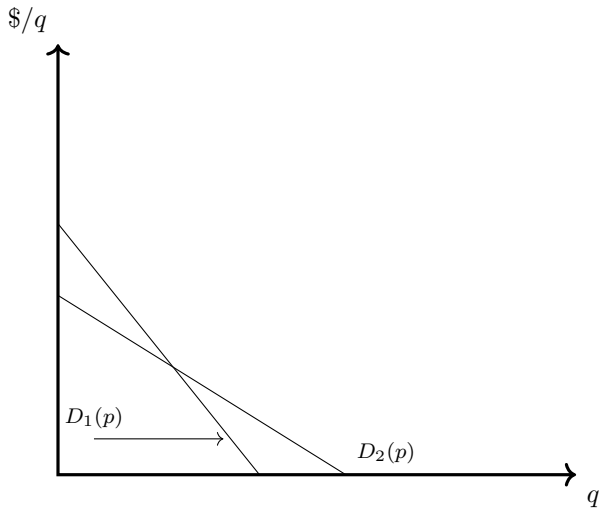
B. Boycotting a store because it polluted a local lake.

C. Damages to health from a factory's pollution.

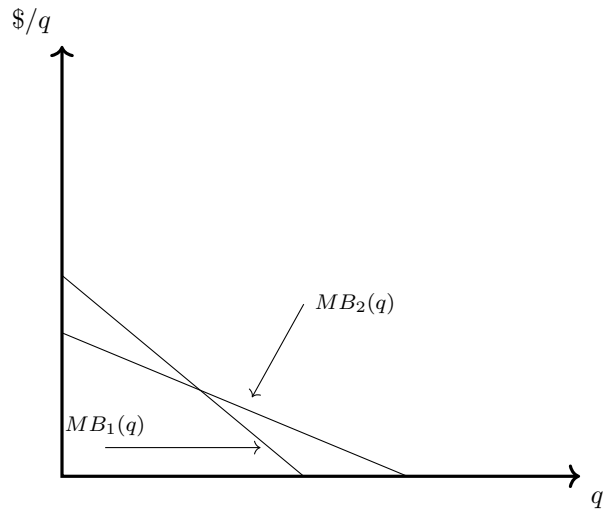
D. Yellowstone National Park raising money to repair a bridge.

E. A surge in economic activity in areas surrounding Yellowston National Park after it completes repairs on a broken bridge.

11. [2 ½ points] On the graph below, show what it means to horizontally sum two demand curves.



12. [2 ½ points] On the graph below, show what it means to vertically sum two marginal benefit curves.



13. Consider the demand given by $Q_d = 30 - 2p$ and supply given by $Q_s = p - 3$.
    (a) [5 points] What is the equilibrium price?

    (b) [5 points] What is the equilibrium quantity?

    (c) [2 ½ points] What are the inverse demand and inverse supply functions?

    (d) [5 points] Calculate the consumer surplus at the equilibrium?

    (e) [5 points] Calculate the producer surplus at the equilibrium?

    (f) [5 points] Draw this market. Make sure you label the supply, demand, equilibrium price, equilibrium quantity, choke prices for demand and supply, consumer surplus, and producer surplus. All prices and quantities should be labeled with their numeric value.

(g) Now consider a \$3 tax on producers. Answer the following:

i. [5 points] What is the new equilibrium quantity?

ii. [2 ½ points] What is the *effective price* that is used in calculating producer surplus?
(**Hint:** The effective price is the price that the suppliers take home after taxes as revenue.)

iii. [2 ½ points] What is the *market price* that consumers pay?
(**Hint:** The market price is the sum of the effective price and the tax.)

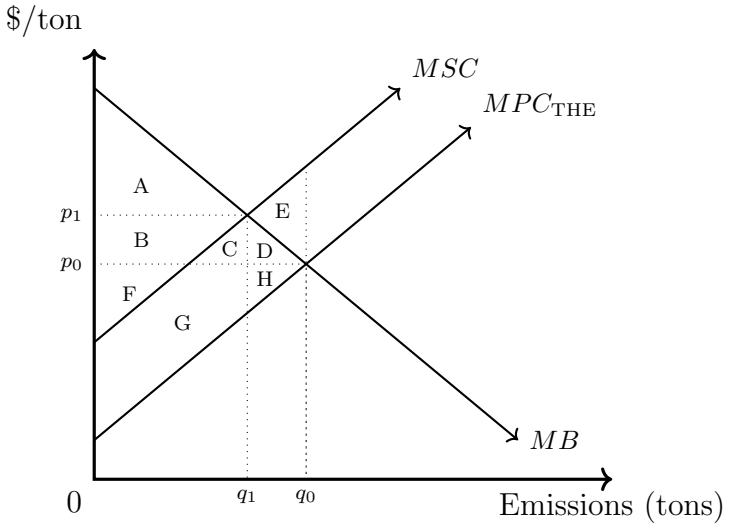
iv. [5 points] How much tax revenue is collected?

v. [5 points] How much deadweight loss is there?

Question 13: 47½ points

14. Consider the case of Tar Heel Electric (THE), an energy plant which is situated across a valley from Wolfpack Winery and Vineyard (WWV). THE collects revenue by generating electricity through a process which pollutes the local air. Local air pollution decreases the enjoyment of visitors to WWV and can also affect the taste of its grapes. THE was here first, so they have the "right to pollute" without internalizing the externality it creates via lost profit to WWV.

    This market is shown in the graph below where MB represents the marginal benefit of all electricity users, MPC_{THE} is the marginal private cost of producing electricity, and MSC is the marginal privat cost of producing electricity *plus* the marginal external damages to WWV:



(a) [5 points] Given that THE has the right to pollute, what is the baseline level of emissions?

(b) [5 points] Is the baseline quantity of emissions socially optimal? Why or why not? If not, what is?

(c) [2 ½ points] Using the letters marked in the graph, what is the consumer surplus, the producer surplus collected by THE, and the lost profits (externality) suffered by WWV at the baseline?

(d) [2 ½ points] Assuming the baseline quantity of emissions is not socially optimal, how much would WWV be willing to pay THE to produce the optimal level of emissions? Use the letters to refer to parts of the graph).

Question 14: 15 points

15. Marcie and John are roommates. John loves listening to his favorite band, Creed, really loudly on his house speakers (and singing). John's marginal value of listening to Creed is

$$MV(H_l, H_q) = 11 - \frac{1}{2}H_l - H_q$$

where H_l and H_q are the number of hours spent listening to music at a loud volume and a quiet volume, respectively. The loud music hurts Marcie's serenity, and she would be happier if he played his music at a quieter volume. Unfortunately, there are only 8 hours in the day that John can listen to Creed (Marcie is home for all 8 hours).

(**Hint:** The time constraint means we can write $H_q = 8 - H_l$, so we only really need to choose the number of hours he spends listening loudly.)

(a) [2 ½ points] Realizing that $H_q = 8 - H_l$, write John's marginal value MV as a function of just the number of hours he spends listening to music loudly.

(b) [2 ½ points] If John ignores Marcie's serenity, how many hours will he spend listening to music loudly? Call this quantity H_l^*. Using the fact that $H_l^* + H_q^* = 8$, how many hours will his spend listening to his music quietly?

(**Hint:** Remember his marginal cost is 0 when he ignores the externality his listening creates.)

(c) [2 ½ points] Now assume that the marginal external damage created by John's listening is

$$MD(H_l, H_q) = -10 + 2H_l + \frac{1}{2}H_q.$$

What is the socially optimal number of hours that John should listen to his music loudly? Call this H_l^{**}. What is the socially optimal number of hours that John should listen to his

music quietly? Call this H_q^{**}.
(**Hint:** Assume that John still spends all 8 hours listening to his music loudly.)

(d) [2 ½ bonus points] Marcie can't stop John from listening to Creed for 8 hours, but she can make an offer to him to induce him to listen to Creed *quietly* for 8 hours (à la Coasian bargaining). How much would Marcie be willing to pay John to decrease the time he spends listening to music loudly from H_l^{**} to 0?

Question 15: 7½ points