Instructions: This is a closed-book, closed-notes exam. No calculators or electronic devices are allowed. Please turn off and put away all phones and other electronic devices. There are 14 multiple-choice questions and two free-response questions. Answer as many as you can in the time allowed. I do not expect everyone to be able to answer all questions. If you get stuck on something, I suggest moving on and coming back later when/if you have time. If you have a question, please raise your hand. Good luck!

Multiple choice – 29 out of 50 pts. (14 qns., 2 pts. each + 1)

Answer these questions on your Scantron. Your score will only be based on the marks on your Scantron. You will not receive any credit for anything written on your exam paper. You will receive 1 extra point for correctly writing your TA’s name on your Scantron, and correctly bubbling in your name, perm number, and version (A, B, C, or D) in the appropriate places on your Scantron. Exams without the version marked will be assigned the average score for all four versions.

1. In the competitive belt industry, the demand is \( q = 10 - p \) and the supply is \( q = p - 2 \). What is the consumer surplus if the government imposes a tax of 4 per belt?
   (a) 6
   (b) 4
   (c) 2
   (d) 8

2. Suppose Eli faces the following inverse demand function, \( p = 48 - 8q \). At what price is the price elasticity of demand \( \epsilon = -3 \)?
   (a) 32
   (b) 36
   (c) 2
   (d) 1.5

3. Nefi has $16 and preferences given by \( u(w) = \sqrt{w} \). Which of the following options maximizes her expected utility?
   (a) Pay $7 for a lottery ticket that has a 50-50 chance of winning an additional $72
   (b) Pay all her money ($16) for a lottery ticket that has a 50-50 chance of winning $100
   (c) Get a free lottery ticket that has a 1 in 4 chance of winning an additional $48
   (d) Do nothing

4. BananaHammock has a monopoly on bananas on Paradise Island and faces a marginal cost of \( MC = 2 \). Wilson has an inverse demand for bananas given by \( P = 5 - 0.5q \) and is the only consumer on the island. What price should BananaHammock charge per banana to maximize profits?
   (a) 3
   (b) 2
   (c) 7/2
   (d) 4
5. (continued from previous question) BananaHammock realizes it can increase profits by selling bananas by the bunch instead of individually. Assuming it can create bunches of any size, how many bananas should be in each bunch and what are total profits?

(a) \( q = 8; \pi = 16 \)
(b) \( q = 6; \pi = 9 \)
(c) \( q = 8; \pi = 24 \)
(d) \( q = 6; \pi = 15 \)

6. The inverse demand function for computers is \( P = 60 - Q \), where \( Q \) is the total quantity of computers. There are two computer manufacturers, Apple and IBM, and they operate as Cournot duopolists. Apple has a \( MC \) of 20 and IBM has a \( MC \) of 10. How many computers would Apple produce in equilibrium?

(a) \( 60/3 \)
(b) \( 30/3 \)
(c) \( 40/3 \)
(d) \( 50/3 \)

7. In a two good exchange economy, consumer A has utility is given by \( U_A(x_1, x_2) = \min\{x_1, 2x_2\} \). Consumer B has utility given by \( U_B(x_1, x_2) = \sqrt{x_1} + \sqrt{x_2} \). Each consumer starts with an endowment of 1 of each good. Which of the functions below represents the contract curve for this exchange economy (written in terms of consumer A’s allocations)?

(a) \( x_2 = 2x_1 \)
(b) \( x_2 = \frac{x_1}{2} \)
(c) \( x_2 = 4x_1 - 6 \)
(d) \( x_2 = 4x_1 - 12 \)

8. In an exchange economy, the initial endowment of consumer A is (30, 0) and her utility is given by \( U_A(x_1, x_2) = x_1^{1/2} x_2^{1/2} \). Consumer B is endowed with (0, 30) and has utility given by \( U_B(x_1, x_2) = 2x_1 + x_2 \). What is \( x_1^B \) at the competitive equilibrium?

(a) 20
(b) 0
(c) 10
(d) 15

9. A profit function of a factory that makes widgets is \( \pi_w(w) = 20w - w^2 \). Production of widgets releases smoke in to the air. The smoke in the air affects the dry cleaner who lives next door. Her profit function, as a function of the number of loads of dry cleaning, \( d \), she does and the number of widgets, \( w \), produced is \( \pi_d(d, w) = 25d - d^2 - wd \). How many loads of dry cleaning will she do?

(a) 7.5
(b) 2.5
(c) 5
(d) 10
10. Suppose a car shop fixes cars and earns $100 per car, $c$, with cost $C(c) = \frac{c^2}{2}$ per week. The noise from this shop hurts the cafe next door, which has cost $C(c, s) = s + \frac{s^2}{20} + \frac{c^2}{6}$ from selling $s$ sandwiches. The prices of sandwiches is $6. What is the socially optimal level of cars and sandwiches?

(a) $(c, s) = (50, 30)$
(b) $(c, s) = (75, 50)$
(c) $(c, s) = (50, 50)$
(d) $(c, s) = (75, 30)$

11. (continued from previous) How much tax per car should the government impose on the car shop such that the optimal number cars are fixed?

(a) 25
(b) 50
(c) 100
(d) 2

12. The total dollar value of bison killed from Huntington Forest is $f(b) = 50b - b^2$, where $b$ is the number of bison killed. The marginal cost of killing bison is 0. What is the optimal bison-killing tax to avoid the tragedy of the commons in this forest?

(a) 25
(b) 20
(c) 50
(d) 10

13. The city of Ventura would like to build a seawall to protect the city from the threat of tsunamis. Each additional inches of height further protects the city and the 100 residents are each willing to pay $6 per inch of seawall height, regardless of how many inches are provided. The cost of building a wall that is $i$ inches high is given by $c(i) = 5i^2$. What is the Pareto Optimal height for the seawall?

(a) 30 inches
(b) 120 inches
(c) 90 inches
(d) 60 inches

14. A developer wants to build a high-rise apartment in an expensive Brooklyn neighborhood. If the construction of the building moves ahead, 100 residents currently living in the area will lose their very desirable view of the Manhattan Financial District. The 50 residents of the upper floors value the view at $15 each and the 50 residents of the lower floors value the view at $5 each. The developer stands to make a profit of $2000 on the building. The current residents complain to the development board who use a VCG mechanism to resolve the dispute. What is the outcome of this process?

(a) The building is approved and the developer pays a $1000 tax.
(b) The building is approved and the developer pays a $1500 tax.
(c) The building is not approved and no one pays a tax.
(d) The building is not approved and residents pays a total of $2,000 tax.
1. Consider an exchange economy consisting of two people, A and B, endowed with two goods, 1 and 2. Person A is initially endowed with $\omega^A = (4, 8)$ and person B is initially endowed with $\omega^B = (4, 0)$. Their preferences are given by $U^A(x_1, x_2) = x_1 x_2$ and $U^B(x_1, x_2) = x_2^4 x_2^2$.

(a) Write the equation of the contract curve (express $x^A_2$ as a function of $x^A_1$).

(b) Let $p_2 = 1$. Find the competitive equilibrium price, $p_1$, and allocations, $x^A = (x^A_1, x^A_2)$ and $x^B = (x^B_1, x^B_2)$.

(c) Now suppose that person B’s preferences are instead given by $U^B(x_1, x_2) = \min\{x_1, x_2\}$. Given a price of $p_1 = \frac{1}{3}$ (and assuming $p_2 = 1$), what Pareto-optimal allocation will result from trade between the two people?

(d) Briefly explain why this price and allocation combination are not a competitive equilibrium.

(e) Let $p_2 = 1$. Find the actual competitive equilibrium price, $p_1$, and allocations, $x^A = (x^A_1, x^A_2)$ and $x^B = (x^B_1, x^B_2)$.
2. Ten (10) fishermen live on the shores of Lake George, a freshwater lake with a surface area of 10 hectares. Each fisherman can decide how many fishing trips to take per year and over how large an area in the lake to cast his nets. Each fishing trip costs $1 in gas and supplies, regardless of the area fished, and the total dollar value of fish caught in a patch of the lake with area \( A \) is given by 
\[
f(A, X) = \frac{A^2 \sqrt{X}}{5},
\]
where \( X \) is the total number of fishing trips taken by all fishermen. (You can assume that all fishermen fishing the same area get the same value of fish per boat.)

(a) Each fisherman takes the behavior of others as given. If a fisherman decided to take a trip, how large an area, \( A^* \), would he choose to fish? Since everyone chooses to fish \( A^* \), plug in this value to find the total dollar value of fish caught, as a function only of the number of trips, i.e. \( f(A^*, X) \).

(b) When each fisherman independently decides how many trips to take, how many trips will be taken overall and what will the total profits for all 10 fishermen be?

(c) The fishermen hold a meeting to figure out a way increase all their profits. One suggestion is to form a collective which will act as a single decision-making body overseeing the fishing rights to the lake. It will allow only the optimal number of fishing trips and divide all profits evenly among all fishermen. Under this proposal, how many trips will be taken and what will the total profits for all 10 fishermen be?

(d) Another suggestion is that the fishermen divide up the lake into 10 single-hectare parcels and give each of the 10 fishermen the exclusive rights to fish one of those 1-hectare patches of water. Under this proposal, how many trips will be taken and what will the total profits for all 10 fishermen be? (Assume that fishermen are allowed to take fractional numbers of trips.)

(e) Both proposals try to avoid the tragedy of the commons by assigning private fishing rights—in the first case the rights to the entire lake are assigned to the fisherman’s collective and in the second case the rights to each hectare are assigned to a different fisherman. Do both proposals avoid the full depletion of the lakes resources? Which is more successful at increasing the fisherman’s profits? Very briefly explain in intuitive terms why the other proposal is not as successful.