This is your Exam A. Exam A is a 100-minute exam (1hr. 40 min.). There are 6 questions (about 17 minutes per question). To avoid the temptation to cheat, you must abide by these rules then sign below after you understand the rules and agree to them:

- Turn off your cell phones.
- You cannot leave the room during the exam, not even to use the restroom.
- The only things you can have in your possession are pens or pencils and a simple non-graphing, non-programmable, non-text calculator.
- All other possessions (including phones, computers, or papers) are prohibited and must be placed in the designated corner of the room.
- Possession of any prohibited item (including phones, computers, or papers) during the exam (even if you don’t use them but keep them in your pocket) earns you a zero on this exam, and you will be reported to the Academic Integrity Committee for further action.

Sign here: __________________________________________________________

Each individual question on the following exam is graded on a 4-point scale. After all individual questions are graded, I sum the individual scores, and then compute that total as a percentage of the total of all points possible. I then apply a standard grading scale to determine your letter grade: 90-100% A; 80-89% B; 70-79% C; 60-70% D; 0-59% F

Finally, curving points may be added to letter grades for the entire class (at my discretion), and the resulting curved letter grade will be recorded on a standard 4-point numerical scale.

Tip: Explain your answers. And pace yourself. When there is only ½ hour left, spend at least 5 minutes outlining an answer to each remaining question.
Price Restrictions

Question 1. Suppose demand and supply for a commodity are \( Q^d = 20 - P \) and \( Q^s = 2P - 4 \)

a. For that commodity, compute equilibrium price, quantity, consumer surplus, and producer surplus.

b. Suppose that commodity with \( Q^d = 20 - P \) and \( Q^s = 2P - 4 \) were food grown by American farmers and a minimum price of $10 is imposed (with the intention of helping American farmers). Compute the effect of that minimum price on American farmers.

c. Now instead of food, suppose that commodity with \( Q^d = 20 - P \) and \( Q^s = 2P - 4 \) were homeowners insurance policies in Florida and a maximum price of $5 is imposed (with the intention of making insurance more affordable). Compute the effect of that maximum price on buyers.

Answer to Question:
Equating quantity demanded and quantity supplied yields the equation

\[20 - P = Q^D = Q^S = -4 + 2P\]

Solving for \(P\) yields the equilibrium price of \(P = \$8.00\) per unit.

Plugging that into the demand equation yields the equilibrium quantity \(Q\) of \(Q = 12.00\) units.

Consumer surplus is the right triangle with height \(Q^d = 12.00\) units.

\[\text{CS} = 72.00\]

Likewise, producer surplus is the right triangle with height \(Q^s = 6.00\) units.

\[\text{PS} = 36.00\]
b. The price floor of $10.00 is effective since it is above the equilibrium price of P = $8.00 per unit. As a result, quantity demanded will decrease to 
\[ Q^D = 20 - 1 \times (10.00) = 10.00 \]
while quantity supplied will increase. That is, supply exceeds quantity demanded. Therefore, price must fall to the full economic price, where supply equals quantity demanded. Solving 
\[ Q^S = -4 + 2P = 10.00 \]
yields the full economic price of 
\[ P^F = $7.00 \text{ per unit} \]
Suppliers are thus hurt by the price floor, by the drop from the equilibrium price to the full economic price.

c. The price ceiling of $5.00 is effective since it is below the equilibrium price of P = $8.00 per unit. As a result, quantity supplied will decrease to 
\[ Q^S = -4 + 2 \times (5.00) = 6.00 \]
while quantity demanded will increase. That is, demand exceeds quantity supplied. Therefore, price must rise to the full economic price, where demand equals quantity supplied. Solving 
\[ Q^D = 20 - 1 \times P = 6.00 \]
yields the full economic price of 
\[ P^F = $14.00 \text{ per unit} \]
Demanders are thus hurt by the price ceiling, by the rise from the equilibrium price to the full economic price.
Overtime Wages

Question 2. Use indifference curve and constraint analysis to show how Pizza Hut can get employees to work more hours and receive less income than if they offered a uniform wage for all hours worked.

To begin analysis, divide all consumption into two categories: leisure and “all other goods”. Suppose “all other goods” cost $1 per unit. (If it makes analysis simpler for you, divide consumption into leisure and food, with the price of food $1 per unit.)

Consider a typical customer with 24 hours available each day and 7 days available each week. Consider two alternative potential employment deals offered by pizza hut:

- Work for $12 for each of the first 40 hours during the week, then $18 for each additional hour beyond 40.
- Work for $18 for each hour.

Given that information, graph the budget constraints for each potential deal. (Be sure to label the points where the budget constraints intersect the horizontal and the vertical axes.)

Then, draw indifference curves so that under the first deal (work for $12 for each of the first 40 hours during the week, then $18 for each additional hour beyond 40) the employee chooses less leisure and less of “all other goods” than he chooses under the first deal (work for $18 for each hour). What can you conclude about the total hours worked and total income received under the second deal?

Tip: Label the points where the budget constraints intersect the horizontal and the vertical axes.

Answer to Question:
Answer to Question:
Graphically, the second deal is the red budget line. The first deal is the black line segments.

Finally, given the indifference curves drawn, the optimal consumption of both goods is less under the first deal than they are under the second deal. (Going beyond the original question: That conclusion is true for any indifference curves for which both goods are normal goods and the consumption of leisure is less than 128.)

In particular, the total hours worked is greater under the first deal because the consumption of leisure is less, and total income received under the second deal is less because the consumption of all other goods is less.
Optimal consumption under overtime wage

Leisure hours per week

All other goods

Optimal consumption under uniform wage
**Cost Minimization**

**Question 3.** You have been hired to replace the manager of the Toys for Tots charity that uses only two inputs, labor and capital, to produce and distribute toys to poor children. The charity can hire as much labor as it wants at a wage of $5 per hour and can rent as much capital as it wants at a price of $5 per hour. After you look at the company books, you learn that the charity has been using labor and capital in amounts that imply a marginal product of labor of 50 and a marginal product of capital of 100.

a. Is the charity running right? Explain.  
b. How can the charity be improved? Explain.  

**Answer to Question:**
Answer to Question:

a. Is the charity running right?
Answer: Currently,
\[
\text{(marginal rate of labor / wage)} = \frac{50}{5} = 10
\]
\[
\text{(marginal rate of capital / rental rate)} = \frac{100}{5} = 20
\]
Since those numbers are different, the firm is not minimizing the cost of producing its current level (call it Q) of toys.

b. How can the charity be improved?
Answer: Since the marginal product per dollar is lower for labor, the firm should use less labor and more capital in order to minimize costs of producing Q toys. There is not enough information to figure out how many toys Q to produce and distribute.

c. What do Microeconomic assumptions imply about the effectiveness of giving toys to poor children?
Answer:
1. If “poor” children are in families lead by rational people, then giving away toys probably makes the poor family less happy than giving away the cash value of the toys. Toys for Tots is thus not as effective as “Cash” for Tots.
2. If children are treated as commodities to be chosen like cars, then having a lot of children does not make a family poor. Calling a family with a $12,000 yearly income poor if there are 5 kids and not poor if there are no kids makes as much sense as calling a family poor if they bought nice cars. Cash for Tots is thus not as effective as Cash for “Poor People”.
3. Sometimes having a low income is a choice of leisure over other commodities. So when giving Cash to Poor People you should make sure you are not including people that have little income but a lot of leisure time (like Huckleberry Finn wearing rags but happy to float down the Mississippi river).

Comment: Using too much labor is a common mistake for charities that get volunteer labor. They could produce more output if they asked some of
their volunteers to work extra hours at their day jobs and donate their extra income, which the charity can then use to rent extra capital.
Competitive Entry and Exit

Question 4. Gilead Sciences Inc. is considering developing an HIV/AIDS drug. The drug is expected to cost $7,500,000 to develop and $5 per dose to produce and distribute. Consumers would be willing to pay $300 per dose for medication for up to 90,000 doses.

a. Determine Gilead's total cost function.

b. Determine whether Gilead will develop the drug. And if so, determine output and profit.

c. What would happen if $300 per dose is considered price gouging, and so the government imposed a cap of $100 per dose? Determine output and profit.

d. How would your answer to questions a, b, c change if Gilead Sciences Inc. has already developed the drug?

Answer to Question:
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Answer to Question:

a.
On the one hand, suppose the supplier has not yet developed the new product. (That is, the supplier is considering entering the industry.) Since the supplier has not yet developed the new product, sunk cost \( C(0) = 0 \). Fixed costs are

\[ FC = 7,500,000 \]

Varialbe cost are

\[ VC = 5 \text{ per unit.} \]

Thus the total cost function for positive quantity \( Q > 0 \) is

\[ C = 7,500,000 + 5Q \]

b.
The supplier will develop the product, produce a positive quantity, and make a positive profit \( \Pi \) when revenue exceeds cost. At market price

\[ P = 300 \text{ per unit,} \]

profit \( \Pi \) is positive when

\[ 300Q > 7,500,000 + 5Q \]

Solving for \( Q \) implies the supplier makes a profit when it sells

\[ Q > 25,423.73 \text{ units.} \]

And the total profit \( \Pi \) from selling all

\[ Q = 90,000 \text{ units is} \]

\[ \Pi = 300Q - (7,500,000 + 5Q) = 19,050,000 \]

Since that profit is positive, the supplier will develop the product, and produce

\[ Q = 90,000 \text{ units.} \]
c.
Again, the supplier will develop the product and make a positive profit $\Pi$ when revenue exceeds cost. At the government capped price
$$P = \$100 \text{ per unit,}$$
profit $P$ is positive when
$$\$100 \cdot Q > \$7,500,000 + 5Q$$
Solving for $Q$ implies the supplier makes a profit when it sells
$$Q > 78,947.37 \text{ units.}$$
And the total profit $\Pi$ from selling all
$$Q = 90,000 \text{ units is}$$
$$\Pi = \$100 \cdot Q - (\$7,500,000 + 5Q) = \$1,050,000$$
Since that profit is positive, the supplier will develop the product.
d. On the other hand, suppose the supplier has already developed the new product. (That is, the supplier has already entered the industry.) Since the supplier has already developed the new product, sunk cost $C(0)$ equals fixed costs,

$$C(0) = 7,500,000$$

Variable cost remains

$${VC} = 5 \text{ per unit.}$$

Thus the total cost function for non-negative quantity $Q \geq 0$ is

$$C = 7,500,000 + 5Q$$

The supplier will produce a positive quantity when profit $\Pi$ exceeds the negative of sunk cost. At market price

$$P = 300 \text{ per unit,}$$

profit $\Pi$ exceeds the negative of sunk cost when

$$\Pi = 300Q - (7,500,000 + 5Q) > -7,500,000$$

Since profit $\Pi$ exceeds the negative of sunk cost at all positive quantities, the supplier will produce a positive quantity.

Again, the supplier will produce a positive quantity when profit $\Pi$ exceeds the negative of sunk cost. At the government capped price

$$P = 100 \text{ per unit,}$$

profit $\Pi$ exceeds the negative of sunk cost when

$$\Pi = 100Q - (7,500,000 + 5Q) > -7,500,000$$

Since profit $\Pi$ exceeds the negative of sunk cost at all positive quantities, the supplier will produce a positive quantity.
Comparing Markets

Question 5. Consider the cost function
\[ C(Q) = 600 + 100Q + 5Q^2 \]
for Amazon to produce the new Kindle e-book reader. Using that cost function for the Kindle, determine the profit-maximizing output and price for the Kindle, and discuss its long-run implications, under three alternative scenarios:

a. Amazon’s Kindle is a perfect substitute with the Barnes & Noble Nook and several other e-book readers that have similar cost functions and that currently sell for $150 each
b. Amazon’s Kindle has no substitutes and so is a monopolist, and the demand for the Kindle is expected to forever be \( Q = 32 - (1/5)P \)
c. Amazon’s Kindle currently has no substitutes, and currently the demand for the Kindle is \( Q = 80 - (1/5)P \), but Amazon anticipates other firms can develop close substitutes in the future.

Answer to Question:
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Answer to Question:

a. Amazon is a Price Taker in Perfect Competition.

MC = 100 + 10Q
MR = P = $150
Set MR = MC
100 + 10Q = 150
Q = 5 units

Cost of producing 5 units
C(Q) = 600 + 100Q + 5Q^2 = 600 + 100(5) + 5(5) = $1,225

Revenues:
PQ = (150)(5) = $750

Maximum profits of -$475, which is negative but less than the fixed cost of $600.

Implications: Produce Q = 5 in short run, but expect exit in the long-run.

b. Amazon is a Monopolist.

MR = 160 - 10Q (since Q = 32 – (1/5)P and P = 160 - 5Q)
Set MR = MC, or 160 - 10Q = 100 + 10Q
Optimal output: Q = 3
Optimal price: P = 160 - 5(3) = $145

Maximal profits:
PQ - C(Q) = (145)(3) - (600 + 100(3) + 5(9)) = -$510,
which is negative but less than the fixed cost of $600.

Implications: Produce Q = 3 in short run, but expect exit in the long-run.

c. Amazon is a Monopolistic Competitor

MR = 400 - 10Q (since Q = 80 – (1/5)P and P = 400 - 5Q)
Set MR = MC, or 400 - 10Q = 100 + 10Q
Optimal output: Q = 15
Optimal price: P = 400 - 5(15) = $325

Maximal profits:
PQ - C(Q) = (325)(15) - (600 + 100(15) + 5(225)) = $1,650,
which is positive so expect other firms to enter in the long-run until demand drops enough so that profit drops to zero.
Bundle Pricing

Question 6. Block booking is a system of selling multiple films to a theater as a unit. Block booking was the prevailing practice among Hollywood's major studios from the turn of the 1930s until it was outlawed by the U.S. Supreme Court's decision in United States v. Paramount Pictures, Inc. (1948). Under block booking, theater owners were forced to license large numbers of a studio's pictures as a bundle.

For example, suppose Paramount Pictures has to decide whether to license its five biggest movies to theaters separately or sell all five as a block. Paramount has divided all theaters into 4 groups (West Coast, Midwest, South, East Coast) and collected internet data to estimate the maximum price each type of theater will pay to license each movie:

<table>
<thead>
<tr>
<th>Group \ Movie</th>
<th>Movie 1</th>
<th>Movie 2</th>
<th>Movie 3</th>
<th>Movie 4</th>
<th>Movie 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast</td>
<td>$8</td>
<td>$4</td>
<td>$3</td>
<td>$3</td>
<td>$5</td>
</tr>
<tr>
<td>Midwest</td>
<td>$6</td>
<td>$6</td>
<td>$8</td>
<td>$6</td>
<td>$6</td>
</tr>
<tr>
<td>South</td>
<td>$7</td>
<td>$8</td>
<td>$9</td>
<td>$9</td>
<td>$3</td>
</tr>
<tr>
<td>East Coast</td>
<td>$4</td>
<td>$7</td>
<td>$7</td>
<td>$2</td>
<td>$8</td>
</tr>
</tbody>
</table>

To keep the problem simple, assume there are zero marginal costs of licensing to any of those theaters, and there are 312 theaters in each group.

Assume market conditions allow the firm to bundle units licensed to each theater so that theaters do not share their bundles. But assume that the price to license a bundle must be the same to all theaters in all groups.

What are the optimal prices of licensing each movie if each is licensed separately? What is the optimal price per block if all five movies are licensed as a block? Is it better to license the five movies separately? Or better to license as a block? Or is it the same?

Answer to Question:
Answer to Question: Let G = number of theaters in each group.

Optimal Movie 1 Price? Optimal Profit?
- At a price of $8, only Group 1 buys license, profit = $8x1xG
- At a price of $7, only Groups 1 and 3 buy, profit = $7x2xG
- At a price of $6, all but Group 4 buys, profit = $6x3xG
- At a price of $4, all four buy, profit = $4x4xG
Optimal profit is $18xG, with price $6

Optimal Movie 2 Price? Optimal Profit?
- At a price of $8, one group buys, profit = $8x1xG
- At a price of $7, two groups buy, profit = $7x2xG
- At a price of $6, three groups buy, profit = $6x3xG
- At a price of $4, four groups buy, profit = $4x4xG
Optimal profit is $18xG, with price $6

Optimal Movie 3 Price? Optimal Profit?
- At a price of $9, one group buys, profit = $9x1xG
- At a price of $8, two groups buy, profit = $8x2xG
- At a price of $7, three groups buy, profit = $7x3xG
- At a price of $3, four groups buy, profit = $3x4xG
Optimal profit is $21xG, with price $7

Optimal Movie 4 Price? Optimal Profit?
- At a price of $9, one group buys, profit = $9x1xG
- At a price of $6, two groups buy, profit = $6x2xG
- At a price of $3, three groups buy, profit = $3x3xG
- At a price of $2, four groups buy, profit = $2x4xG
Optimal profit is $12xG, with price $6

Optimal Movie 5 Price? Optimal Profit?
- At a price of $8, one group buys, profit = $8x1xG
- At a price of $6, two groups buy, profit = $6x2xG
- At a price of $5, three groups buy, profit = $5x3xG
- At a price of $3, four groups buy, profit = $3x4xG
Optimal profit is $15xG, with price $5
Given the maximum price each type of theater will pay to license each movie, we can compute the maximum price each type of theater will pay for the block of all five movies: Group 1 would pay $23 = 8 + 4 + 3 + 3 + 5; Group 2, $32; Group 3, $36; Group 4, $28.

Optimal Block Price? Optimal Profit?
• At a price of $36, one group buys, profit = $36 \times 1 \times G$
• At a price of $32, two groups buy, profit = $32 \times 2 \times G$
• At a price of $28, three groups buy, profit = $28 \times 3 \times G$
• At a price of $23, four groups buy, profit = $23 \times 4 \times G$

Optimal profit is $92 \times G$, with price $28$

If they license all five movies separately, total profit is $84 \times G$, which is worse than the total profit $92 \times G$ when the five products are licensed as a block. So, license as a block.