Instructions:

- Answer all of the following questions. You have the class period to complete the exam.

- Answer each question clearly and concisely. You must show your work to receive credit.

This exam is given under the rules of the Montana State University. By printing your name above you acknowledge the University’s Honor Code and agree to comply with the provisions of the Honor Code. You may not use notes or receive any assistance. There is to be no talking during the exam. You may use a calculator, but are never allowed to use a device allowing you to take photographs or transmit over a network. **No notes, no assistance, no talking, no cell phones, but you can use a calculator.**

Clearly print your name above, in the space provided on the next page and in your blue book(s). You must turn in the exam and your blue book(s). There are two versions of the exam. **Indicate your exam version on your blue book.** It is your responsibility to make sure your version of the exam is different from the students next to you. If you have the same version as any of the students next to you, you will be asked to move.
Name: ____________________________

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<th>Question</th>
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True/False/Uncertain Plus Explanation

1. For each of the following, state whether it is true, false or uncertain and explain your answer. No points are given without explanation. (20)

   (a) In the short run a firm may produce a quantity that does not minimize costs.

   (b) As long as a market allows for free entry and exit, there won’t be a monopoly.

   (c) The main point of the Prisoner’s Dilemma game is to show that the optimal solution is always reached when each player follows their dominant strategies.

   (d) Both Tums and Rolaids will cure David’s heartburn, and he regards them as perfect substitutes. Therefore, his indifference curves will be linear with a slope of $-1$.

   (e) A firm’s producer surplus equals it’s profit.

Short Answer/Numerical

2. Market demand is $P = 185 - 2Q$. There are potentially many identical firms in this market each with the following cost structure: $C(q) = 243 + 5q + 3q^2$. (20)

   (a) What is the perfectly competitive market equilibrium firm quantity, market quantity, and price.

   (b) At the perfectly competitive market equilibrium, how many firms are there?

   (c) If the government grants one firm a patent for this market, what is the new equilibrium firm quantity, market quantity, and price.

   (d) What’s the loss in welfare associated with the government’s issuing of the patent?

   (e) If instead you wanted to determine the deadweight loss associated with a monopolist, what would that be and is your above analysis the most relevant? Explain.
3. Two players play the following simultaneous move game. The payoffs are \((A, B)\) where \(A\) is Player 1’s payoff and \(B\) is Player 2’s payoff.

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<th>Player 1</th>
<th>Player 2</th>
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<td>L</td>
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<tr>
<td>T</td>
<td>(1,0)</td>
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<tr>
<td>M</td>
<td>(0,2)</td>
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<tr>
<td>B</td>
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(a) What is each player’s best response function? Be sure to write it out explicitly.

(b) Are there any dominant or dominated strategies? If so, indicate whether the strategy is dominant or dominated.

(c) Use the method of iterated elimination to find the unique outcome.

(d) Is this outcome a Nash equilibrium? If so why and if not why not? Are there any other pure strategy Nash equilibrium?

(e) Instead of making simultaneous choices, consider a sequential game. Is the outcome of a sequential game different and does it matter who chooses first?

4. Consider the following constrained multivariate optimization problem.

\[
\max_{x,y} f(x, y) = 5x^2y \\
\text{subject to } 20x + 15y = 90
\]

For the parts below, always consider \(y\) to be on the vertical axis and \(x\) to be on the horizontal axis.

(a) What is the Lagrangian for this problem?

(b) Find the optimal values of \(x\) and \(y\).

(c) What is the value of \(f(x, y)\) evaluated at the optimal values of \(x\) and \(y\)? Call this value \(A\) where \(A = f(x^*, y^*)\).

(d) Find an equation for a curve (\(y\) as a function of \(x\)) such that \(f(x, y) = A\) where \(A\) is the value you found in the part above.

(e) Show that the slope of the curve you found above by setting \(f(x, y) = A\) is equal to the slope of the constraint at the optimal values of \(x\) and \(y\).
5. There are 100 consumers and each consumer has the following preferences for the goods $q$ and $Y$
\[ u(q, Y) = q^{3/4}Y^{1/4} \]
and each consumer has an income level of $m = 48$. (Consider $Y$ to be a composite good.)
There is one firm who produces good $q$ with the following production technology.
\[ q = \min\{4K, 5L\} \]
This firm acts as a price taker. $K$ is the amount of capital used in production which has a rental rate of $r = 8$ and $L$ is the amount of labor used in production with a wage rate of $w = 10$.
(a) What is the individual demand curve for good $q$?
(b) What is the market demand curve for good $q$?
(c) Describe the supply curve for good $q$.
(d) What is the market equilibrium price and quantity?
(e) How does the market equilibrium price and quantity change when the government imposes a lump sum tax on every consumer of $16$?