Note: these 9 questions were drawn from questions that I have given in prior years (in a similar class). These questions should not be considered a comprehensive study guide. Rather, they should just give you an idea of the style of questions that I tend to ask.

1) Government Intervention in Markets

A city issues 1,000 licenses for taxicab drivers, but has no other regulations on taxicabs. Graphically diagram how this licensing affects the market price, consumer surplus, producer surplus, social surplus. Under what conditions would the licensing cause deadweight loss?

2) Perfect Competition – Short Run

In the short-run, Acme, Inc. has only one input: labor. All of Acme’s workers earn $10 per hour. Acme’s fixed cost is $100. The price of Acme’s output is $50. With no workers hired, Acme produces 0 units. With this information, fill in the following table (note any formulas that you use):

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L=Hours of Labor, Q=Units of Output, APL=Average Product of Labor, MPL=Marginal Product of Labor, VC=Variable Cost, TC=Total Cost, MC=Marginal Cost, AFC=Average Fixed Cost, AVC=Average Variable Cost, ATC=Average Total Cost.

3) Perfect Competition – Long Run

a) For a perfectly competitive firm, explain why P=MC=ATC in the long-run. What does this imply about the firm’s profit?

b) In choosing how much capital and labor to use in the long-run, why will a profit maximizing firm set the marginal rate of technical substitution equal to the ratio of w/r, where w is the wage paid to workers and r is the rental cost of capital?
4) **Consumer and Producer Surplus**

The demand and supply for electric-powered cars is given by the following equations:

\[ Q_d = 2000 - \frac{P}{25} \]
\[ Q_s = 2000 + \frac{P}{5} \]

Assume that these cars are supplied by perfectly competitive firms.

a) Compute the initial equilibrium price, quantity, producer surplus, and consumer surplus. (If you cannot solve this mathematically, do so graphically for fewer points.)

b) What information would you need to know to compute the firms’ total profits? Fill in the following equation: Firms’ total profits = ______________________.

5) **Monopolies**

A monopolist faces the following demand curve: \( Q_d = 50 - \frac{P}{4} \). The monopolist’s marginal cost is the following: \( MC = 10 + Q_s \).

a) Explain why a monopolist will choose to produce where price > marginal cost.

b) Compute the number of units sold by the monopolist and the price charged.

c) Explain why a monopolist may not earn any profit, even if price is greater than marginal cost.

d) If regulators wanted to maximize social surplus by setting a price ceiling, what price would they choose? Explain your answer.

6) **Game Theory**

There are two politicians vying for office, Smith and Jones. Both are considering whether to increase their advertising expenditures. If they both spend a high amount, due to an incumbent advantage, Smith will win the election with certainty. On the other hand, if Jones spends high, while Smith does not, Jones will win the election with certainty. If Jones spends a low amount, the election outcome is less clear:

- If Smith also spends low, Jones has a 1/4 chance of winning.
- If Smith outspends Jones, Jones has 1/2 chance of winning (suppose that voters might get turned off by Smith’s advertising absent Jones’ advertising).

a) Summarize this advertising expenditure decision in a payoff matrix.

b) Does either candidate have a dominant strategy? Explain.

c) What is the Nash Equilibrium? Explain.
7) **Game Theory**

Using the concept of the prisoner’s dilemma, explain why Pepsi and Coke are unlikely to charge a price that is substantially above their average total cost.

8) **Oligopoly: Cournot Model**

Two towns operate adjacent beaches during the summer months. The marginal cost of supplying the beaches is zero. They each must charge the same price, as consumers are indifferent between the beaches. Both towns want to maximize their profits. Total demand for going to the beach is given by the following:

\[ P = 20 - Q \]

Where \( Q = Q_1 + Q_2 \), \( Q_1 \) = number admitted onto town 1’s beach, and \( Q_2 \) = number admitted onto town 2’s beach.

a) What is the marginal revenue function for Town 1?

b) What is town 1’s optimal \( Q_1 \) as a function of \( Q_2 \)?

c) What is town 2’s optimal \( Q_2 \) as a function of \( Q_1 \)?

d) Solve for \( Q_1, Q_2, Q, \) and \( P \). Assuming the two towns do not collude.

e) Now, if the two towns colluded to maximize total profit, solve for \( Q \) and \( P \).

f) What is the socially optimum \( P \) and \( Q \)?

9) **Monopolistic Competition**

Explain in words and graphically why a monopolistically competitive firms will earn zero profit in the long run, despite the fact that \( MC < P \).
1) **Government Intervention in Markets**

A city issues 1,000 licenses for taxicab drivers, but has no other regulations on taxicabs. Graphically diagram how this licensing affects the market price, consumer surplus, producer surplus, social surplus. Under what conditions would the licensing cause deadweight loss?

![Graph showing market price, consumer surplus, producer surplus, and social surplus.]  

*Market price rises, consumer surplus is decreased, producer surplus could be higher or lower (depends on if the area of the lost triangle is bigger or smaller than area of gained rectangle), social surplus is smaller (by the size of DWL). There will be deadweight loss if the number of licenses issued is smaller than the market equilibrium Q.*

2) **Perfect Competition – Short Run**

In the short-run, Acme, Inc. has only one input: labor. All of Acme’s workers earn $10 per hour. Acme’s fixed cost is $100. The price of Acme’s output is $50. With no workers hired, Acme produces 0 units. With this information, fill in the following table (note any formulas that you use):

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L=Hours of Labor, Q=Units of Output, APL=Average Product of Labor, 
MPL=Marginal Product of Labor, VC=Variable Cost, TC=Total Cost, MC=Marginal 
Cost, AFC=Average Fixed Cost, AVC=Average Variable Cost, ATC=Average Total 
Cost.

\[
\begin{align*}
APL &= \frac{Q}{L} \\
MPL &= \frac{\Delta Q}{\Delta L} \\
VC &= w \times L = 10 \times L \\
TC &= FC + VC = 100 + VC \\
MC &= \frac{\Delta TC}{\Delta Q} \\
AFC &= \frac{FC}{Q} = 100/Q \\
AVC &= \frac{VC}{Q} \\
ATC &= \frac{TC}{Q} \\
Profit &= Revenue - TC = P \times Q - TC = 50 \times Q - TC
\end{align*}
\]

3) **Perfect Competition – Long Run**

a) For a perfectly competitive firm, explain why \( P = MC = ATC \) in the long-run. 
What does this imply about the firm’s profit?

*All firms maximize profit when MR=MC. For a perfectly competitive firm, MR=P. Thus, 
P=MC. If there is a profit available, firms will enter the industry, which will increase 
supply and drive down the price. This will continue until there is no profit available. Thus, 
in the long run, profit = 0.*

\[
\begin{align*}
Profit &= Revenue - Cost \\
&= P \times Q - TC \\
&= P \times Q - ATC \times Q \\
&= (P - ATC) \times Q.
\end{align*}
\]

*Thus, profit = 0 when \( P = ATC \). Thus, \( P=MC=ATC \) in the long run.*

b) In choosing how much capital and labor to use in the long-run, why will a
profit maximizing firm set the marginal rate of technical substitution equal to
the ratio of \( w/r \), where \( w \) is the wage paid to workers and \( r \) is the rental cost of 
capital?

\[MRTS = \text{the amount of capital I am could give up for a one unit increase in labor, while}
\text{holding output constant.} \ \text{w/r is the amount of capital I would have to give up to buy one}
\text{more unit of labor. If MRTS} > \text{w/r, I could produce the same amount of output at a lower}
\text{price by increasing labor and decreasing capital. Likewise, if MRTS} < \text{w/r, I could produce}\]
the same amount of output at a lower price by increasing capital and decreasing labor. 
Thus, the firm has the optimal amount of labor and capital when MRTS = w/r.

4) Consumer and Producer Surplus

The demand and supply for electric-powered cars is given by the following equations:
Qd = 2000 - P/25
Qs = -2000 + P/5

Assume that these cars are supplied by perfectly competitive firms.

a) Compute the initial equilibrium price, quantity, producer surplus, and consumer surplus. (If you cannot solve this mathematically, do so graphically for fewer points.)

\[ Qd = Qs \]
\[ 2000 - P/25 = -2000 + P/5 \]
\[ 4000 - P/25 = P/5 \]
\[ 4000 = P/5 + P/25 \]
\[ 4000 = 6P/25 \]
\[ 100000 = 6P \]
\[ 16667 = P \]
\[ Qd = 2000 - 16667/25 = 1333 \]
\[ Qs = -2000 + 16667/5 = 1333 \]

\[ CS = \text{Area below the demand curve and above the price consumers pay.} \]
\[ = \frac{1}{2} * (P\text{-intercept} - P) * Q \]
\[ = \frac{1}{2} * (50000 - 16667) * 1333 \]
\[ = 22,222,222 \]

\[ PS = \text{Area above the supply curve and below the price producers receive.} \]
\[ = \frac{1}{2} * (P - P\text{-intercept}) * Q \]
\[ = \frac{1}{2} * (16667 - 10000) * 1333 \]
\[ = 4,444,444 \]

b) What information would you need to know to compute the firms’ total profits?

\[ \text{Profit} = \text{Revenue} - \text{Cost} \]
\[ = \text{Revenue} - \text{Variable Cost} - \text{Fixed Cost} \]
\[ = \text{Producer Surplus} - \text{Fixed Cost} \]

Thus, if we knew the firms’ total fixed costs, we could compute total profit in the market.
c) Fill in the following equation: Firms’ total profits = \textit{Producer Surplus – Fixed Cost}

5) \textit{Monopolies}

A monopolist faces the following demand curve: Qd = 50 – P/4. The monopolist’s marginal cost is the following: MC=10+Qs.

a) Explain why a monopolist will choose to produce where price > marginal cost.

The monopolist will maximize profit where \( MC = MR \). Since the monopolist faces a downward sloping demand curve, \( P \) does not equal \( MR \) – in fact, the MR curve lies below the demand curve, thus \( MR < P \). Thus, \( MC < P \).

b) Compute the number of units sold by the monopolist and the price charged.

\[
\begin{align*}
Q_d &= 50 - P/4 \\
4\times Q_d &= 200 - P \\
P + 4\times Q_d &= 200 \\
P &= 200 - 4\times Q_d \\
MR &= 200 - 8\times Q_d \\
MC &= MR \\
10 + Q &= 200 - 8\times Q \\
10 + 9\times Q &= 200 \\
9\times Q &= 190 \\
Q &= 21.11 \\
\end{align*}
\]

Plug into the demand curve:

\[
\begin{align*}
P &= 200 - 4\times 21.11 \\
P &= 115.56 \\
\end{align*}
\]

c) Explain why a monopolist may not earn any profit, even if price is greater than marginal cost.

\textit{If ATC > P, profit is negative – note, this can happen even if MC < P.}

d) If regulators wanted to maximize social surplus by setting a price ceiling, what price would they choose? Explain your answer.
The socially optimum price is where \( MC = P \) (at this point, the cost of producing the last unit = the benefit of the last unit). One would need to be careful to make sure the firm earns a profit at this price, else, the firm will close and social surplus would be dramatically lower.

6) **Game Theory**

There are two politicians vying for office, Smith and Jones. Both are considering whether to increase their advertising expenditures. If they both spend a high amount, due to an incumbent advantage, Smith will win the election with certainty. On the other hand, if Jones spends high, while Smith does not, Jones will win the election with certainty. If Jones spends a low amount, the election outcome is less clear:

- If Smith also spends low, Jones has a \( \frac{1}{4} \) chance of winning.
- If Smith outspends Jones, Jones has \( \frac{1}{2} \) chance of winning (suppose that voters might get turned off by Smith's advertising absent Jones' advertising).

a) Summarize this advertising expenditure decision in a payoff matrix.

\[
\begin{array}{c|cc}
    & \text{High} & \text{Low} \\
\hline
\text{High} & (1, 0) & (0, 1) \\
\text{Low} & (1/2, 1/2) & (3/4, 1/4) \\
\end{array}
\]

b) Does either candidate have a dominant strategy? Explain.

*If Jones goes high, Smith should go high.*
*If Jones goes low, Smith should go low.*

Thus, Smith does not have a dominant strategy.

*If Smith goes high, Jones should go low.*
*If Smith goes low, Jones should go high.*

Thus, Jones does not have a dominant strategy.

c) What is the Nash Equilibrium? Explain.

A Nash equilibrium occurs when a set of strategies is best for both players given the others strategy. In this game, there is no Nash equilibrium, since for any set of strategies, one player always has an incentive to change their strategy given what their opponent is doing.
7) **Game Theory**

Using the concept of the prisoner’s dilemma, explain why Pepsi and Coke are unlikely to charge a price that is substantially above their average total cost.

Since Pepsi and Coke are substitute goods, if the price of one is lower than the other, consumers will tend to choose the lower priced soft drink. While both companies will fare better if they both charge a high price, there is always an incentive for the other firm to cheat and charge a lower price to corner the market. Since both firms face the same dilemma, both will “cheat” and charge the “low” price. The “low” price must be above their ATC, or else they would earn zero profit. It will be difficult for the two oligopolists to maintain a much higher price due to the incentive to cheat.

8) **Oligopoly: Cournot Model**

Two towns operate adjacent beaches during the summer months. The marginal cost of supplying the beaches is zero. They each must charge the same price, as consumers are indifferent between the beaches. Both towns want to maximize their profits. Total demand for going to the beach is given by the following:

\[
P = 20 - Q/4
\]

Where \( Q = Q_1 + Q_2 \), \( Q_1 \)=number admitted onto town 1’s beach, and \( Q_2 \)=number admitted onto town 2’s beach.

a) What is the marginal revenue function for Town 1?

\[
P = 20 - Q/4
\]

\[
P = 20 - (Q_1 + Q_2)/4
\]

\[
P = 20 - Q_1/4 - Q_2/4
\]

\[
P = 20 - Q_2/4 - Q_1/2
\]

\[
MR = (20 - Q_2/4) - Q_1/2
\]

b) What is town 1’s optimal \( Q_1 \) as a function of \( Q_2 \)?

\[
MC = MR
\]

\[
0 = (20 - Q_2/4) - Q_1/2
\]

\[
Q_1/2 = (20 - Q_2/4)
\]

\[
Q_1 = 40 - Q_2/2
\]
c) What is town 2’s optimal Q2 as a function of Q1?

*Since the problem is symmetric (with both having the same MC), the math is the same as for part b:*

\[ Q_2 = 40 - \frac{Q_1}{2} \]

d) Solve for Q1, Q2, Q, and P. Assuming the two towns do not collude.

*Plug answer c into answer b:*

\[ Q_1 = 40 - \frac{(40 - Q_1/2)/2}{2} \]
\[ Q_1 = 40 - \frac{20 - Q_1/4}{2} \]
\[ Q_1 = 20 + Q_1/4 \]
\[ Q_1 = 20 + \frac{Q_1}{4} \]
\[ Q_1 - \frac{Q_1}{4} = 20 \]
\[ \frac{3}{4} Q_1 = 20 \]
\[ Q_1 = \frac{20 \times 4}{3} \]
\[ Q_1 = 26.67 \]

*Plug Q1 into answer c:*

\[ Q_2 = 40 - \frac{26.67}{2} \]
\[ Q_2 = 26.67 \]

\[ Q = Q_1 + Q_2 \]
\[ = 26.67 + 26.67 \]
\[ = 53.33 \]

\[ P = 20 - \frac{(53.33)}{4} \]
\[ P = 6.67 \]

e) Now, if the two towns colluded to maximize total profit, solve for Q and P.

*They would then act like a monopolist:*

\[ P = 20 - \frac{Q}{4} \]
\[ MR = 20 - \frac{Q}{2} \]
\[ MC = MR \]
\[ 0 = 20 - Q/2 \]
\[ Q/2 = 20 \]
\[ Q = 40 \]

\[ P = 20 - (40)/4 \]
\[ P = 10 \]

Note, the monopolist price is higher and quantity lower than the oligopolist solution.

f) What is the socially optimum P and Q?

Social optimum is where MB = MC (or, where \( P = MC \)). Thus, \( P = 0 \) is optimal,

\[ P = 20 - Q/4 \]
\[ 0 = 20 - Q/4 \]
\[ Q/4 = 20 \]
\[ Q = 80 \]

Note, the oligopolist price is higher and quantity lower than the social optimum.

9) Monopolistic Competition

Explain in words and graphically why a monopolistically competitive firm will earn zero profit in the long run, despite the fact that \( MC < P \).

A monopolistically competitive firm faces a downward sloping demand curve. Thus, \( MR \) is below the demand curve -- with \( MR = MC \) \( \Rightarrow MC < P \).

However, if profit is positive, due to low barriers to entry, other firms will enter and demand will fall. This will continue until \( P = ATC \) and profit = 0: