Note: these 10 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) Define the Marginal Rate of Substitution. Why does the Marginal Rate of Substitution equal the Price Ratio when the consumer has chosen an optimal amount of goods X and Y? (10 Points)

2) Suppose that there are 10 identical farmers whose demand is for seed is the following:
   \[ Q_d = 3 - \frac{P}{500} \]
   a) Plot the Market Demand Curve for seed below (5 Points):

   ![Market Demand Curve Diagram](image)

   b) If the equilibrium price is $500, compute the total consumer surplus (5 Points).

3) Suppose that the government offered a tax credit of 20 cents for each dollar that is spent on college tuition. That is, if you spend $10,000 on tuition, you would be able to lower your tax liability by $2,000.
   a) What effect would this tax credit have on college enrollment, assuming that college attendance is a normal good? Would your answer be different if college attendance is an inferior good? (8 Points)
b) Using a supply and demand diagram, what effect would the tax credit have on tuition? (5 Points)

c) Does this tax credit cause a deadweight loss? Would consumers choose a Pareto efficient amount of college enrollment after the tax credit is enacted? (5 Points)

d) Note that persons who do not have any tax liability (those with low incomes) would get no benefit from the tax credit. Using your answers to parts a and b, what effect would the tax credit have on the college enrollment of low-income students? (5 Points)

4) Suppose that the supply curve for cigarettes is a horizontal line at $2 per pack. Suppose that 1000 packs are sold at this price. Further suppose that the price elasticity of demand is -2. (To compute percentage changes, use the formula: \( \frac{X_1 - X_0}{X_0} \))

a) If the government imposes a 50 cent tax per pack, what effect will this have on the quantity sold? (5 Points)

b) Compute the deadweight loss caused by the imposition of the tax (assume that the demand curve is linear (i.e., not curved)). (5 Points)

c) Suppose the cross-price elasticity of demand for chewing tobacco is +0.8. Compute the effect of the cigarette tax have on the demand for chewing tobacco. Are cigarettes and chewing tobacco complements or substitutes? Explain. (5 Points)

5) Suppose that an individual can earn $5 per hour if he chooses to work. Suppose that we institute a welfare program that gives a person who does not work $50 per week. Further, for each dollar earned from work, assume that the welfare contribution is reduced by one dollar (e.g., if he works 1 hour, he will get a welfare check of $45). Assume that the person has 60 hours in each week that could be spent at work.

a) Draw this individual’s budget set in the graph below (Note that the x-axis is Hours NOT Worked – if you don’t work any hours, you have 60 hours not worked): (5 Points)
b) Next suppose that the government changes the welfare program. Again, suppose that the welfare program gives $50 per week if the individual does not work. However, the welfare check is reduced by $0.50 for each dollar earned by work (e.g., if he works 1 hour, he will get a welfare check of $50 – 0.5*$5 = $47.50). Draw this individual’s budget set in the graph below: (5 Points)
c) How would the new program (in part b) affect the hours worked of a worker who worked 15 hours under the old program (in part a)? Describe both the income and substitution effects (assume that leisure (i.e., not working) is a normal good). (5 Points)

6) Suppose that at an interest rate of 10%, an individual who lives two periods decides to borrow money in the first period. If the interest rate falls, could second period consumption rise? Explain. (7 Points)

7) You are given the following supply and demand curves:

\[ Q_d = 50 - \frac{P}{2} \]
\[ Q_s = -130 + 4P \]

a) Compute the equilibrium price and quantity.
b) Graph the supply and demand curves and label the equilibrium price and quantity.
c) Compute the consumer surplus.

Now, suppose the government places a price ceiling of $38 on this good.

d) Compute the new quantity that will be sold.
e) Are consumers better or worse off? Discuss. (No calculation is necessary).

8) Jenny smokes cigarettes and chews gum. Suppose there is no tax on either good to start.

a) The government adds a $1 per pack tax on cigarettes. Use a budget constraint graph to show what will happen to Jenny’s consumption of cigarettes and chewing gum. Explain and list all assumptions. Explain what happens to Jenny’s marginal rate of substitution of gum for cigarettes.
b) Now, after the government receives all this tax revenue, suppose they decide to give some of it back and send everyone (including Jenny) a check. Explain what will happen to Jenny’s consumption of cigarettes and chewing gum relative to your answer in part a (after the tax is imposed). List all assumptions.

9) Low-income and high-income households have different demands for milk:

Low-Income Demand: \[ P = 4 - Q \]
High-Income Demand: \[ P = 3 - \frac{Q}{2} \]

a) Compute an equation (or equations) for the market demand curve.
b) Suppose the government gives low-income households a voucher for one gallon of milk. Explain what will happen to the market price of milk. No calculation needed.

10) Bill is planning an outdoor concert which will cost $20,000 to produce. If it is sunny, the concert will generate $120,000 of revenue, so Bill will earn $100,000 net of expenses. If it does rain, there will be no revenue, so Bill will lose $20,000. There is a 20% chance of rain.

An insurance agent has offered Bill a policy. The policy costs $10,000. If it rains, Bill will receive a check for $40,000 from the insurance company—otherwise, he receives nothing.

a) What is the expected return if Bill does not purchase the insurance?
b) What is the expected return if Bill does purchase the insurance?
c) Would the standard deviation be lower in case a or b (i.e., without or with insurance)? Explain – you do not need to calculate these standard deviations.
d) If Bill was risk averse, would he purchase the insurance? Explain.
e) Using your answers above, explain why U.S. government bonds pay a lower expected return than the typical U.S. stock.
ANSWER KEY

1) Define the Marginal Rate of Substitution. Why does the Marginal Rate of Substitution equal the Price Ratio when the consumer has chosen an optimal amount of goods X and Y? (10 Points)

*MRS is the amount of good Y a consumer is willing to give up to obtain one more unit of good X (while holding the level of utility constant). The Price Ratio is the amount of good Y a consumer has to give up to obtain one more X. If MRS > Price Ratio, the consumer will buy more X, thus reducing MRS. If the MRS < Price Ratio, consumer will buy less X and more Y, thus increasing MRS.*

2) Suppose that there are 10 identical farmers whose demand is for seed is the following:

\[ Q_d = 3 - P/500 \]

a) Plot the Market Demand Curve for seed below (5 Points):

*The price that one farmer is willing to pay is given by the following:*

\[ P = 1500 - 500*Q_d \]

*(This is found by subtracting 3 from both sides and then multiplying both sides by -500)*

$1500$ is the maximum amount that a farmer would be willing to pay, and at a price of $0$, one farmer would purchase 3 units. Now, with 10 identical farmers, none of them would be willing to pay more than $1500$ (so the P-intercept will be $1500$), and at a price of $0$, ten farmers would purchase 30 units (so the Q-intercept will be 30).

b) If the equilibrium price is $500$, compute the total consumer surplus (5 Points).

*At \( P = 500 \), one farmer will demand 2 units, and ten farmers will demand 20 units.*

\[
\text{Consumer surplus} = \frac{1}{2} \times (\text{base}) \times (\text{height})
\]

\[
= \frac{1}{2} \times (20) \times (1500 - 500)
\]

\[
= \frac{1}{2} \times (20) \times (1000)
\]

\[
= 10,000
\]

3) Suppose that the government offered a tax credit of 20 cents for each dollar that is spent on college tuition. That is, if you spend $10,000 on tuition, you would be able to lower your tax liability by $2,000.

a) What effect would this tax credit have on college enrollment, assuming that college attendance is a normal good? Would your answer would be different if college attendance is an inferior good? (8 Points)
The tax credit is a subsidy, which lowers the price of attending college. Consumers will substitute towards the cheaper good (college). For students who didn't attend without the tax credit, this is the only effect and their enrollment should rise.

For students who already attend college, the tax credit will give them more income and may prompt them to spend more on all normal goods (including college). However, if college is an inferior good, it would cause these students to spend less on college – thus, if college is an inferior good it is ambiguous whether the amount spent on college would increase or decrease for students who were attending before the tax credit was offered.

b) Using a supply and demand diagram, what effect would the tax credit have on tuition? (5 Points)

The demand curve will shift right (assuming college is a normal good). Then, assuming an upward sloping supply curve, tuition would increase. However, if supply is perfectly elastic, then tuition would stay the same.

c) Does this tax credit cause a deadweight loss? Would consumers choose a Pareto efficient amount of college enrollment after the tax credit is enacted? (5 Points)

Since the tax credit forces a wedge between the price that consumers pay and the price the colleges receive, it does cause a deadweight loss and consumers would NOT choose a Pareto efficient amount of college enrollment after the tax credit is enacted. However, this assumes that there is not a positive externality to college enrollment – we will discuss this more later in the term.

d) Note that persons who do not have any tax liability (those with low incomes) would get no benefit from the tax credit. Using your answers to parts a and b, what effect would the tax credit have on the college enrollment of low-income students? (5 Points)

If tuition increase, the enrollment of low-income students would fall (as there would be no shift outward of these students demand).

4) Suppose that the supply curve for cigarettes is a horizontal line at $2 per pack. Suppose that 1000 packs are sold at this price. Further suppose that the price elasticity of demand is -2. (To compute percentage changes, use the formula: \( \frac{X_1 - X_0}{X_0} / \frac{P_1}{P_0} \))

a. If the government imposes a 50 cent tax per pack, what effect will this have on the quantity sold? (5 Points)

Price increases from $2 to $2.50, or 25%.

\( \frac{\Delta Q}{\Delta P} = -2 \)
\( \frac{\Delta Q}{25\%} = -2 \)
\[ \% \Delta Q = -2 \times 25\% = -50\% , \text{ or from 1,000 down to 500 packs} \]

b. Compute the deadweight loss caused by the imposition of the tax (assume that the demand curve is linear (i.e., not curved)). (5 Points)

\[
\text{DWL} = \text{Loss to CS} = \frac{1}{2} \times (1000-500) \times ($0.5) = $125
\]

c. Suppose the cross-price elasticity of demand for chewing tobacco is +0.8. Compute the effect of the cigarette tax have on the demand for chewing tobacco. Are cigarettes and chewing tobacco complements or substitutes? Explain. (5 Points)

\[
\frac{\% \Delta Q_{\text{Chewing Tobacco}}}{\% \Delta P_{\text{Cigarettes}}} = 0.8
\]
\[
\frac{\% \Delta Q_{\text{Chewing Tobacco}}}{25\%} = 0.8
\]
\[
\% \Delta Q_{\text{Chewing Tobacco}} = 0.8 \times 25\% = 20\%
\]

They are substitutes since the cross-price elasticity is positive.

5) Suppose that an individual can earn $5 per hour if he chooses to work. Suppose that we institute a welfare program that gives a person who does not work $50 per week. Further, for each dollar earned from work, assume that the welfare contribution is reduced by one dollar (e.g., if he works 1 hour, he will get a welfare check of $45). Assume that the person has 60 hours in each week that could be spent at work.

a) Draw this individual’s budget set in the graph below (Note that the x-axis is Hours NOT Worked – if you don’t work any hours, you have 60 hours not worked): (5 Points)
b) Next suppose that the government changes the welfare program. Again, suppose that the welfare program gives $50 per week if the individual does not work. However, the welfare check is reduced by $0.50 for each dollar earned by work (e.g., if he works 1 hour, he will get a welfare check of $50 – 0.5*5 = $47.50). Draw this individual’s budget set in the graph below: (5 Points)

Income (Pay + Welfare)

$300

$50

Hours NOT Worked

50

60

c) How would the new program (in part b) affect the hours worked of a worker who worked 15 hours under the old program (in part a)? Describe both the
income and substitution effects (assume that leisure (i.e., not working) is a normal good). (5 Points)

For this worker, the welfare program would reduce the value of each hour of work from $5 per hour down to $2.50. This will cause a substitution effect away from work and towards leisure. Also, this person has more income -- Since leisure is a normal good this person will work less.

6) Suppose that at an interest rate of 10%, an individual who lives two periods decides to borrow money in the first period. If the interest rate falls, could second period consumption rise? Explain. (7 Points)

The price of C1 has fallen – thus, we will substitute towards C1 and away from C2. However, we are now wealthier (our debt will require less interest payment) – if C2 is a normal good, the income effect would raise C2. If the income effect dominates the substitution effect, C2 could rise.

7) You are given the following supply and demand curves:

\[ Q_d = 50 - \frac{P}{2} \]
\[ Q_s = -130 + 4P \]

a) Compute the equilibrium price and quantity.

\[ 50 - \frac{P}{2} = -130 + 4P \]
\[ 180 - P/2 = 4P \]
\[ 180 = P/2 + 4P \]
\[ 180 = 4.5P \]
\[ 180 / 4.5 = P \]
\[ 40 = P \]
\[ Q_d = 50 - 40/2 = 30 \]
\[ Q_s = -130 + 4*40 = 30 \]

b) Graph the supply and demand curves and label the equilibrium price and quantity.
c) Compute the consumer surplus.

\[ CS = \frac{1}{2} \times (100 - 40) \times 30 \]
\[ CS = \$900 \]

Now, suppose the government places a price ceiling of $38 on this good.

d) Compute the new quantity that will be sold.

At \( P = $38 \), supply will equal \(-130 + 4 \times 38 = 22\).
At this price, demand will equal \(50 - 38/2 = 31\). The extra 9 is a shortage that would not be sold. Only 22 will be sold.

e) Are consumers better or worse off? Discuss. (No calculation is necessary).

Those consumers who continue to buy the product gain surplus (as they pay a lower price). However, those consumers who can no longer buy the product lose surplus. The overall effect on consumer surplus is ambiguous in general (although it can be computed for this problem and is done below).
First, start with the assumption that the consumers who by the 22 units of the good are the ones with the highest willingness to pay (note -- this is not guaranteed – anyone who is willing to pay $38 may be the one who gets the product). At a quantity of 22 units, the willingness to pay for the good is:

\[
\begin{align*}
Q_d &= 50 - P/2 \\
22 &= 50 - P/2 \\
22 - 50 &= -P/2 \\
-38 &= -P/2 \\
$76 &= P = \text{highest willingness to pay}
\end{align*}
\]

We can then compute the lost consumer surplus triangle =
\[
\frac{1}{2} * ($76 - $40) (31 - 22) = $162
\]

Now, those who still by the good gain $2 * 22 = $44.

So, the gain in consumer surplus is less than the loss in consumer surplus, so consumers are worse off.

8) Jenny smokes cigarettes and chews gum. Suppose there is no tax on either good to start.

a) The government adds a $1 per pack tax on cigarettes. Use a budget constraint graph to show what will happen to Jenny’s consumption of cigarettes and chewing gum. Explain and list all assumptions. Explain what happens to Jenny’s marginal rate of substitution of gum for cigarettes.

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*Note: The graph shows the budget constraint for Jenny's consumption before and after the tax is implemented.*
<table>
<thead>
<tr>
<th></th>
<th>Cigarettes</th>
<th>Gum</th>
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<tbody>
<tr>
<td>Substitution Effect</td>
<td>-</td>
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<tr>
<td>Income Effect</td>
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<td>Total Effect</td>
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Assuming that each good is normal, the income effect would be negative on both. If either good is inferior, then the income effect would be positive.

Since the price of cigarettes goes up, the MRS, which equals \( \frac{P_{\text{cigarettes}}}{P_{\text{gum}}} \) will also rise. That is, after she re-optimizes, she will be willing to give up more gum for one cigarette.

b) Now, after the government receives all this tax revenue, suppose they decide to give some of it back and send everyone (including Jenny) a check. Explain what will happen to Jenny's consumption of cigarettes and chewing gum relative to your answer in part a (after the tax is imposed). List all assumptions.

This rebate has a pure income effect. If we assume that both goods are normal, consumption of both will rise relative to the amounts after the tax is imposed.

9) Low-income and high-income households have different demands for milk:

Low-Income Demand: \( P = 4 - Q \)

High-Income Demand: \( P = 3 - Q/2 \)

a) Compute an equation (or equations) for the market demand curve.

Note that low-income households are willing to pay up to $4, which is higher than the intercept for the high-income households, $3. Thus, the total demand curve will be just the low-income demand for prices between $3 and $4.

For price between $0 and $3, we need to sum the quantity's demanded. First, manipulate the equations to have \( Q \) by itself:

Low-Income Demand: \( P = 4 - Q \)

\[
\begin{align*}
P - 4 &= -Q \\
-P + 4 &= Q
\end{align*}
\]

High-Income Demand: \( P = 3 - Q/2 \)

\[
\begin{align*}
P - 3 &= -Q/2 \\
-2P + 6 &= Q
\end{align*}
\]
Now, add these together:

Total demand = \((-P + 4) + (-2P + 6) = -3P + 10\)

b) Suppose the government gives low-income households a voucher for one gallon of milk. Explain what will happen to the market price of milk. No calculation needed.

If we assume that milk is a normal good, this will raise low-income consumers demand for milk (think about it this way, at any particular price, consumers will want more milk). This will shift the market demand curve out and (assuming the supply curve slopes upwards) will raise the price of milk.

10) Bill is planning an outdoor concert which will cost $20,000 to produce. If it is sunny, the concert will generate $120,000 of revenue, so Bill will earn $100,000 net of expenses. If it does rain, there will be no revenue, so Bill will lose $20,000. There is a 20% chance of rain.

An insurance agent has offered Bill a policy. The policy costs $10,000. If it rains, Bill will receive a check for $40,000 from the insurance company—otherwise, he receives nothing.

a) What is the expected return if Bill does not purchase the insurance?

\[
E[X] = 0.8 \times $100,000 + 0.2 \times (-$20,000)
E[X] = $80,000 - $4,000
E[X] = $76,000
\]

b) What is the expected return if Bill does purchase the insurance?

\[
E[X] = 0.8 \times ($100,000 - 10,000) + 0.2 \times (-$20,000 + $10,000 + $40,000)
E[X] = 0.8 \times ($90,000) + 0.2 \times ($10,000)
E[X] = $72,000 + $2,000
E[X] = $74,000
\]

c) Would the standard deviation be lower in case a or b (i.e., without or with insurance)? Explain – you do not need to calculate these standard deviations.

It would be lower in case b. In this case, the deviations of the possible returns are smaller than in case a.

In case b, the deviations are $(90,000 - 74,000)$ and $(10,000 - 74,000)$.
In case a, the deviations are (100,000 – 76,000) and (-20,000 – 76,000).

d) If Bill was risk averse, would he purchase the insurance? Explain.

Maybe. It depends on his degree of risk aversion. If he was only mildly risk averse, he may choose to take risk as the cost of the insurance policy may be too high. If he is very risk averse, he would be willing to pay a high premium to reduce his risk.

e) Using your answers above, explain why U.S. government bonds pay a lower expected return than the typical U.S. stock.

Individuals who are risk averse are willing to receive a lower expected return if they can reduce their risk. Conversely, investors must be compensated with higher expected returns to induce them to buy a riskier investment.

The returns on U.S. government bonds have less variance than the return on stocks. Thus, for anyone to be willing to buy stock, they must believe that the expected return on stocks is higher. This can only occur if the current price on stock is well below the expected future value of the stock – thus, the expected return is higher. Stock and bond prices will adjust until the higher expected return for holding a stock just offsets the "cost" of holding a riskier asset.