1. (6 points) The East Lansing Public School District purchased an old church several years ago for a price of $500,000. The school system uses half of this old church for the school district’s administrative offices and leases the other half to the MSU community music school. MSU pays the East Lansing Public School District $150,000 per year to lease this space. The East Lansing Public School District may move their administrative offices to the Hannah Community Center which the City of East Lansing owns. The City of East Lansing has agreed not to charge the school district any rent for the space in the Hannah Community Center. When Mike Conlin asked Rich Pugh (the Director of Finance for the East Lansing Public School District) about the opportunity cost associated with keeping the administrative offices at the old church, Rich emailed that half of the utilities associated with the old church amounted to $30,000 per year. Rich is a smart guy, but does this $30,000 represent the opportunity cost associated with the East Lansing Public School District keeping its administrative offices at the old church instead of moving them to the Hannah Community Center? Describe in detail how one would accurately determine this opportunity cost. What would it depend on? Be precise in your answer.

There are obviously a number of correct answers to this. Many people wrote that if the East Lansing Public School District does not use the office space in the old church, they may be able to rent it out or they may choose to sell the property. Whether the utilities are part of the opportunity cost depends on whether the new tenant in the old church is responsible for paying utilities and the utilities at the Hannah Community Center may also affect the opportunity cost if the East Lansing Public School District pays them.

2. (8 points) Kalin Lucas is the point guard on the MSU basketball team. He is a very good basketball player with an NBA career in his future. Kalin is deciding whether to enter the 2010 NBA draft or play another year at MSU and then enter the 2011 NBA draft. The NBA draft occurs every year at the end of June. Suppose Kalin believes that if he enters the 2010 NBA draft, he will agree to a 5 year contract that pays him a guaranteed $4M ($4,000,000) a year starting in 2010. (For simplicity, assume that Kalin would receive the first $4M payment in June of 2010 and the last in June of 2014.) If Kalin plays next year at MSU and then enters the 2011 NBA draft, he believes he will sign a 5 year contract for a guaranteed $4.7M per year. (For simplicity, assume that Kalin would receive the first $4.7M payment in June of 2011 and the last in June of 2015.) If Kalin decides to play for MSU next year, he will purchase an insurance policy in June of 2010 because of the risk of a career ending injury. Suppose the insurance policy stipulates that if Kalin has a career ending injury while playing for MSU, he will receive insurance payments equivalent to those associated with the NBA contract he would have signed in 2011 (basically 5 annual payments of $4.7M starting in June of 2011 with the last being in June of 2015). Suppose this insurance policy will cost Kalin $1M to be paid in June of 2010. Assume that Kalin’s annual interest rate is 10%.

a. If Kalin expects not to work after his NBA career or if he collects the insurance payments, should Kalin enter the 2010 NBA draft or stay at MSU next year and then enter the 2011 NBA draft? Assume that this decision is strictly based on monetary considerations. Show your calculations.

PDV of payoff if enter 2010 NBA Draft:
4+4/1.1+4/(1.1)^2+4/(1.1)^3+4/(1.1)^4 = 16.68 M
PDV of payoff if stay at MSU next year and enter 2011 NBA Draft:
-1+4.7/1.1+4.7/(1.1)^2+4.7/(1.1)^3+4.7/(1.1)^4 +4.7/(1.1)^5 = 16.82 M
Therefore, Kalin should stay at MSU for the year and enter 2011 NBA Draft.

b. Now suppose that after his 5-year NBA career, Kalin expects to take over for Tom Izzo as MSU men’s basketball head coach. If he plays for MSU next year, is injured, and collects his insurance payments, Kalin expects to become the head coach at MSU starting in June of 2011. For simplicity, assume that this probability of Kalin getting injured is .10. Suppose Kalin expects his compensation as head coach to be $1M per year and this payment is collected in June of each year. He also expects to retire at age 65 no matter what. If this is the case, should Kalin enter the 2010 NBA draft or stay at MSU next year and enter the 2011 NBA draft? As in part a), assume that this decision is strictly based on monetary considerations. Show your calculations.

PDV of payoff if enter 2010 NBA Draft:
4+4/1.1+4/(1.1)^2+4/(1.1)^3+4/(1.1)^4 +1/(1.1)^5 = 17.30 M
PDV of payoff if stay at MSU next year and enter 2011 NBA Draft:
-1+4.7/1.1+4.7/(1.1)^2+4.7/(1.1)^3+4.7/(1.1)^4 +4.7/(1.1)^5 + .1[1/1.1+1/(1.1)^2+1/(1.1)^3+1/(1.1)^4 +1/(1.1)^5] = 17.20 M
Therefore, Kalin should enter the 2010 NBA draft. I only consider the PDV of payments until 2015 because the PDV of payments after 2015 is the same no matter what Kalin decides.
3. (8 points) Below is an excerpt from a December 31, 2009 USA Today article entitled “Garlic prices soar in China amid flu fears; Despite no scientific evidence, supporters of pungent bulb say it wards off H1N1 virus”.

Wrapped up in earmuffs and a heavy jacket to fight the Beijing winter, Liu Zhan shows little sign of soaring wealth. Until he removes his gloves -- and reveals a large gold ring. At the Chinese capital's biggest vegetable wholesale market, other traders call him "Millionaire Liu."

The pungent root of that nickname is stacked in bags on and around Liu's haulage truck. Garlic prices have jumped so high in China that the crop has outperformed gold and stocks to be the country's best performing asset this year.

As H1N1 swine flu continues to worry China's leaders -- who are rolling out a nationwide vaccine program -- its people seek a more traditional remedy. Just as some Chinese turned to turnips to prevent the SARS virus in 2003, garlic has emerged as a swine flu fighter in 2009.

"Garlic kills bacteria, and I eat at least half a bulb each day," says Liu, 43, whose prices have leapt from just five cents a pound in February to almost 55 cents today.

Suppose many Chinese enjoy a dish containing Chinese eggplant topped with a chili garlic sauce. (For simplicity, assume that people’s tastes and preferences for this dish did not change due to the H1N1 swine flu.) This dish contains a great deal of garlic and, because of that, the increase in the price of garlic from 5 cents to 55 cents has affected the demand for Chinese eggplant.

Suppose the demand in China for eggplant is depicted below when the price of garlic is 5 cents (D₅) and when the price of garlic is 55 cents (D₅₅).

![Graph of Demand for Eggplant in China]

- a. Based on the graph above, are eggplant and garlic substitutes or complements in China? Explain in detail.

When the price of garlic increases, the demand for eggplant decreased so eggplant and garlic are complements. Part b calculated a negative cross price elasticity which also indicates that they are complements.

- b. Based on the graph above, what is the cross price elasticity of demand for Chinese eggplant and garlic when the price of Chinese eggplant is $1? Show calculations and explain.

The cross price elasticity of demand is just the percent change in quantity demanded of eggplant [(400-500)/500] divided by the percent change in the price of garlic [(55-5)/5]. Therefore, the cross price elasticity of demand is -.02.
4. (10 points) Panasonic sells their 46-inch plasma television at a price of $1,500. The total revenue Panasonic obtains from this television is $1.5M ($1,500,000). Panasonic is considering dropping the price of this television from $1,500 to $1,400. Panasonic expects that lowering the price to $1,400 will increases its revenue from $1.5M to $1.68M.

a. What is the price elasticity of demand for the Panasonic 46-inch plasma television? Show your calculations.

Note first that the quantity demanded at a price of $1,500 is 1.5M/1500=1000 and the quantity demanded at a price of $1,400 is 1.68M/1400=1200. The price elasticity of demand is just the percent change in quantity demanded \([(1200-1000)/1000]\) divided by the percent change in the price \([(1400-1500)/1500]\). Therefore, the price elasticity of demand is -3.

b. At a price of $1,500, is the demand for the Panasonic 46-inch plasma television elastic or inelastic? Explain.

It is elastic because -3<-1 and because a price decrease results in increased revenue.

c. Can you determine whether Panasonic’s profits will increase or decrease as a result of the price decrease? Explain in detail.

You cannot determine whether profits increase or decrease. The price decrease results in an increase in revenue from $1.5M to $1.68M. Whether this increases or decreases profits depends on whether total costs increase by more or less than .18M when you increase output from 1000 to 1200.

5. (6 points) The average total cost (ATC) for a firm if it produces 40 units of output (Q) is $20 and the firm’s total fixed cost (TFC) is $350. Suppose the firm’s average variable cost (AVC) is $10 if it produces 39 units of output.

a. Based on the above information, what is the firm’s marginal cost (MC) associated with the 40th unit? Show calculations.

MC of 40th unit is 60 based on table below.

b. Suppose this firm can sell all 40 units for a price of $30 per unit but to sell 41 units, the firm would have to lower the per unit price to $25. Suppose also that the marginal cost (MC) of the 41st unit is $50. What are the firm’s profits if it sells 40 units? What are the firm’s profits if it sells 41 units? Show calculations.

Based on table below, profits at 40 units of output are 400 and profits at 41 units of output are 175.

<table>
<thead>
<tr>
<th>Q</th>
<th>TFC</th>
<th>TVC</th>
<th>TC</th>
<th>AFC</th>
<th>AVC</th>
<th>ATC</th>
<th>MC</th>
<th>Total Revenue</th>
<th>Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>39</td>
<td>350</td>
<td>390</td>
<td>740</td>
<td>10</td>
<td>800</td>
<td>800</td>
<td>60</td>
<td>40*30=1200</td>
<td>1200-800=400</td>
</tr>
<tr>
<td>40</td>
<td>350</td>
<td>450</td>
<td>800</td>
<td>20</td>
<td>100</td>
<td>50</td>
<td></td>
<td>41*25=1025</td>
<td>1025-850=175</td>
</tr>
</tbody>
</table>

6. (3 points) At the present output level, a firm that does not price discriminate is in the following position: Output= 2,000 units, Price=$10, Marginal Revenue= $7, Average Total Cost= $29, Average Fixed Cost= $18, Marginal Cost= $7. Is this firm maximizing profits? EXPLAIN IN DETAIL. (Hint: You may want to use a graph in your explanation.)

The firm is not maximizing profits even though the firm is producing at an output where MR=MC. The reason they are not maximizing profits at an output of 2,000 units is because total revenue is less than total variable costs which means the firm would be better off producing zero units. The firm’s total revenue is 2,000*10=20,000 and the firm’s total variable cost is TC-FC= ATC*Q-AFC*Q=29*2,000-18*2,000=22,000. OR, just notice that the AVC=29-18=11 is less than the price of $10.
7. (12 points) The graph below depicts the cost curves for a particular firm.

Suppose the firm is currently producing an output of 6 units and making profits of -$12 (negative $12 or a loss of $12).

a. What is the firm’s total revenue obtained from selling the 6 units of output? Show calculations.

**Total cost at an output of 6 is ATC*Q=18*6=108. If profits are -$12, then total revenue must be 96.**

b. Suppose the firm’s profits would decrease from -$12 to -$20 if the firm reduces output from 6 units to 5 units. How much does the firm’s total revenue change when the firm reduces output from 6 units to 5 units? Show calculations.

**Based on the marginal cost curve, total costs are $22 less at an output of 5 than an output of 6. If profits decrease by $8, then total revenue must have decreased by 30 when output decreases from 6 to 5 units.**

c. Suppose the firm’s only fixed costs involve a factory and assume two-thirds of this fixed cost is sunk. In other words, assume that the firm can sell the factory for a third of the total cost involved in constructing the factory. If this is the case, could the firm be maximizing profits by producing 6 units of output and making profits of -$12? Explain in detail.

**Based on the graph above, you can calculate the total fixed costs to be $30. (Take any output, say 6 and calculate the AFC which is $5 – calculate TFC=AFC*Q=5*6=30.) Because two-thirds of the fixed costs are sunk, the firm’s profits would be negative $20 if the firm did not produce an output of zero. They are better off producing an output of 6 because -$12>$-20. Therefore, it could be the case that the firm maximizes profits by producing 6 units. Whether it is the case or not depends on whether the marginal revenue equals the marginal cost at an output of 6. (Cannot determine this based on the information provided.)**
a) If the firm is unable to price discriminate, how much will the firm’s profits change if the firm increases its output from 6 units to 7 units? Show calculations. Be precise in your answer by making use of the MC curve.

Total revenue at a quantity of 6 is 6*4=24 and total revenue at a quantity of 7 is 7*2=14. Therefore, the marginal revenue associated with the 7th unit is -10. The marginal cost of the 7th unit is 11 (go to 6.5 and use the MC curve) so the firm’s profits would decrease 21 if the firm increases output from 6 to 7.

b) If the firm is unable to price discriminate, what are the maximum profits for the firm? Show calculations.

Profits are maximized at an output of 3. The profits would be 10*3 – 5.6*3= 13.20.
9. (6 points) Suppose you own a company that produces lawn furniture and you are currently selling this furniture from your retail store located in East Lansing. For simplicity, assume that you produce only one type of lawn furniture whose annual demand is depicted on the graph below. The marginal cost associated with producing lawn furniture is constant at $1000 and fixed costs are $40,000.

a) If you do not price discriminate, what are your maximum profits? Show your calculations and use the graph above to depict how you profit maximized.

Profits are maximized where \( MR = MC \) which is at an output of 80. At \( Q = 80 \), Price = 3000 and Profits = 3000 * 80 - 1000 * 80 - 40000 = 120,000

b) You are now deciding whether to start a website so that you can sell your lawn furniture over the internet. You understand that by selling over the internet, it will cause some customers who would have purchased the lawn furniture in your store to purchase it from your website. For simplicity, assume that if you do start a website the demand at your retail store will be cut in half - the quantity demanded at each price will be decreased by half if you start the website. (The graph below allows you to depict the new demand for the retail store.) A benefit of the website is that it will enable you to attract new customers. The demand curve associated with your website is depicted below. Also assume that another benefit of the website is that it will allow you to perfectly (1st degree) price discriminate for those consumers who purchase through your website. As before, assume you are not able to price discriminate at your retail store. The cost of hiring a company to develop and maintain your website is $20,000 per year. Should you start your website and allow some of your customers to purchase your lawn furniture over the internet? Show your calculations and use the graphs below to depict how you profit maximized.

Sell 40 units at the retail store at a price of $3000 and sell 100 units on the website where you can 1st degree price discriminate. The profits of 145000 indicates that the firm should start website.

Profits = 3000 * 40 - 1000 * 40 + 0.5 * (3500 - 1000) * 100 + 1000 * 100 - 1000 * 100 - 40000 - 20000 = 145000
10. (10 points) Condo Club Incorporated is a company that offers condominium rentals in exotic locations around the world (Hawaii, Costa Rica, Beijing, East Lansing, Paris…). Condo Club Incorporated offers rentals of these condominiums for $2000 per week (with no fixed fee/membership fee). They also offer the option of paying a certain fixed fee (i.e. "club membership fee") annually which allows individuals to receive a weekly rental price of $1000 for any of their condominiums. Condo Club’s costs include a constant marginal cost of $500 (for each weekly rental) and fixed costs of $100,000. The market demand for Condo Club’s weekly condominium rentals is based on demand from 5 Type A individuals and 10 Type B individuals. The annual demand curve for each Type A individual (DA) is depicted below, along with the annual demand curve for each Type B individual (DB).

If Condo Club cannot distinguish between Type A and Type B individuals, what fixed fee will they select to maximize profits? What will be their profits? SHOW ALL CALCULATIONS.

If an individual does not pay a membership fee, the individual still can purchase a rental for $2000. A Type A individual would purchase 6 rentals at a price of $2000 and would benefit (i.e., consumer surplus) .5*(5000-2000)*6=9000. This is represented by the blue area above. A Type B individual would purchase 3 rentals at a price of $2000 and would benefit (i.e., consumer surplus) .5*(5000-2000)*3=4500. This is represented by the red area above. Because this is the case, the maximum amount Type A would pay in terms of membership fee is the purple area above which is 1000*6+.5*1000*2=$7000 and the maximum amount Type B would pay in terms of membership fee is the green area above which is 1000*3+.5*1000*1=$3500. Given this is the case, if a membership fee of $7,000 is chosen by Condo Club, Type B will chose to not pay the membership fee and instead purchase 3 rentals at a price of 2000. This explains why the profits are calculated as they are below.

<table>
<thead>
<tr>
<th>Profits from Membership fee of $3500</th>
</tr>
</thead>
<tbody>
<tr>
<td>15<em>3500+5</em>1000<em>8+10</em>1000<em>4-5</em>500<em>8-10</em>500*4-100000= -7500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profits from Membership fee of $7000</th>
</tr>
</thead>
<tbody>
<tr>
<td>5<em>7000+5</em>1000<em>8-8-5</em>500<em>8+10</em>2000<em>3-10</em>500*3-100000= 0</td>
</tr>
</tbody>
</table>

A Membership greater than $7000 (or no membership package) so no one purchases membership

5*2000*6-5*500*6+10*2000*3-10*500*3-100000=-10000

So set membership fee at $7000.
11. Luke Landscaping is a firm located in Haslett that provides grass cutting services in the summer, landscaping services in the spring and fall, and snow plowing services in the winter. Luke Landscaping’s clientele consists of two types of customers. Type I customers value the grass cutting at $200, the landscaping at $125 and the snow plowing at $125. Type II customers value the grass cutting at $75, the landscaping at $175 and the snow plowing at $250. There are 10 Type I customers and 20 Type II customers. Assume Luke Landscaping cannot distinguish Type I from Type II customers. Luke Landscaping has (constant) marginal costs of $50 for the grass cutting services, marginal costs of $75 for the landscaping services, and marginal costs of $25 for the snow plowing services. The table below summarizes this willingness to pay and cost information.

<table>
<thead>
<tr>
<th>Service</th>
<th>Type I (10)</th>
<th>Type II (20)</th>
<th>Marginal Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Cutting Services</td>
<td>200</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>Landscaping Services</td>
<td>125</td>
<td>175</td>
<td>75</td>
</tr>
<tr>
<td>Snow Plowing Services</td>
<td>125</td>
<td>250</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>450</td>
<td>500</td>
<td>150</td>
</tr>
</tbody>
</table>

a) What are Luke Landscaping’s maximum profits if they decide not to bundle. That is if Luke Landscaping decides to set a price for the grass cutting ($p_G$), a price for the landscaping ($p_L$), and a price for the snow plowing ($p_S$)? Show calculations.

$p_G=200$, $p_L=175$, $p_S=250$. Profits=10*(200-50)+20*(175-75)+20*(250-25)=8000

b) What are Luke Landscaping’s maximum profits if they decide to bundle the grass cutting, landscaping and snow plowing by setting a single price for all three services ($p_{GLS}$)? Show calculations.

$p_{GLS}=450$, Profits=10*(450-150)= $9000

c) What are Luke Landscaping’s maximum profits if they decide to use a mixed bundling pricing strategy? Show calculations and be complete in your calculations.

You don’t have to go thru too many calculations if you use a little logic. First consider targeting the bundle at Type II. You will want to set the price of the bundle to be 500. You definitely want Type I to buy the grass cutting because they are willing to pay a lot more than marginal cost. In addition, you would like Type I to purchase the landscaping and snow plowing but the problem with that is that you will have to reduce the price of the bundle if you sell these services separately because, if you don’t, Type II will buy the landscaping and/or plowing individually. Instead of offering them individually, you can “bundle” it with grass cutting because that way you do not have to reduce the price of the bundle containing all three services to induce Type II to purchase the bundle. You really want to bundle grass cutting with snow plowing because Type I’s willingness to pay for these services are the same but the marginal cost of snow plowing is only $25 relative to the $75 for landscaping. If you target the bundle at Type I, set the price of the bundle to be $450 and then induce Type II to purchase both landscaping and snow plowing because Type II’s are willing to pay a lot more than the marginal cost of the service. You can induce Type II to purchase the landscaping and snow plowing by pricing them such that Type II obtains $50 surplus from buying these services.

$p_{GLS}=500$, $p_G=200$ : Profits=10*(200-50)+20*(500-150)=8500

$p_{GLS}=500$, $p_{GL}=325$ : Profits=10*(325-125)+20*(500-150)=9000

$p_{GLS}=500$, $p_{GS}=325$ : Profits=10*(325-75)+20*(500-150)=9500

$p_{GLS}=450$, $p_L+p_S=375$ (with $p_L\leq175$ and $p_S\leq250$) : Profits=10*(450-150)+20*(375-100)=8500

So $p_{GLS}=500$, $p_{GS}=325$ maximizes profits.
12. (7 points) Matt Ritter is responsible for the 2nd Annual MBA Mustache Competition Benefitting CureSearch. As part of this fund raiser, faculty and MBA students can nominate other faculty and students. This nomination requires the faculty or student to grow a mustache unless the nominated individual chooses to “buyout”. A “buyout” requires the nominated faculty and student to pay a certain amount to relieve him/her of the obligation of growing a mustache. Matt set the buyout price at $30 this year. Assume that Matt had paid attention when he took MBA814 last year and decided to use 3rd degree price discrimination for these “buyouts” – basically, set the price of the buyout for faculty different than the price for an MBA student. Also, assume Matt knew that the demand for MBA student buyouts (Dₜₜ) and the demand for faculty buyouts (Dₕ) are as depicted below.

- MBA Student Demand
- Faculty Demand

<table>
<thead>
<tr>
<th>MBA Student Demand</th>
<th>Faculty Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) If Matt wanted to maximize the amount raised for CureSearch, what price should he set for a faculty buyout (ₚₕ) and what price should he set for a student buyout (ₚₜₜ)? At these prices, how much would be raised for CureSearch? Show calculations.

Set a price of 30 for students and a price of 100 for faculty. The amount raised would then be 30*15+100*5=950.

b) Based on the prices in part a), what is the own price elasticity of demand for the faculty and what is the own price elasticity of demand for the students? Show calculations.

Own price elasticity for faculty = (1/slope)(P/Q)=(1/-20)(100/5) = -1

Own price elasticity for students = (1/slope)(P/Q)=(1/-2)(30/15) = -1

c) Consider the own price elasticities in part b). Are they what you expected? Explain.

Because the marginal cost is zero, the quantities and prices are selected to maximize revenue and revenue is maximized when own price elasticity equals -1.
13. (8 points) Twichells is a dry cleaner located on MAC Avenue in downtown East Lansing. For simplicity, assume that Twichells only dry cleans shirts and they have two types of customers (Type A and Type B). Also assume that Twichells cannot distinguish between the types. Assuming that the dry cleaned shirt can be picked up in two days, Type A’s are willing to pay a maximum of $4 for dry cleaning a shirt and Type B’s are willing to pay a maximum of $2.50. For simplicity, assume each consumer only demands a single dry cleaned shirt. There are 80 Type A’s and 150 Type B’s each day. Suppose the opportunity cost associated with waiting more than two days for the dry cleaned shirt is $0.75 per day for Type A’s and $0.25 per day for Type B’s. Finally, assume that Twichells’ marginal cost of dry cleaning a shirt is constant at $0.50 and their fixed costs are zero.

<table>
<thead>
<tr>
<th></th>
<th>Type A (80)</th>
<th>Type B (150)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Willing to Pay if dry clean shirt is available in two days</td>
<td>$4</td>
<td>$2.50</td>
</tr>
<tr>
<td>Opportunity Cost per day associated with waiting more than two days</td>
<td>$0.75 per day</td>
<td>$0.25 per day</td>
</tr>
</tbody>
</table>

a) Twichells currently does not price discriminate but instead offers the same price to all consumers. Given that Twichells does not price discriminate, what are their maximum daily profits and what price do they charge for dry cleaning a shirt? Show all calculations.

Set price at $4 and profits are 80*(4-.5)=280. Set price at $2.50 and profits are 230*(2.50-.5)=460. Therefore, set a price of $2.50.

b) Now suppose Twichells is deciding whether to price discriminate by charging a certain price (p_S) if the customer wants the shirt in two days and a lower price (p_R) if the customer is willing to wait more than two days for his shirt. In terms of the production process, Twichells would dry clean all shirts within two days of the shirt being dropped off no matter when the shirt is expected to be picked up. Twichells would have to “store” the shirts not picked up in two days in a storage room next to the dry cleaners. The owner of the storage room is willing to rent it to Twichells for a price of $10 per day. To maximize profits, how many days would Twichells hold the shirt for those customers who chose to pay the lower price (p_S)? What price would Twichells charge for a shirt available to be picked up in two days (p_R) and what price would they charge for a shirt available to be picked up in more than the two days (p_S)? Are profits greater than when Twichells did not price discriminate? Show calculations and explain.

<table>
<thead>
<tr>
<th>Days delay to get sales price</th>
<th>p_S</th>
<th>p_R</th>
<th>Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.25</td>
<td>3.00</td>
<td>150*(2.25-.5)+80*(3-.5)-10=$452.50</td>
</tr>
<tr>
<td>2</td>
<td>2.00</td>
<td>3.50</td>
<td>150*(2.00-.5)+80*(3.50-.5)-10 = $455</td>
</tr>
<tr>
<td>3</td>
<td>1.75</td>
<td>4.00</td>
<td>150*(1.75-.5)+80*(4-.5)-10=$457.50</td>
</tr>
<tr>
<td>4</td>
<td>1.50</td>
<td>4.00</td>
<td>150*(1.50-.5)+80*(4-.5)-10=$420</td>
</tr>
</tbody>
</table>

Therefore, profits cannot be increased by this type of price discrimination. A number of people assumed that the cost of the storage area increased by $10 for each additional day of delay. I did not take points off for this because of the manner the question was worded.
After retiring from MSU, Mike Conlin decides to open a bagel store in East Lansing called Conlin’s Bagels (clever marketing guy that Conlin). In an effort to expand quickly, Conlin decides to franchise Conlin’s Bagels. (Conlin is the franchisor.) He has decided to expand into Ann Arbor and open two franchise locations. Suppose the market demand in Ann Arbor for Conlin’s Bagels is given on the graph below. This is the bagel demand for both stores (not for each store). The franchisees must buy the ingredients for the bagels from Conlin and Conlin charges $.40 for the ingredients needed to make one bagel. Conlin also charges an up-front/fixed fee. Besides a total fixed cost of $100, the cost of the ingredients and the up-front fee are the only other costs for the franchisee. (This fixed cost is for each store.)

If Conlin franchises one store to Prof. Wagner and the other to Prof. Morgeson, the professors will compete in the Ann Arbor bagel market. Suppose this competition results in both setting a price of $2 per bagel. Suppose half the customers go to Prof. Wagner’s store and half go to Prof. Morgeson’s store when they set the same price. What is the maximum amount that Conlin can charge as an up-front fee and still have Prof. Wagner and Prof. Morgeson want to be open franchises of Conlin’s Bagel? What is Conlin’s total revenue from this 2-part pricing? (Assume that Prof. Wagner and Prof. Morgeson are smart in terms of the maximum they are willing to pay in up-front/fixed fees.) SHOW CALCULATIONS.

At a price of $2 where each sell 200 units, both Prof. Wagner and Prof. Morgeson make profits of $2*200-.4*200-100-X=220-X where X is the upfront fee charged by Conlin. The maximum Conlin can charge as an upfront fee to each is either 220 if the fixed costs are not sunk or 320 if the fixed costs are sunk. Either answer is correct. Conlin’s maximum revenue from this 2-part pricing is $2*220+.4*400=600 or $2*320+.4*400=800.
15. (8 points) Suppose you own a hair salon on Grand River that provides haircuts for women and men. Let the daily demand curves below depict the demand from women (\(D_w\)) and the demand for men (\(D_m\)). (The demand for men is perfectly elastic up to a quantity of 5. Think of this as 5 men who are willing to pay $80 each for a haircut and there are no other men who demand haircuts at your hair salon.) Let the marginal cost of a haircut be the same for a woman as a man and let this marginal cost be constant at $20. Assume the daily fixed costs associated with your hair salon are $100.

<table>
<thead>
<tr>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Graph of Women's Demand and Marginal Cost" /></td>
<td><img src="image2" alt="Graph of Men's Demand and Marginal Cost" /></td>
</tr>
</tbody>
</table>

a) What are your hair salon’s maximum daily profits if you third degree price discriminate by charging women a different price than men? Show your calculations.

\[
\text{Profits} = 60 \times 4 - 20 \times 4 + 80 \times 5 - 20 \times 5 - 100 = 360
\]

b) What would be your maximum profits if you were unable to price discriminate? Use the graph below to depict your market demand haircuts and draw the marginal revenue curve associated with this demand curve if you are unable to price discriminate. Show your calculations for maximum profits.

The marginal revenue can be plotted by looking at the change in revenue associated with each unit change in output. The salon maximizes profits at \(P=80\) and \(Q=7\). Profits are \(80 \times 7 - 20 \times 7 - 100 = 320\).
c) Now suppose that it is illegal to directly charge women a different price than men (i.e., illegal to price discriminate based on gender). However, it is legal to offer a coupon that allows the bearer of the coupon to receive a lower price. Assume that the opportunity cost of cutting a coupon is $10 for women and the opportunity cost of cutting a coupon is $30 for men. To maximize profits, what price would you charge for a haircut and what would be the value of the coupon? What are these profits? Show your calculations and feel free to use the graphs below. (These are the graphs from part a.)

Because the opportunity cost of using the coupon for women is $10, the women’s demand curve shifts downward by this amount (they are willing to pay $10 less if they have to use a coupon). Given that, the salon should have the women pay $55 for a haircut by setting the price of a haircut at $80 and the coupon value at $25. A coupon value of $25 induces the women to use it but the men would not because their opportunity cost is $30. Profits would then be $55*3.5-20*3.5+80*5-20*5-100=$322.50.
16. (10 points) Suppose a new shopping mall has opened in Lansing. Sears and Nordstrom are deciding whether to become the “anchor” stores in the mall. Assume Sears and Nordstrom decide whether or not to locate in the shopping mall at the same time. The profits for each firm are provided below in the normal form representation of the “game”. (The first number in each “box” corresponds to Sears’ profits and the second number corresponds to Nordstrom’s profits.)

<table>
<thead>
<tr>
<th></th>
<th>Locate in the Shopping Mall</th>
<th>Do Not Locate in the Shopping Mall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sears</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locate in the Shopping Mall</td>
<td>20 , 40</td>
<td>-80 , 0</td>
</tr>
<tr>
<td>Do Not Locate in the Shopping Mall</td>
<td>0 , -10</td>
<td>0 , 0</td>
</tr>
</tbody>
</table>

a) Does Sears or Nordstrom have a dominant strategy? Explain.

No, Sears’ best strategy (with highest payoff) depends on Nordstrom’s strategy.
In addition, Nordstrom’s best strategy (with highest payoff) depends on Sears’ strategy.

b) Identify all Pure Strategy Nash Equilibria.

{Sears to locate in the shopping mall, Nordstrom to locate in the shopping mall}
{Sears does not locate in the shopping mall, Nordstrom does not locate in the shopping mall}

c) Identify the mixed strategy Nash Equilibrium. Show calculations.

Let $P_s$ denote the probability that Sears locates in the shopping mall and $P_n$ denote the probability that Nordstrom locates in the shopping mall.

Nordstrom randomizes so that Sears is indifferent between locating in the mall and not locating in the mall. If this is the case, a best response for Sears is to randomize.

**Sears’ expected payoffs given that Nordstrom locates in the shopping mall with probability $P_n$:**

Locate: $20P_n + (-80)(1-P_n) = -80 + 100P_n$

Don’t Locate: $0P_n + 0(1-P_n) = 0$

These payoffs are equal when $P_n = .8$

**Nordstrom’s expected payoffs given that Sears locates in the shopping mall with probability $P_s$:**

Locate: $40P_s + (-10)(1-P_s) = -10 + 50P_s$

Don’t Locate: $0P_s + 0(1-P_s) = 0$

These payoffs are equal when $P_s = .2$. 

---

OLD EXAM PROBLEMS ON May 19th MATERIAL.
17. (10 points) Suppose Gang A and Gang B sell drugs in the same area, but their customers can choose to buy drugs in other areas the gangs don’t operate in. If there are conflicts between the two gangs, people will be less likely to come buy drugs from them so they will have to lower their prices to sell their drugs, hurting their profitability. The gangs’ profits are represented by their payoffs in the extensive form game below.

\[
\begin{array}{c|c|c|c|c}
 & \text{Fight} & \text{Don’t Fight} \\
\hline
\text{Gang A} & \text{Gang B} & \text{Gang B} \\
\hline
\text{Retaliate} & -50 & 70 & 20 & 65 \\
\text{Don’t Retaliate} & -30 & 10 & 50 \\
\text{Attack} & 10 & 50 & \text{Don’t Attack} \\
\end{array}
\]

**a)** What is the Subgame Perfect Equilibrium of the above game? Explain.

**Gang A Fight: Gang B Don’t Retaliate if Gang A Fights and Gang B Don’t Attack if Gang A Don’t Fights**

It is depicted above by the red lines.

**b)** Identify a Nash equilibrium that is not a Subgame Perfect Equilibrium. Explain.

The one the majority of you identified was the one below which relies on the most logical non-credible threat. It is depicted above by the red lines.

**Gang A Don’t Fight: Gang B Retaliate if Gang A Fights and Gang B Don’t Attach if Gang A Don’t Fights**
18. (8 points) You operate a restaurant that has an “all you can eat” smorgasbord. Suppose you have three types of consumers. The “Big Eater” type is willing to pay $19 for the smorgasbord, the “Moderate Eater” type is willing to pay $14 for the smorgasbord and the “Minimal Eater” type is willing to pay $11 for the smorgasbord. The cost of the food that a Big Eater type consumes is $15, the cost of the food that a Moderate Eater type consumes is $10, and the cost of the food that a Minimal Eater type consumes is $5. Suppose there are 50 Big Eater types, 100 Moderate Eater types and 70 Minimal Eater types. You cannot identify the different types of eaters. The table below summarizes this information.

<table>
<thead>
<tr>
<th></th>
<th>Big Eater</th>
<th>Moderate Eater</th>
<th>Minimal Eater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willingness to Pay</td>
<td>$19</td>
<td>$14</td>
<td>$11</td>
</tr>
<tr>
<td>Marginal Cost</td>
<td>$15</td>
<td>$10</td>
<td>$5</td>
</tr>
<tr>
<td>Number</td>
<td>50</td>
<td>100</td>
<td>70</td>
</tr>
</tbody>
</table>

If you are maximizing profits, what price would you select for your smorgasbord? What are your profits? Show your calculations.

**Profits are maximized by charging a price of 19, 14, or 11.**

At \( p=11 \), all types buy so profits \( =50(11-15)+100(11-10)+70(11-5)=320 \)
At \( p=14 \), Big and Moderate types buy so profits \( =50(14-15)+100(14-10)=350 \)
At \( p=19 \), Big types buy so profits \( =50(19-15)=200 \)

**Profits are maximized by charging a price of 14.**

19. (5 points) There are 10 buyers of a particular good and each demand one unit of the good. The good can be either low quality or high quality. All ten risk-neutral buyers value the low quality good at $100 and the high quality good at $200. There is physically only one firm that sells the good but the firm can be one of two types. A Type I firm produces a high quality good with probability .9 while a Type II firm produces a high quality good with probability .5. The firm knows what type it is but the buyers cannot observe the type. Both types of firms have constant marginal costs of $20 and this cost is the same whether it produces a high quality or a low quality good. Suppose the buyers cannot tell the difference between a high quality good and a low quality good at the time of purchase. The firm cannot differentiate a high quality from a low quality either but knows the probability that the good is of high quality. (This probability depends on whether the firm is Type I or Type II.)

Suppose Type I signals that it is a Type I firm by offering a warranty of \( W \). Let the warranty be such that the buyer can only collect the warranty if the good is of low quality. If the buyer collects the warranty, he still keeps the low quality good. For simplicity, assume all ten risk-neutral buyers are willing to pay their expected valuation for the good and that this willingness to pay does not depend on the warranty. (This is obviously not the case in the real world but it simplifies the problem.)

Calculate the minimum value of \( W \) that enables the Type I firm to credibly signal that it is the type of firm that produces a high quality product with probability .9. Provide an explanation of these calculations.

Each buyer is willing to pay \( 100*.1+200*.9=190 \) if he thinks it is the Type I firm and is willing to pay \( 100*.5+200*.5=150 \) if he thinks it is the Type II firm Therefore, the marginal benefit (from each consumer) to the firm receives from being perceived a Type I firm is 40. The marginal cost of signaling thru a warranty that the firm is Type I is \(.1*W\) for the Type I firm and \(.5*W\) for the Type II firm. To “discourage” Type II from offering the warranty in order to be perceived as Type I, it must be that \(.5*W \geq 40\) or \(W \geq 80\).