MKT 282: Data Analytics & Dynamic Pricing
(Raghunath Rao: Fall 2021)
Assignment #1

This assignment is due by midnight on 10/27/2021. Please paste your answers within this file and save it as "HW1_DP_SOLN" on Canvas at the appropriate place. If you used M.S. Excel/R (or any other statistical software) to arrive at your answers, please submit the relevant files/annotated code as well (so that you can get partial credits for your work even if your answer is incorrect). The scores from your submissions will be reweighted, and you can earn up to 75 points from this exercise.

***Only one submission per team, please- one person from each team should upload the solution**. It is the responsibility of each group to get together and finish the assignment. The team information is available under announcements on Canvas.*

Late assignments are NOT acceptable.

Team members: Carter Cowman, Chloe Estrin, Nihit Parikh, Demetri Whitsett

Part A

Abe has just become a product manager for Brand X, which has a retail price of $1. Brand X and its direct competitors sell a total of 20 million units annually; Brand X has 24% of this market.

Variable manufacturing costs for Brand X are $0.09 per unit. Fixed manufacturing costs are $900,000. The advertising budget is $500,000. The Brand X product manager's salary and expenses total $35,000. Salespeople are paid entirely by a 10% commission of the retail price. Shipping cost, breakage, insurance, and so forth are $0.02 per unit.

1. What is the $ unit contribution margin for Brand X? (10 Points)

   $0.79

2. What is Brand X's breakeven point? (10 Points)

   1,816,455.7 units

3. What market share does brand X need to break even? (10 Points)

9.08%

4. What is Brand X's profit? (10 points)

$2,357,000.0

5. *Industry demand is expected to increase to 23 million units next year. Abe is considering raising the advertising budget to $1 million. At the same time, the variable manufacturing cost decreases to $0.06 per unit.*

    a. If the advertising budget is raised and the variable manufacturing cost is reduced, how many units will Brand X have to sell next year to break even? (10 points)

    2,359,756.1 units

    b. How many units will Brand X have to sell next year for it to have the same profit as it did this year? (10 points)

    5,234,146.34 units

    c. What will Brand X's market share have to be next year to achieve the same profit that it did this year? (10 points)

    22.76%

Part B

Calculate the answers for problems 1-5 below and answer the question at the end.

BACKGROUND: Bob decides to mow lawns this summer. He buys a new lawnmower for $500 and must pay for it by the end of the summer. Each lawn mowed will cost Bob $5.00 (for fuel and labor).*
Bob will use the cost-plus pricing approach. Bob will determine the expected quantity demanded with this approach, which he will use to compute the expected cost. If Bob wants to make a 20% profit or markup on cost, he can compute the revenue needed as: RevenueNeeded = TotalCost(1+.2). He can then determine the price he needs to charge in order to generate the revenue needed.*
Note: Assume 4 weeks/month.
*In other words, assume that the lawnmower's cost will be spread across the lawns mowed this summer.

Calculate how much profit Bob will make under each of the following scenarios:

1. Bob estimates that the 10 lawns in his neighborhood will need to be mowed every week for 5 months. How much should Bob charge to mow each lawn if he wants to make a 20% profit (markup on cost)? (10 points)

   Charge $9.00/lawn to achieve a $300.00 profit

2. Bob is concerned that this spring will be unusually dry. With the drought, the 10 lawns on the block will only need to be mowed every 2 weeks for 5 months. How much should Bob charge to mow each lawn if he wants to make a 20% profit (markup on cost)? (10 points)

   Charge $12.00/lawn to achieve a $200 profit

3. Bob is concerned that this spring will be unusually dry. With the drought, the 10 lawns on the block will only need to be mowed every 2 weeks for 5 months. With the drought, Bob is afraid that he could lose 5 customers. How much should Bob charge to mow each lawn if he wants to make a 20% profit (markup on cost)? (10 points)

   Charge $18.00/lawn to achieve a $150 profit

4. The rains come and the 10 lawns on the block will need to be mowed 2 times a week for 5 months. How much should Bob charge to mow each lawn if he wants to make a 20% profit (markup on cost)? (10 points)

   Charge $7.50/lawn to achieve a $500 profit

5. The rains come and 10 lawns on the block will need to be mowed 2 times a week for 5 months. But with all the rain, the 10 homeowners on the next block do not want to mow their yards and ask Bob to mow their yards too. How much should Bob charge to mow each lawn if he wants to make a 20% profit (markup on cost)? (10 points)

Charge $6.75/lawn to achieve a $900 profit

QUESTION: What conclusions can you draw from this exercise regarding the weakness of cost-plus pricing? (20 points)

From this exercise we can conclude the following regarding the weakness of cost-plus pricing:

- Cost-plus pricing assumes each product pulls its own weight. Each product is equally accountable and comparable, and its performance is measured on profit. This is not the case for Bob's lawn mowing service because mowing a lawn when it's not raining is different than mowing a lawn when it had rained, or it is raining.
- By limiting himself to only 20% desired profit, Bob is missing out on the additional profit he could have made had he priced his lawn mowing service at a static higher price point, as the demand for his services isn't only driven by price, it has been proven to be driven by environmental/weather factors.
- Additionally, cost-plus pricing doesn't take into consideration the value Bob is offering to is customers, and the fact that his customers do not have any idea about the costs he is incurring and therefore lack insight into why his services are priced as they are
- We are also not thinking about what value are we offering to our customers which we could leverage in order to drive up customer WTP in scenarios where overall demand is low.
- Additionally, this exercise also proved the short-coming of cost-plus pricing in that often times when demand decreases, when using this strategy, it is our first thought to increase prices. However, higher prices doesn't always mean more profit as the financial gain depends on the impact of that increase on sales volume and on the impact of changes in sales volume on unit cost.

Part C

1A. Consider the following dessert menu from Shoreline Grill where the variable unit cost of each item is listed in parentheses:

Lemon Cake --$8 ($3.30)
With white chocolate apricot cream, plum fizz, watermelon granita, ginger crisp

Cool Orange Mousse –$8 ($2.75)
Light orange Mousse with almond lace, candied orange, Grand Marnier syrup

Texas Strawberry Mango Shortcake --$8 ($4.00)
With habanero honey drizzle, candied pecan

Raspberry Peach Crisp --$8 ($6.50)
Served warm. With butter oat streusel, Mexican vanilla ice cream

The manager is considering an increase in the Cool Orange Mousse price to $9.00 (which currently sells 500 units per month). This would make it the most expensive dessert item. He expects that 10% of customers who would have otherwise bought Mousse will switch to the **Texas Strawberry Mango Shortcake,** and 20% will switch to the **Raspberry Peach Crisp.**

What is the quantity of Cool Orange Mousse that Shoreline Grill still needs to sell per month to remain breakeven? (10 points)

Units of COM to Breakeven: 364

Part D

DuPont has developed a new pipe that uses Alathon24 – a polyethylene resin, which makes pipes more flexible and, therefore, less susceptible to breaking. Dupont's Alathon24 pipe will compete with existing pipe products that are competitively priced at approximately $6.50 per 100 feet.

Farmers use pipes for below-ground irrigation. If a pipe breaks before the harvest, in March, April or May, the crop damage cost is typically $40. In other months, the crop damage is negligible. Whenever a section of pipe breaks, the typical labor cost for replacing the pipe is $60. While the annual rate of failure for existing pipes is 8%, lab tests show the yearly failure rate of the Alathon24 to be 2%.

1. Compute the economic value of the new Alathon24 pipes per 100 ft to farmers for one year. (20 points)

   Economic value $10.70

Part E

Arun Singh emigrated to the U.S. in 1976 from India after 16 years as an expert on turbine controls after working with Bharat Heavy Electricals Limited, a govt. owned power equipment manufacturing firm. Singh's specialty is gas compressors' technology—big-ticket, industrial-strength machinery used to pressurize and move gases though gas pipelines and within refineries and steel mills.

Fortunately, for Mr. Singh, compressors are finicky. Any number of conditions—a change in gas mix, a fluctuation in power, a temperature change—can result in a "compressor surge." In milliseconds, the flow of gas can reverse itself. At a minimum, the surge will bring a gas pipeline to a screeching halt, requiring hours to restart. The worst case is that the surge will mangle a compressor so badly that it takes days to replace at a cost that can reach six figures.

Singh realized that what goes on in the guts of a compressor can be mathematically modeled using physics. The variables are many and the interactions complex, but ultimately the conditions leading to a surge can be described by a handful of equations. That was an important discovery. Soon after Singh arrived in the U.S., he started Compressor Controls Corp. in Minneapolis. By 1980, Singh and a few researchers from the University of Minnesota had perfected their first surge-controlling machine. Initially, their mathematically controlled version

was little better than the mechanically controlled versions that eliminated only about half of all surges on a pipeline and were priced approximately at $10,000 each. As they gained experience, however, they kept upgrading the software and hardware. Their current version eliminates 95% of naturally occurring surges (making it 90% more effective than mechanical devices). Customers who have tried the product report being very satisfied with everything but the price.

The cost of making each surge-controlling machine is minimal. The machine consists of off-the-shelf temperature and pressure sensors, a Japanese-made microprocessor, and a tiny chunk of software that fits into a mere 500 kilobytes of memory—less than you would find in many digital photos. Consequently, the manufacturing cost of the Compressor Control's equipment is no more than $1,000. However, no one else can manufacture it since no one else knows the equations that enable it to work so effectively.

Compressor control estimates the following as the direct costs of **a minor surge** (all costs are per compressor since each compressor requires a surge protector):

Labor	$ 9,000
Incremental materials, fuel	$ 6,000

More importantly, there is also an opportunity cost associated with the downtime due to a surge. Typically, these surges happen during peak seasons when the gas companies charge about $10K/hour, and a minor surge can halt the transportation for about 8 hours. Besides, the expected frequency of minor surge per compressor is 0.4 per year.

Compressor control estimates the following as the direct costs of **a major surge** (all costs are per compressor since each compressor requires a surge protector):

Labor	$ 24,000
Incremental materials, fuel	$ 11,000
Equipment (new compressor)	$180,000

Furthermore, a major surge can halt the transportation for about 24 hours. Also, the expected frequency of major surge per compressor is 0.004 per year.

Both the competitive mechanical surge controller and compressor control's product last for about 4 years.

1. Assuming 10% per annum cost of capital and that saved costs are paid at the end of the year, calculate the **Total Economic Value (TEV)** of Compression Control's electronic surge

controller assuming that the closest competing mechanical surge controllers still sell at $10,000 per unit. (50 points)

$66,800.82

2. Suppose that Compression Control prices its electronic surge controller at $50,000 per unit and faces a lot of resistance from purchasing managers. Describe at least two strategies that Compression Control might use to overcome this resistance. (15 points)

    a) Purchasing managers **may not be aware** of the true economic value that our electronic surge controller has to offer. One of the ways we can deal with the resistance from purchasing managers is to **educate them** about the differential value that our controller has as compared to our competitors, which is essentially the cost savings they will incur as a result of our product's premier surge prevention. Essentially, we must capitalize on our product's efficiencies through our marketing efforts.

    b) In addition to promoting the monetary differential value, Compressor Control can also emphasize functional value to raise willingness to pay. One way to do this is to show the trend of increased efficiency in eliminating naturally occurring surges. Over the lifetime of the Compressor Control they have moved from eliminating 50% of surges to eliminating 95% of surges. If consumers believe that this trend will continue, and if the surge-controlling machine can have its software updated after purchase, customers will be willing to pay considerably more.