**ADM 3305 A**

**Business Simulation Analytics**

**Project 2**

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**December 13, 2017**

**Introduction**

Simulation teaches us the importance of predicting the future to improve business models, functions, and plans, and to bring success and happiness to companies. This goal of success and happiness is what we had in mind when forming the idea of our project. We decided to delve into the sales of something that many canadians had access to and through simulation see if we could improve the sales performance.  For the purpose of this project we had taken the sales in units of new manufactured vehicles in Canada during 1986 - 2016. (See Attached file ‘Raw Data’ for Raw data). We retrieved the data from Statistics Canada, which can be found at the following link: <http://www5.statcan.gc.ca/cansim/a34?lang=eng&mode=tableSummary&id=0790003&stByVal=2&p1=-1&p2=9> (Note that only the data between 1986 and 2016 was used. Also, monthly data was added together to create a total for each year)*.* When we were looking through the data we wanted to be mindful of the major factors that affect vehicle sales on the end of the manufacturer, mainly the economy, advertising, and inventory during a certain year. This is crucial to our simulation model since the state of the economy greatly affects production/inventory etc. of more expensive goods like cars. It is very common for businesses to go under from either overspending, having an over-complicated production process, or not knowing how to make proper changes/manage risks. Simulation can save manufacturers time, money and mistakes. Keeping our goal in mind we aim to help manufacturers reduce any bottlenecks, risks, and control change when facing it. We would like to ensure that the model we have created will bring much success to the future business endeavors of  vehicle manufacturers, and help to immensely improve their future sales performance.

**Business Model and Data Description**

We obviously modelled the Markov Chain as our simulation contains three states that we decided to evaluate (Bad sales, Medium sales, and Good sales). We decided that the lowest 30 percent of the data is considered a bad year for sales and the top 20 percent is considered good. We simply labeled the middle 40 percent as Medium sales. We came up with the following transitional matrix:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Bad | Medium | Good |
| Bad | 9/12 = 75% | 3/12 = 25% | 0/12 = 0% |
| Medium | 1/10 = 10% | 6/10 = 60% | 3/10 = 30% |
| Good | 1/10 = 10% | 3/10 = 30% | 6/10 = 60% |

**Assumptions**

When simulating this data, in order to increase sales performance, we want to focus on inventory management and advertising expenses. One assumption we made was that inflation had already been factored into the data. We also assumed that advertising did not have an impact on the data, so that we can make the assumption that spending more on advertising in a bad market will have an effect.

**Recommendations**

First of all, if in the next three years the sales go bad, we would advise manufacturers not order a lot of inventory and spend more on advertising, and if the sales were to remain good constantly for the next 3 years, spend a lot less on advertising and order more inventory. Depending on the effects of the economy and how manufacturers market their vehicles, we also advise manufacturers to focus on boosting morale within in the company. We advise them to allocate some resources to benefits for employees to provide incentive during years that we predict sales will be bad. A successful company is created by successful employees.

We also looked at the results  in terms of long-term sales. If the market were to remain either good or medium during the next 5 years we encourage management/manufacturers to spread out spending on inventory throughout the following years. If the market were to remain good and then go bad focus, on spending more in the coming years rather than saving up the money. If the market were to go bad then good again in the next 5 years we recommend management  save up until the later years to be able to spend more on inventory. Finally, if the market were to become bad and not go back to good in the next 5 years, spread out the spending evenly.

**Our Results**

From our simulation of 10 000 sample paths we came up with the following results. The initial state for each started as good.

**Results:**

Short-term (View attached *Short-term Output*)

Chance it will go bad in the next 3 years: 26.78%

Chance it will only be good (not bad or medium) in the next 3 years: 22.24%

Long-term (View attached *Long-term Output*)

Chance it will go bad then good in next 5 years: 5%

Chance it will go good then bad in next 5 years: 23.99%

Chance it will never go bad in next 5 years: 59.26%

Chance it will never go good in next 5 years: 17.23%

Based on the results, we can conclude several things. First, in terms of the short-term, we find that there is a 26.78% chance that sales will turn bad within 3 years. While it’s relatively low, there is still a very real possibility of it happening. Something else we found was that there is a 22.24% chance that sales remain good within 3 years. This is close in probability to the chance that sales turn bad. Because of this it is still relatively uncertain which direction sales will turn. However, by keeping track of whether or not we get medium sales within a year, we can use this to better predict which direction sales are moving. If sale remain good, it’s likely they will stay like that in the short-term, and if sales go medium, there is a larger risk of sales going bad. For now however, as sales are currently good, more inventory should be ordered and less should be spent on advertising.

Next, in terms of the long-term, we find that the likelihood of sales going bad than good within 5 years is 5%. This means that if sales ever reach a bad state, than they will likely remain that way for a long time. However, the likelihood of moving from good to bad states within 5 years was higher at 23.99%. One important thing we found was that the probability of sales never turning bad within 5 years was 59.26%. This is a much higher probability than what we’ve seen, and it supports the conclusion that sales will remain good in the long term. Finally, we found that the likelihood of sales never going good within 5 years was only 17.23%, which was relatively low. Based on these findings, since the likelihood of sales going bad is relatively low (59.26% chance they never go bad), we would encourage management to spread out inventory spending throughout the years, as we mentioned in our recommendations section. Less money should be spent over the coming years and should instead be saved up.

**Conclusion**

In following the steps outlined in our recommendations and predicting how sales will move in the coming years, manufacturers should be able to increase profit, regardless of which direction sales are expected to move. If sales are expected to be good, less advertising costs will need to be incurred and a higher inventory will be sold. If sales are expected to be bad, increasing advertising will attract new customers and holding less inventory will help avoid unsold units. If vehicle sales are expected to be medium, business would continue as normal and no adjustments would be needed. By maximising revenues and minimizing expenses, management can yield a higher profit.

We hope that our model will help bring clarity and confidence to management as they now know when to expect a good, bad, or medium sales year. We ensure that this will greatly help manufacturers prepare for the years ahead and have a better understanding of where their businesses is headed in the future. This aspect of the model was especially important to providing the solution for manufacturers so they may know how and when to manage change to remain profitable. We take pride in the fact that our model encourages limitation on advertising and inventory, and due to this limitation manufacturers will be able to adjust each accordingly. Often times many businesses realize when sales are plummeting but have no clear idea what to fix. Our model will benefit manufacturers with the insights provided and give them the ability to tackle harder years ahead of time, as well as pinpointing the exact factors to be adjusted. We can guarantee that with this new insight sales performance will no longer negatively affect profit. We encourage you to follow our recommendations as we wish you much prosperity and happiness in all your future business endeavors.