**STA-590 Applied Qualifier (January 2022)**

1. A consumer products company is attempting to model monthly unit sales (in thousands) of their toothpaste using the number of television commercials run each month in a large metropolitan market. Since sales and commercials are both correlated with time, it was determined that perhaps an AR(1) model would be appropriate to forecast future sales. Given the dataset (n=60 or 5 years) provided:
2. Create a valid linear model to forecast Sales using Commercials. Determine if the model exhibits evidence of autocorrelation.
3. If necessary, make the appropriate transformations to the model using an appropriate procedure (Hildreth Lu, Cochrane-Orcutt etc.) and provide a model that is shown to be valid.
4. Based on this model, calculate the point estimate of sales for the next time period (if only X=10 commercials will be run).

1. The XYZ Credit Card Company wants to better understand its college educated customers. At a university Homecoming event, the company randomly surveyed 27 customers and asked them some questions about their background and credit card ownership. The variables were:

|  |  |
| --- | --- |
| Gender | Female=0  Male = 1 |
| Highest Degree | Bachelor Degree = 0  Graduate Degree =1 |
| Cash | Cash on their person, in dollars |
| Income | Annual income, in thousand dollars |
| XYZ Card Owner | No =0  Yes =1 |

Based on this data, create an appropriate model that can

1. Determine the significant predictor(s) of XYZ Credit Card Ownership. Interpret the influence these predictor(s) have on Credit Card Ownership.
2. Predict both the probability, and odds, of a female customer, with a graduate degree, that has $50 and makes $80,000 per year.
3. Assume that a mailing campaign is being considered. Any potential customer that has a probability over .5 will be sent an Amazon gift card.
   1. Based on this data set, how many gift cards were given to customers that are not XYZ owners? In other words, we forecast Y=1 but Y is actually 0.
   2. Based on this data set, how many gift cards were not given to customers that would be XYZ owners? In other words, we forecast Y=0 but Y is actually 1.
   3. Based on this dataset, what would be the total misclassification rate?
4. A manufacturing engineer wants to better understand the process of manufacturing glass jars. The acceptable temperature range is around 475 degrees F, but for quality purposes the manufacturer wants the temperatures to be as similar as possible. The engineer's company manufactures the glass jars at four locations (Plant). Each furnace has 4 operators that work a 6-hour shift, so the furnaces run 24 hours a day. The furnace temperatures at the start of the 6-hour shift were monitored externally over 12 days. So the sample size is 4 plants x 4 operators x 12 days=192. Using a Two-Way ANOVA model, determine if there is a difference between the plants, operators, and if there is a plant by operator interaction. Utilize the appropriate underlining procedure to summarize the results. In addition, show that you have a valid model for doing this analysis.