- Week 1
    - Name of the project : HCIP (House Construction Investment Project)
    - Objective of the project:
        - Develop a sales model to predict sales by product family
        - Milestones
            - Use new houses dataset started to build by province
            - Establish a correlation with the new construction and Nedco sales dataset
            - Use # of permits by construction type dataset
            - Use Nedco CRM sales data to look into customer profile
            - Evaluate the correlation among sales 2017 / Product family / market segment
            - Evaluate the correlation among sales 2017 / Market segment / ship type
            - Evaluate the correlation among sales 2017 / market segment / ship type / product family
            - Repeat the model with 2016
    - Create a functional map
        - Understand the relationship between:
            - An electrical Distributor (Nedco) & customer
        - Potential attributes from a distributor perspective
            - Sales 2017, product families, market segment, customer type, age of account, profit by customer
            - From a customer perspective and the market
                - # of house permits, Type of construction, City, postal code, province, New construction or renovation
        - Use cases examples
            - SEARCH BY FEATURE
                - What is the age of the account by customer for 2017?
                - What is the credit limit by customer class for 2017?
                - What is the avg payment terms for a residential contractor in 2017?

- SEARCH BY PRICE
    - What is the avg selling price by type of houses by province in 2017?
    - What is the avg selling price for residential houses by province in 2017?

- SEARCH BY MARKET TRENDS
    - What type of order a contractor orders?
    - How many residential houses were built by Postal code in 2017?
    - What are the sales by customers by SIC code in 2017 vs 2016?
    - What are the sales by product family in 2017?
    - What is the avg spend of electrical material according to a contractor?
    - How many permits for new construction of residential houses were awarded in 2017 by province?
    - How many permits were awarded in 2017 by province?

- SEARCH BY TYPE OF MARKETS (Residential, commercial)
    - How many were awarded by cities, municipalities for 2017 by vertical market (resi, commercial)
    - What type of permits were awarded in 2017? i.e commercial, residential
    - What type of houses have been built in 2017 by province?
    - What is the avg sales by market segment?
    - What is the avg sales by type of customer class?

- SEARCH BY TYPE OF SIC CODE
    - What is the SIC code ratio for residential vs all SIC codes for 2017?

- SEARCH BY TYPE OF ROI
    - What is the P&L by market segment in 2017 for Quebec?

- SEARCH BY TYPE OF CUSTOMER
    - How many permits were awarded between contractors or consumers by postal code for 2017?

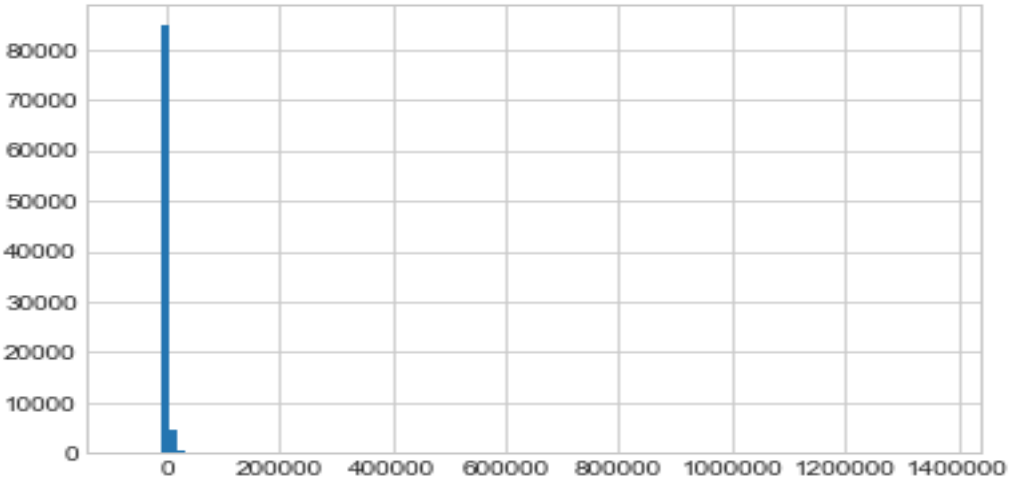
- Week 2: Data exploratory
    - Business Question
        - What could look like 2017 sales within product family, market segment & ship type?
    - Sub questions:
        - What could look like the projected sales for electrical products within residential market by product family in 2018?
        - What would be the best market segment to grow the sales in 2018?
        - What would be the best product family to grow our base line sales in 2018?
    - Data Exploratory
        - Four (4) datasets were exported
            - Nedco Sales 2016_2017
            - SIC code from Nedco CRM
            - Housing starts from Stat Can
            - Housing type from Stat can
        - Challenges
            - Data complexity due to data cleaning
            - Lot of data to analyze from a time constraint perspective
    - Feedback from a technical perspective
        - Challenge to have the right coding
        - Challenge to resolve error within coding
        - Challenge to clean data before machine learning process
        - Challenge to learn and apply python coding
    - Feedback from a business perspective
        - The project was based on Nedco sales data only

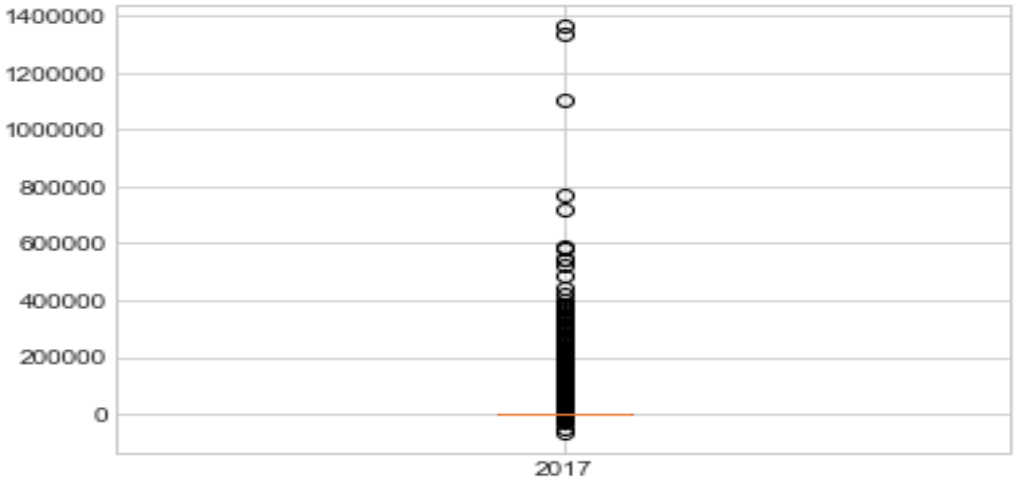
- 1st level of analysis: One variable
  - Define DF_sales 2017 according to the # of transactions :
    - Including 'NA' : 144 468 transactions
    - Excluding 'NA' : 90 761 transactions

```
144447         $14.49
144448            NaN
144449         $81.30
144450        $158.76
144451      $1,530.60
144452       ($434.70)
144453      $1,199.90
144454         $23.40
144455         $83.92
144456        $593.50
144457            NaN
144458          $9.64
144459            NaN
144460         $17.43
144461         $69.97
144462            NaN
144463            NaN
144464            NaN
144465            NaN
144466            NaN
144467            NaN
Name: 2017, Length: 144468, dtype: object
```

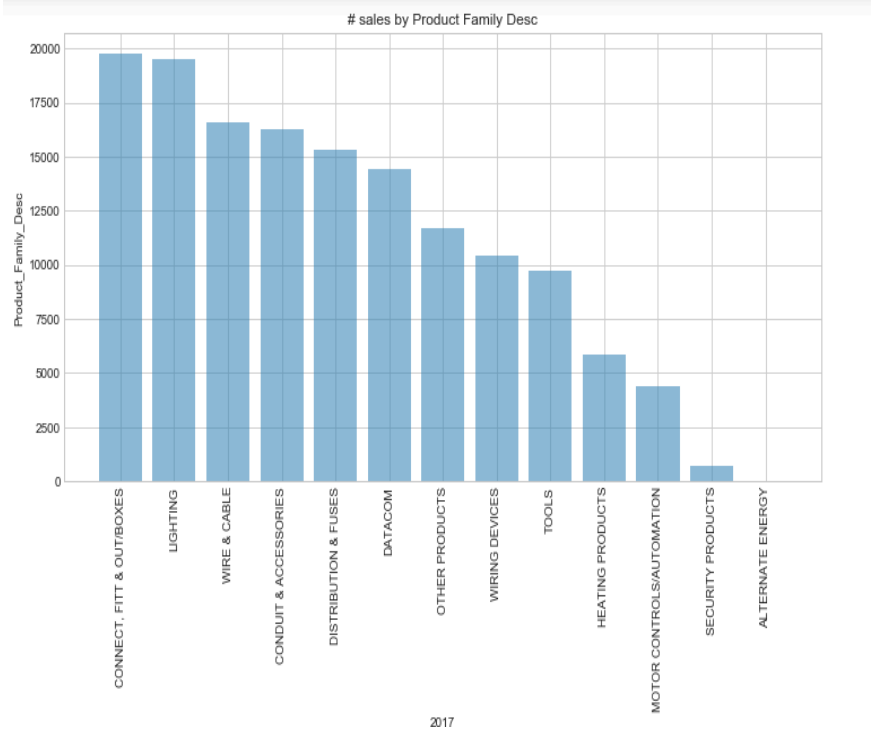
- 2nd level of analysis using an histogram and box plot
  - Mean: avg sales order 1582
  - Std
  - Min per sales order:
  - Max

```
count      90761.0
mean        1582.0
std        13082.0
min       -68151.0
25%          37.0
50%         150.0
75%         600.0
max      1368388.0
Name: 2017, dtype: float64
```



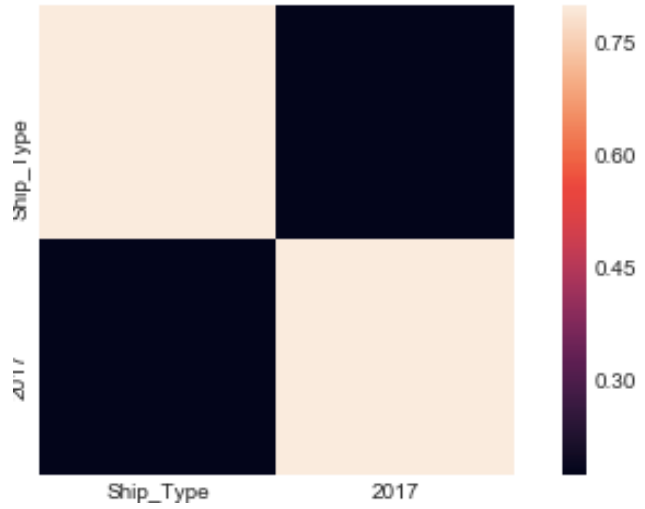


- 3rd level of analysis: Sales by Product Family 2017 (Count)
  - CONNECT, FITT & OUT/BOXES 19730
  - LIGHTING 19532
  - WIRE & CABLE 16557
  - CONDUIT & ACCESSORIES 16240
  - DISTRIBUTION & FUSES 15281
  - DATACOM 14424
  - OTHER PRODUCTS 11668
  - WIRING DEVICES 10393
  - TOOLS 9692
  - HEATING PRODUCTS 5841
  - MOTOR CONTROLS/AUTOMATION 4364
  - SECURITY PRODUCTS 680
  - ALTERNATE ENERGY 30



- 4th level of analysis: Multiple variables (numeric * Numeric)
  - Validate the ship type and sales 2017 correlation's

	Ship Type	2017
Ship Type	1.000000	0.173076
2017	0.173076	1.000000



- 5th level of analysis: Multiple variables (Categorical x Numeric)
  - Box plot to show the distribution Market Segment Desc x sales 2017
  - Validate Ship type 1, 2,3 & product sales

- 6th level of analysis: Multiple variables (Categorical x Categorical)
  - Validate sales between product family and market segment
  - Key questions to answer
    - Is the Product Family Score a good indicator of predictive sales?
    - Identify Product Family with high potential of sales?
    - As an sales executive, select a Product Family to predict sales?

- Week 3: Machine Learning
    - Sk Learn extended
        - Feedback from a technical perspective
        - Challenging to have the right coding
        - Challenging to resolve error
        - Data was not as clean as it should be to process machine learning
        - I was able to run machine learning up tp Model training

Model Training

```
In [89]: # split the data

         threshold = 0.8
         X = df_sales[X_columns]
         y = df_sales[y_column]
         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=1.0-threshold)

         print('X_train', X_train.shape)
         print('y_train', y_train.shape)
         print('X_test', X_test.shape)
         print('y_test', y_test.shape)

         X_train (115574, 8)
         y_train (115574,)
         X_test (28894, 8)
         y_test (28894,)
```

- SK LEARN
    - Challenge to go further than model training

Model Training

```
In [89]: # split the data

         threshold = 0.8
         X = df_sales[X_columns]
         y = df_sales[y_column]
         X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=1.0-threshold)

         print('X_train', X_train.shape)
         print('y_train', y_train.shape)
         print('X_test', X_test.shape)
         print('y_test', y_test.shape)

         X_train (115574, 8)
         y_train (115574,)
         X_test (28894, 8)
         y_test (28894,)
```

- Spark
  - Could not go further, due to multiple unsolved errors and time constraints

Load the data

```
In [13]: # Load and parse the data file, converting it to a DataFrame.
         #data = spark.read.csv('/Users/jeromepotvin/Desktop/PERSONNEL JEROME/CONCORDIA/1260_BIG DATA/PR(
         df_sales = spark.read.csv('/Users/jeromepotvin/Desktop/PERSONNEL JEROME/CONCORDIA/1260_BIG DATA/
         #df_sales = df_sales ['2017'].apply(lambda x: str(x).replace('$','').replace('(','-').replace('
         data.show

         ---------------------------------------------------------------------------
         NameError                                 Traceback (most recent call last)
         <ipython-input-13-e84d1bccfafc> in <module>()
               3 df_sales = spark.read.csv('/Users/jeromepotvin/Desktop/PERSONNEL JEROME/CONCORDIA/126
         0_BIG DATA/PROJECT/DATA/RAW/1_FINAL CUSTOMER SALES_16_17.csv', header = True, inferSchema = T
         rue)
               4 #df_sales = df_sales ['2017'].apply(lambda x: str(x).replace('$','').replace('(','-')
         .replace(')','').replace(',','')).astype(float)
         ----> 5 data.show

         NameError: name 'data' is not defined
```

- Feedback from a business perspective
  - Challenge to find if market segment, Product family and ship type could be good indicators to establish a predictive sales model
  - At this point, there is no specific and formal answer to establish a correlation to validate if the model is positively correlated to predict 2017 sales within product family, market segment & ship type?
- Results
  - Due to time constraints and coding issues, the model was tested at level at Model Training / Evaluation - Using Split, but couldn't figure out how to fix ValueError: could not convert string to float: '$1,628.00 '

- Week 4: Cluster analysis
    - Technical challenge
        - No significant results due to unfinished data mining process with machine learning
        - Model has not been validated and/or tested using all statistical methodology
        - Data exploratory was not enough significant to validate the current model
    - Present the results
        - Since, machine learning process was not processed entirely, I couldn't run my app test with Flask

Model Evaluation

In [58]:
```
# Intra-Cluster
centroids = []
for cluster in sorted(set(T)):
    centroids.append(df_sales_results[df_sales_results['cluster']==cluster][X_columns].mean().va
print('Intra-Cluster Distances', sum(sum(euclidean_distances(centroids, centroids))))

# Inter-Cluster
distances = 0
for cluster in sorted(set(T)):
    centroid = df_sales_results[df_results['cluster']==cluster][X_columns].mean().values
    distances += (sum(euclidean_distances(df_results[df_results['cluster']==cluster][X_columns].
print('Inter-Cluster Distances', distances)
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-58-29908755500f> in <module>()
      1 # Intra-Cluster
      2 centroids = []
----> 3 for cluster in sorted(set(T)):
      4     centroids.append(df_sales_results[df_sales_results['cluster']==cluster][X_columns
].mean().values)
      5 print('Intra-Cluster Distances', sum(sum(euclidean_distances(centroids, centroids))))

NameError: name 'T' is not defined
```

In [ ]:
```
#could make clustering analysis work: dataset issues, multiple errors and time constraint
```