Python Project - Marvel Mart Project

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In [2]:
```
# import statements
import numpy as np
import pandas as pd
from pandas import DataFrame, Series
pd.set_option('display.float_format', lambda x: '%.3f' % x)
import matplotlib.pyplot as plt
import seaborn as sns
sns.set(style='ticks', palette='Set2')
%matplotlib inline
```

Part 1: Cleaning the Data

In [3]:
```
# importing MM_Sales.csv as sales
sales = pd.read_csv('Data/MM_Sales.csv')

# visualizing the layout of the database
display(sales.head())

# testing for missing data in each column
sumNA = sales.isna().sum()
print(sumNA)

salesClean = sales.copy() # saving a new variable for final cleaned data
```

	Region	Country	Item Type	Sales Channel	Order Priority	Order Date	Order ID	Ship Date	Units Sold	Unit Price	Unit Cost	Total Revenue	Total Cost	Tot Pro
0	Sub-Saharan Africa	Namibia	Household	Offline	M	8/31/15	897751939	10/12/15	3604	668.270	502.540	2408445.080	1811154.160	597290.9
1	Europe	Iceland	Baby Food	Offline	L	11/20/10	599480426	1/9/11	8435	255.280	159.420	2153286.800	1344707.700	808579.1
2	Europe	Russia	Meat	Online	L	6/22/17	538911855	6/25/17	4848	421.890	364.690	2045322.720	1768017.120	277305.6
3	Europe	Moldova	Meat	Online	L	2/28/12	459845054	3/20/12	7225	421.890	364.690	3048155.250	2634885.250	413270.0
4	Europe	Malta	Cereal	Online	H	8/12/10	626391351	9/13/10	1975	205.700	117.110	406257.500	231292.250	174965.2

```
Region             0
Country            0
Item Type          6
Sales Channel      0
Order Priority    15
Order Date         0
Order ID           0
Ship Date          0
Units Sold         0
Unit Price         0
Unit Cost          0
Total Revenue      0
Total Cost         0
Total Profit       0
dtype: int64
```

Countries

In [4]:
```
iC = []

print('\nTesting for erronous data in Country')
for i, row in salesClean.iterrows():
# try to convert each Country item as a float, if it fails, it is a string of words
    try:
        row.loc['Country'] = float(row.loc['Country'])
        if type(row.loc['Country']) == float:
            iC.append(i)
    except:
        0 == 0

print(f'Number of erronous countries {len(iC)}')

# know the index of erronous data so can replace with null value
for i in iC:
    salesClean.replace(salesClean['Country'][i], 'NULL', inplace = True)
```

```
Testing for erronous data in Country
Number of erronous countries 3
```

Item Type

In [5]:
```
# replacing na values in Item Type with null value
salesClean['Item Type'] = salesClean['Item Type'].fillna('NULL')
```

Order Priority

In [6]:
```
# replacing na balues in Order Priority with null value
```

```
salesClean['Order Priority'] = salesClean['Order Priority'].fillna('NULL')
```

Order ID

In [7]:
```
iO = []

print('\nTesting for erronous data in Order ID')
for i, row in salesClean.iterrows():
# test to see if rows are letters, if it fails it is numeric
    try:
        if row['Order ID'].isalpha():
            iO.append(i)
    except:
        1 == 1

print(f'Number of erronous IDs {len(iO)}')

# know the index of erronous data so can replace with null value
for i in iO:
    salesClean.replace(salesClean['Order ID'][i], 'NULL', inplace = True)
```

```
Testing for erronous data in Order ID
Number of erronous IDs 5
```

In [8]:
```
# testing for missing data in each column
sumNAC = salesClean.isna().sum()
print(sumNAC)

# testing data to see if any unwanted values remain in cleaned data
print(salesClean['Country'].unique())
print(salesClean['Item Type'].unique())
print(salesClean['Order Priority'].unique())
print(salesClean['Order ID'].unique())

# save salesClean to a new csv file
salesClean.to_csv('Data/MM_Sales_clean.csv')
```

```
Region            0
Country           0
Item Type         0
Sales Channel     0
Order Priority    0
Order Date        0
Order ID          0
Ship Date         0
Units Sold        0
Unit Price        0
```

```
Unit Cost         0
Total Revenue     0
Total Cost        0
Total Profit      0
dtype: int64
['Namibia' 'Iceland' 'Russia' 'Moldova ' 'Malta' 'Indonesia' 'Djibouti'
 'Greece' 'Cameroon' 'Nigeria' 'Senegal' 'Afghanistan' 'India' 'Lebanon'
 'Turkey' 'Iraq' 'Rwanda' 'Ukraine' 'Finland' 'South Sudan'
 'Antigua and Barbuda ' 'Kuwait' 'United Kingdom' 'Saint Kitts and Nevis '
 'Saint Lucia' 'Tunisia ' 'Yemen' 'Guinea' 'Tuvalu' 'South Korea'
 'San Marino' 'Trinidad and Tobago' 'Kosovo' 'Hungary' 'Botswana' 'Serbia'
 'Guatemala' 'United Arab Emirates' 'Samoa ' 'Bahrain'
 'Saint Vincent and the Grenadines' 'Pakistan' 'Poland' 'Lithuania'
 'Sudan' 'Portugal' 'Fiji' 'Tanzania' 'Sao Tome and Principe' 'Cape Verde'
 'Greenland' 'Guinea-Bissau' 'Georgia' 'Jamaica' 'Bulgaria' 'Kazakhstan'
 'Grenada' 'Honduras' 'Mongolia' 'Belize' 'United States of America'
 'South Africa' 'Austria' 'Marshall Islands' 'Sierra Leone' 'Romania'
 'Malaysia' 'New Zealand' 'Mozambique' 'Somalia' 'Denmark'
 'Solomon Islands' 'Vanuatu' 'Singapore' 'Luxembourg' 'Australia' 'Brunei'
 'Papua New Guinea' 'Kyrgyzstan' 'Chad' 'Togo' 'Mali' 'Croatia' 'Taiwan'
 'Barbados' 'Equatorial Guinea' 'Canada' 'Eritrea' 'Mexico' 'Niger'
 'Madagascar' 'Gabon' 'El Salvador' 'Sweden' 'Angola' 'Sri Lanka' 'Cyprus'
 'Ethiopia' 'Liberia' 'Egypt' 'Montenegro' 'Nauru' 'Kiribati' 'Iran'
 'Democratic Republic of the Congo' 'Vatican City' 'North Korea' 'Jordan'
 'Seychelles ' 'France' 'Mauritius ' 'Cambodia' 'Dominican Republic'
 'Tajikistan' 'Netherlands' 'Comoros' 'The Bahamas' 'Burundi' 'Syria'
 'Estonia' 'Bosnia and Herzegovina' 'Tonga' 'Zambia' 'Morocco' 'Monaco'
 'Lesotho' 'The Gambia' 'Germany' 'Slovenia' 'Benin' 'Turkmenistan'
 'Maldives' 'Laos' 'Cuba' 'Myanmar' 'Malawi' 'Nicaragua' 'Ireland'
 'Mauritania' 'Costa Rica' 'Azerbaijan' 'Saudi Arabia' 'Latvia' 'Belgium'
 'Switzerland' 'Bhutan' 'Italy' 'Central African Republic' 'Vietnam'
 'Panama' 'Kenya' 'Libya' 'Algeria' 'Belarus' 'Japan' 'Ghana'
 'Philippines' 'Czech Republic' 'China' 'Liechtenstein' 'Palau'
 'Macedonia' 'Bangladesh' 'Slovakia' 'Swaziland' 'Burkina Faso' 'Uganda'
 'Spain' 'Andorra' 'Zimbabwe' 'Uzbekistan' 'Oman' 'Dominica'
 "Cote d'Ivoire" 'Albania' 'Thailand' 'Norway' 'East Timor'
 'Federated States of Micronesia' 'Israel' 'Haiti' 'Republic of the Congo'
 'Qatar' 'Armenia' 'Nepal' 'NULL']
['Household' 'Baby Food' 'NULL' 'Cereal' 'Vegetables' 'Office Supplies'
 'Personal Care' 'Beverages' 'Clothes']
['M' 'L' 'H' 'C' 'NULL']
['897751939' '599480426' '538911855' ... '322932231' '492142713'
 '943440902']
```

Part 2: Exploratory Data Analysis with Reports & Visualizations

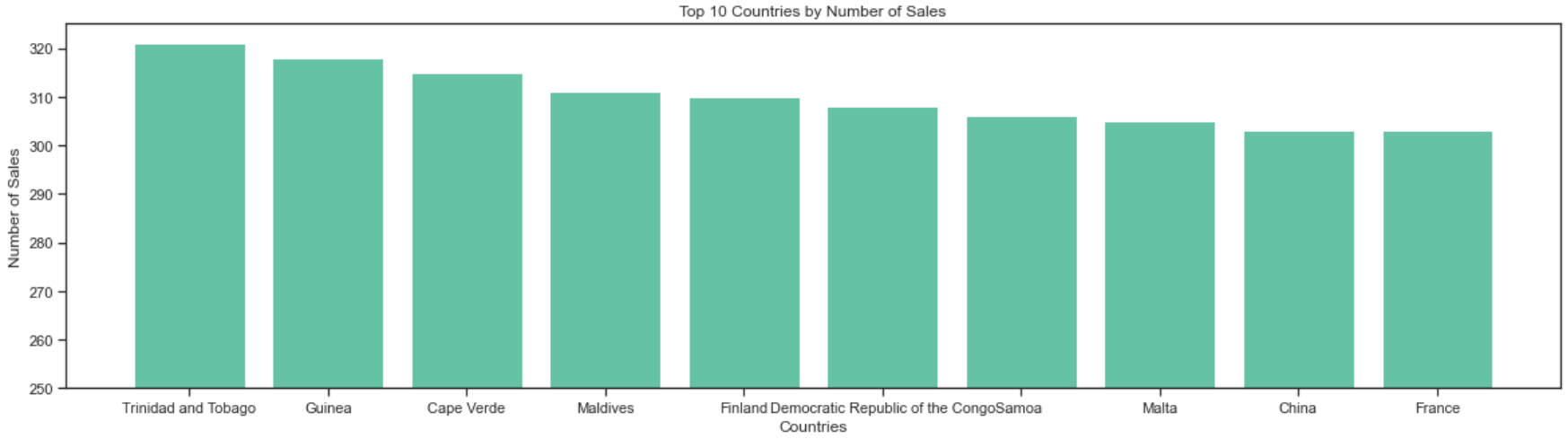
Question 1

In [26]:
```
# create lists for each column to turn into a dictionary
```

```
RegionL = []
for i in salesClean['Region']:
    RegionL.append(i)
CountryL = []
for i in salesClean['Country']:
    CountryL.append(i)
ItemTypeL = []
for i in salesClean['Item Type']:
    ItemTypeL.append(i)
SalesChannelL =[]
for i in salesClean['Sales Channel']:
    SalesChannelL.append(i)
OrderPriorityL = []
for i in salesClean['Order Priority']:
    OrderPriorityL.append(i)
OrderDateL = []
for i in salesClean['Order Date']:
    OrderDateL.append(i)
OrderIDL = []
for i in salesClean['Order ID']:
    OrderIDL.append(i)
ShipDateL = []
for i in salesClean['Ship Date']:
    ShipDateL.append(i)
UnitSoldL = []
for i in salesClean['Units Sold']:
    UnitSoldL.append(i)
UnitPriceL = []
for i in salesClean['Unit Price']:
    UnitPriceL.append(i)
UnitCostL = []
for i in salesClean['Unit Cost']:
    UnitCostL.append(i)
TotalRevenueL = []
for i in salesClean['Total Revenue']:
    TotalRevenueL.append(i)
TotalCostL = []
for i in salesClean['Total Cost']:
    TotalCostL.append(i)
TotalProfitL = []
for i in salesClean['Total Profit']:
    TotalProfitL.append(i)

# combine lists with column values to make dataframe from the dictionary with all values
newDict = pd.DataFrame({'Region': RegionL,
                        'Country': CountryL,
```

```
                    'Item Type': ItemTypeL,
                    'Sales Channel': SalesChannelL,
                    'Order Priority': OrderPriorityL,
                    'Order Date': OrderDateL,
                    'Order ID': OrderIDL,
                    'Ship Date': ShipDateL,
                    'Units Sold': UnitSoldL,
                    'Unit Price': UnitPriceL,
                    'Unit Cost': UnitCostL,
                    'Total Revenue': TotalRevenueL,
                    'Total Cost': TotalCostL,
                    'Total Profit': TotalProfitL})

# get the count of sales of the top 10 countries
sales = (newDict['Country'].value_counts().head(n=10))
print(sales)

# 1.1 create a chart to show top 10 countries from most to lease
plt.figure(figsize=(20, 5))
plt.bar(sales.index, sales.values)
plt.ylim(250, 325)
plt.title('Top 10 Countries by Number of Sales')
plt.xlabel('Countries')
plt.ylabel('Number of Sales')
plt.show()

# 1.2 open MM_Rankings.txt and append values from the sales dictionary above
with open('Data/MM_Rankings.txt', 'a+') as writer:
    writer.write('\nCountries Most Sales Transactions: \n')
    for k,v in sales.items():
        writer.write(f"{k}: {v}\n")
    writer.write(f'The country we should build our shipping center is Cape Verde because it is the highest ranked country
```

```
Trinidad and Tobago                 321
Guinea                              318
Cape Verde                          315
Maldives                            311
Finland                             310
Democratic Republic of the Congo    308
Samoa                               306
Malta                               305
China                               303
France                              303
Name: Country, dtype: int64
```

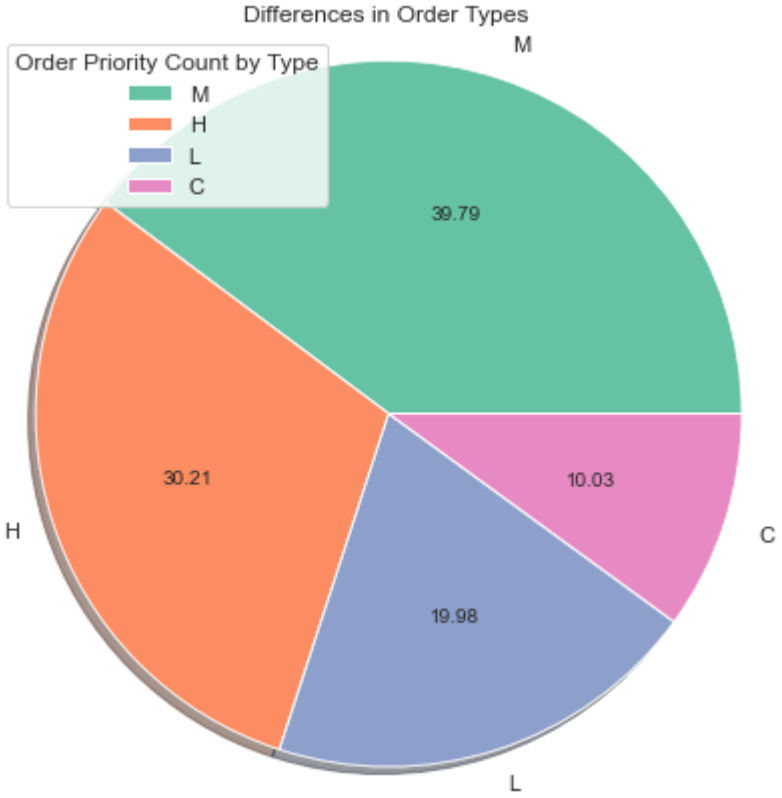


Question 2

In [27]:
```
# 2.1 create a new dataframe containing sales channel counts by each type
salesC = (newDict['Sales Channel'].value_counts())
print(salesC)

# 2.2 create a new dataframe containing order priority counts by each type
OrderP = (newDict['Order Priority'].value_counts().head(n=4))
print(OrderP)

# 2.3 create a pie chart to show differences in values
plt.figure(figsize=(7, 7))
plt.pie(OrderP, labels=OrderP.index, shadow=True, autopct='%.2f')
plt.title('Differences in Order Types')
plt.axis('equal')  # centers pie chart
plt.legend(loc=2, title='Order Priority Count by Type')
plt.show()

# 2.4 save to MM_Rankings.txt by iterating through dictionary keys and values from the salesC dictionary
with open('Data/MM_Rankings.txt', 'a+') as writer:
    writer.write('\nSales Channels: \n')
    for k,v in salesC.items():
        writer.write(f"{k}: {v}\n")
    writer.write('We have more online than offline sales\n')

# save to MM_Rankings.txt by iterating through dictionary keys and values from the OrderP dictionary
with open('Data/MM_Rankings.txt', 'a+') as writer:
    writer.write('\nOrder Priorities: \n')
    for k,v in OrderP.items():
```

```
        writer.write(f"{k}: {v}\n")
    writer.write('We do more M order priorities\n')
```

```
Online     30204
Offline    19796
Name: Sales Channel, dtype: int64
M    19887
H    15099
L     9986
C     5013
Name: Order Priority, dtype: int64
```



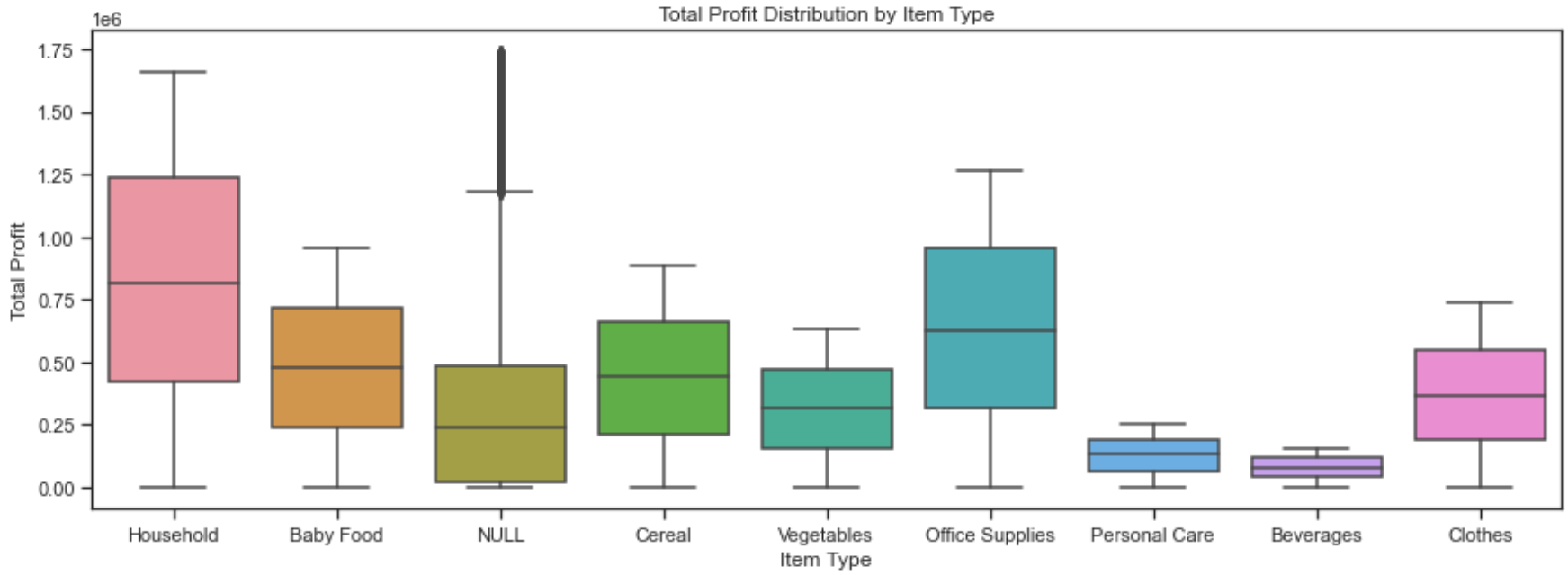
Question 3

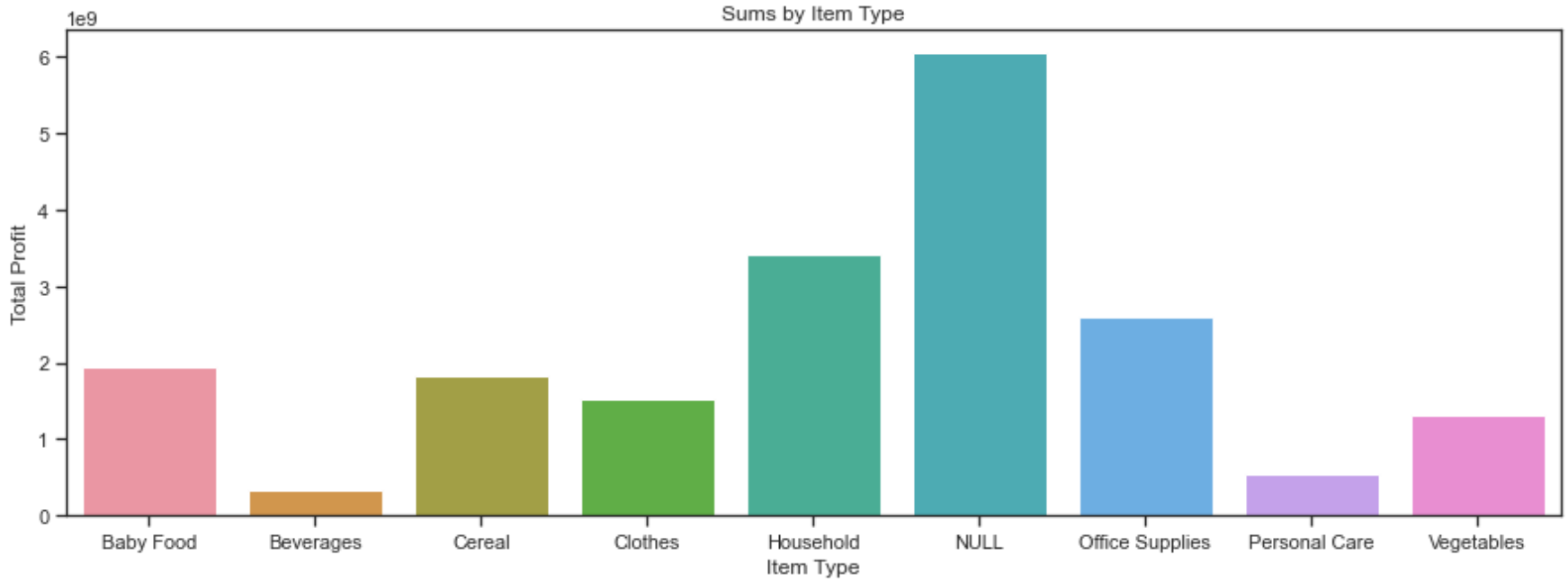
In [28]:
```
# 3.1 create a boxplot for total profits distribution by item type
plt.figure(figsize=(15,5))
ax = sns.boxplot(x='Item Type',y='Total Profit',data=salesClean)
ax.set_title('Total Profit Distribution by Item Type')

# 3.2 use Python to determine the sum of Total Profit by Item Type.
profitByType = salesClean.groupby(['Item Type'])['Total Profit'].sum()
```

```
profitDF = pd.DataFrame(profitByType).reset_index()
profitDF.columns = ['Item Type', 'Total Profit']
print(profitDF)
print("\n")

# 3.3 now create a chart type of your choice (Seaborn or Matplotlib) showing the sums of the different Item Types.
plt.figure(figsize=(15,5))
ax = sns.barplot(x='Item Type',y='Total Profit',data=profitDF)
ax.set_title('Sums by Item Type')

# 3.4 now, using Python, rank the top 3 item types we did the most sales (brought in most profit) in to the least sales.
profitByType = salesClean.groupby(['Item Type'])['Total Profit'].sum().nlargest(3)
profitDF = pd.DataFrame(profitByType).reset_index()
profitDF.columns = ['Item Type', 'Total Profit']
print(profitDF)

# create a dictionary with values from profitDF
TypeL = []
for i in profitDF['Item Type']:
    TypeL.append(i)
ProfitL = []
for i in profitDF['Total Profit']:
    ProfitL.append(i)
profitType = {TypeL[i]: ProfitL[i] for i in range(len(ProfitL))}

# 3.5 add the top 3 results to to MM_Rankings.txt, iterating through above dictionary
with open('Data/MM_Rankings.txt', 'a+') as writer:
    writer.write('\nHighest Selling Items: \n')
    for k,v in profitType.items():
        writer.write(f"{k}: {v}\n")
    writer.write('We profited from NULL the most\n')
```

```
         Item Type   Total Profit
0        Baby Food 1944985596.160
1        Beverages  327751882.740
2           Cereal 1824726412.290
3          Clothes 1521740766.240
4        Household 3403301844.870
5             NULL 6041190914.560
6  Office Supplies 2605583355.000
7    Personal Care  535394370.000
8       Vegetables 1323261806.390


         Item Type   Total Profit
0             NULL 6041190914.560
```

```
1        Household 3403301844.870
2  Office Supplies 2605583355.000
```





Discuss the results (3.6):

The boxplots suggest that consumers spend a wide range on items like Household goods and Office Supplies as shows by the large distribution between the upper and lower quartiles. Item types like these should have careful tracking of inventory as due to these ranges in spending habits there can be unpredictable. Further investigation to seasonal or region based trends and preferences could be essential in manganing inventories and better predicting profit trends.

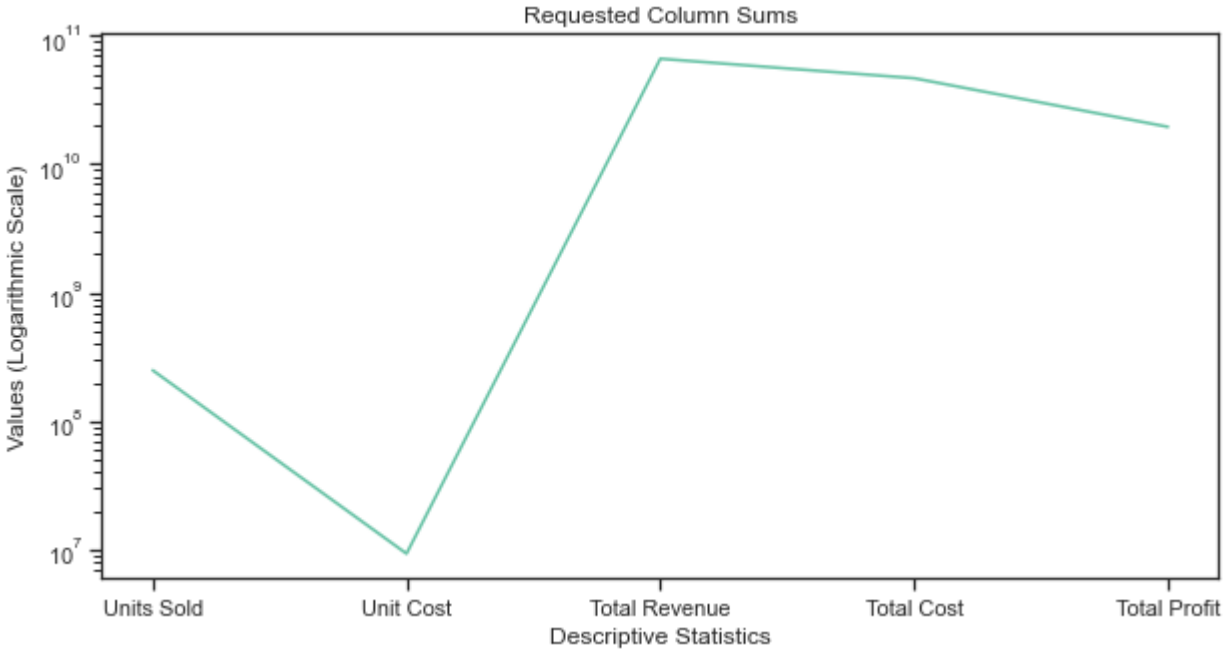
Conversely, items like Personal Care and Beverage types have a seemingly agreed upon amount that is purchased, as there is little range on the boxplot. This is beneficial for an inventory standpoint as consumers will generally purchase consistent amounts.

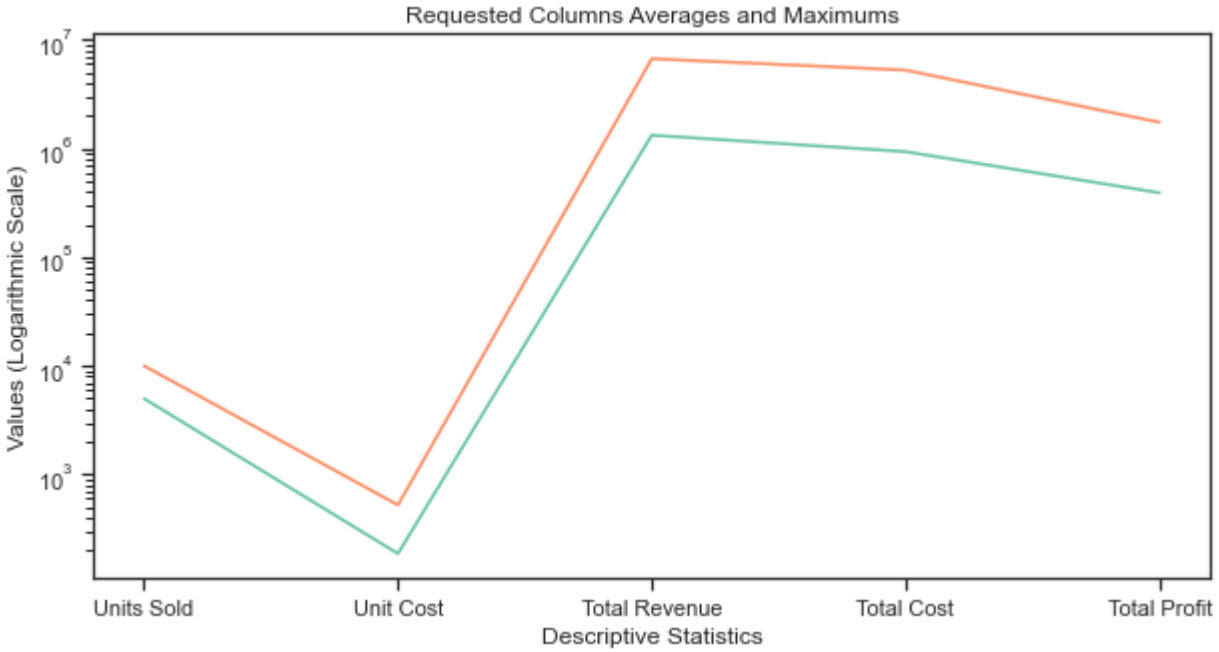
Question 4

In [128…

```
# define a function calc with parameters heading and values from a dataframe that will save to a new .txt file MM_Calc
def calc(heading, stats):
    with open('Data/MM_Calc.txt', 'a+') as txt_file:
        txt_file.write(heading)
        txt_file.write('\n')
        for k,v in DF.items(): # loops through dataframe to print final value for each item.
            txt_file.write(str(k))
            txt_file.write(': ')
            txt_file.write(str(v))
            txt_file.write('\n')

# create dataframe containing requried columns for calculations
stats = salesClean[['Units Sold', 'Unit Cost', 'Total Revenue', 'Total Cost', 'Total Profit']]

# 4.1-4.3 collect sum, average, and max for each column in dataframe
dataSums = stats.sum(axis = 0, skipna = True)
dataAvgs = stats.mean(axis = 0, skipna = True)
dataMax = stats.max(axis = 0, skipna = True)

# 4.4 line plot for Sums of each column
plt.figure(figsize=(10, 5))
plt.plot(dataSums)
plt.title('Requested Column Sums')
plt.yscale('log')
plt.xlabel('Descriptive Statistics')
plt.ylabel('Values (Logarithmic Scale)')
plt.show()

# line plot for Averages and Maximums of each columns
plt.figure(figsize=(10, 5))
plt.plot(dataAvgs)
plt.plot(dataMax)
plt.title('Requested Columns Averages and Maximums')
plt.yscale('log')
```

```
plt.xlabel('Descriptive Statistics')
plt.ylabel('Values (Logarithmic Scale)')
plt.show()

# 4.5 print
print('Sums: ', end = '\n')
calc('Sums: ', dataSums)
print('\n')

print('\nAverages: ', end = '\n')
calc('Averages: ', dataAvgs)
print('\n')

print('\nMaximums: ', end = '\n')
calc('Maximums: ', dataMax)
print('\n')
```





Sums:

Averages:

Maximums:

Part 3: Cross Reference Statistics

In [29]:
```
# create a new dataframe for Regions and Countries and a second one filtering for unique regionsa
df = pd.read_csv('Data/MM_Sales_clean.csv')[['Region', 'Country']]
regions = df['Region'].unique()

# create empty dictionary
crossRef = {}
# loop through dictionary for unique regions
for region in regions:
    crossRef[region] = df[df.Region.eq(region)]['Country'].unique()

#
dataFrames = [pd.DataFrame({key: crossRef[key]}) for key in crossRef.keys()]
```

```
# concatenate the dataframe in to columns
dataFrame = pd.concat(dataFrames, axis=1)

#Saving result to a new CSV file
dataFrame.to_csv('Data/Countries_By_Region.csv', index=False)
```

In [ ]: