ICE - EDA: Data Visualizations

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Exercise

For this assignment, students will use the dataset globalsuperstore.xlsx.

This is a dataset pulled from the online orders for SuperStore. This store sells items that are divided into three categories: technology, furniture, and office supplies. We'll explore this dataset through exploratory data analysis using data visualizations to help us determine which category should be invested in.

This data should be considered cleaned and prepped. Several data points are recorded for each visit, including:

- Row ID: A unique identifier for each row.
- Order ID: A unique identifier for each order.
- Order Date: The month, day, and year the order was placed.
- Ship Date: The month, day, and year the order was shipped.
- Segment: The market segment the order is coming from: Consumer, Corporate, or Home Office
- State: The state in which the order was placed.
- Country: The country in which the order was placed.
- Region: The region in which the order was placed.
- Product ID: The unique identification of the product sold.
- Category: The category the product falls under. (Technology, Furniture, Office Supplies)
- Sub-Category: The subcategory the product falls under.
- Product Name: The name of the product sold.
- Sales: The total amount of sales in dollars.
- Quantity: The amount of products sold in the order.
- Discount: The discount given on the order.
- Discount Category: Categories for discount used to create a histogram.

- Profit: The profit created from the order.
- Profit %: The amount of the sale that is the profit.
- Profit % Category: The profit for each product category.

1.

Import the globalsuperstore.xlsx and load the pandas, numPy and matplotlib libraries. For each variable listed below, indicate whether the variable is nominal, ordinal, or quantitative continuous. Hint: Dates are de facto continuous variables.

In [1]:
```
import warnings
warnings.filterwarnings("ignore") #this can be removed but will help the code be a little cleaner by ignoring warning
```

In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

df = pd.read_excel("globalsuperstore.xlsx")
df.head()
```

Out[2]:

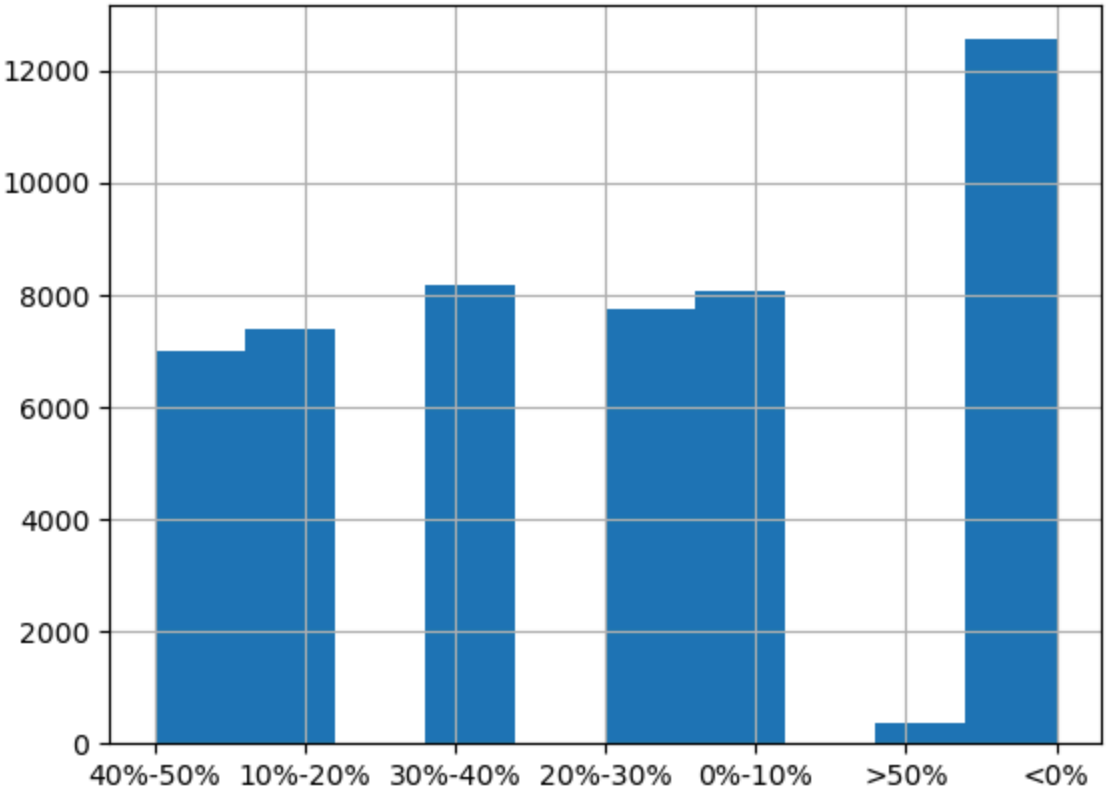
	Row ID	Order ID	Order Date	Ship Date	Segment	State	Country	Region	Product ID	Category	Sub-Category	Product Name	S
0	34559	CA-2011-140662	Thursday, November 17, 2011	Saturday, November 19, 2011	Corporate	California	United States	West	OFF-PA-10003395	Office Supplies	Paper	Xerox 1941	73
1	41207	US-2012-129007	Thursday, September 13, 2012	Saturday, September 15, 2012	Corporate	California	United States	West	OFF-PA-10000994	Office Supplies	Paper	Xerox 1915	20
2	33971	CA-2014-136875	Thursday, December 4, 2014	Thursday, December 4, 2014	Consumer	California	United States	West	OFF-PA-10000357	Office Supplies	Paper	Xerox 1888	16
3	33459	CA-2014-166296	Friday, March 14, 2014	Thursday, March 20, 2014	Home Office	California	United States	West	OFF-PA-10004359	Office Supplies	Paper	Multicolor Computer Printout Paper	31
4	31773	CA-2011-144666	Wednesday, November 9, 2011	Friday, November 11, 2011	Consumer	California	United States	West	OFF-PA-10003465	Office Supplies	Paper	Xerox 1912	9

- **Category:** - nominal qualitative (category)
- **Sales:** - ratio quantitative (sales amount in $)
- **Sales Category:** - ordinal qualitative (categorical for examples $500-1000$)
- **Order Date:** - interval quantitative

2

The histogram below was created using the Profit% Category attribute. It shows the amount of the sale that is profit in each category.

In [3]:
```
df['Profit % Category'].hist()
plt.show()
```



A

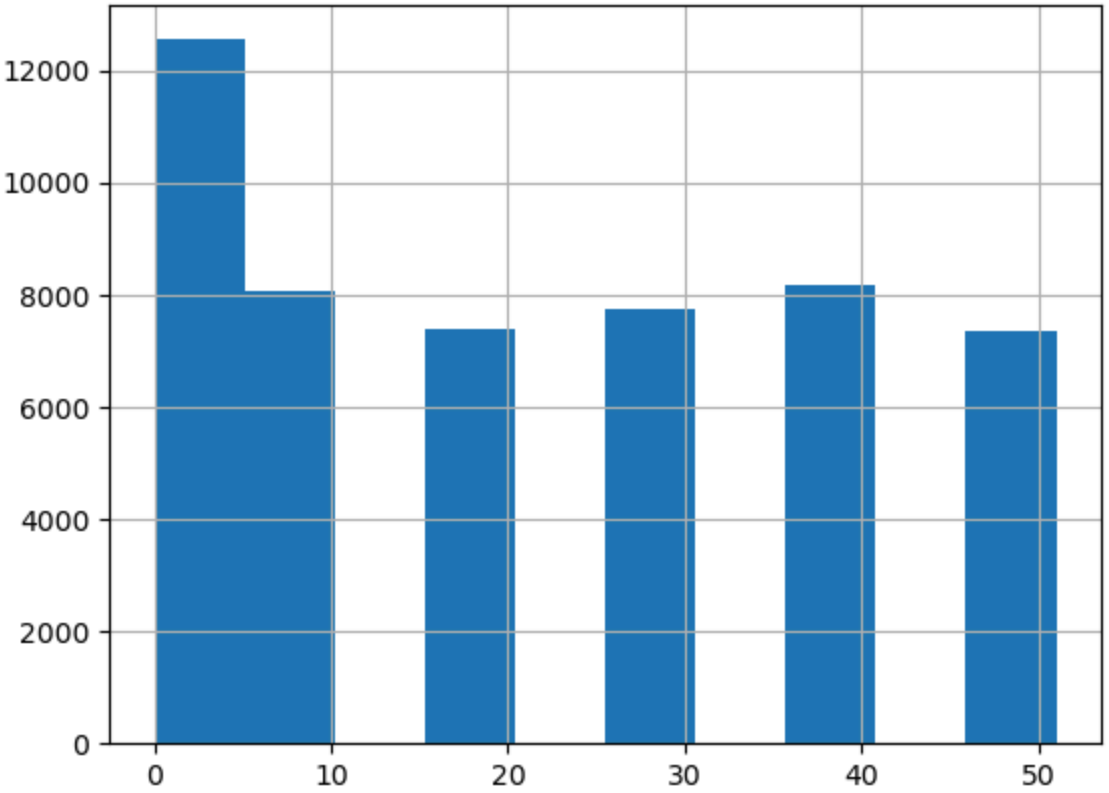
What is wrong with this visualization and how do we fix it?

your x axis is not in order.

In [4]:
```
df.replace({ '<0%': 0,
             '0%-10%': 10,
             '10%-20%': 20,
             '20%-30%': 30,
             '30%-40%': 40,
```

```
            '40%-50%': 50,
            '>50%': 51}, inplace=True)
```

In [5]:
```
df['Profit % Category'].hist()
plt.show()
```

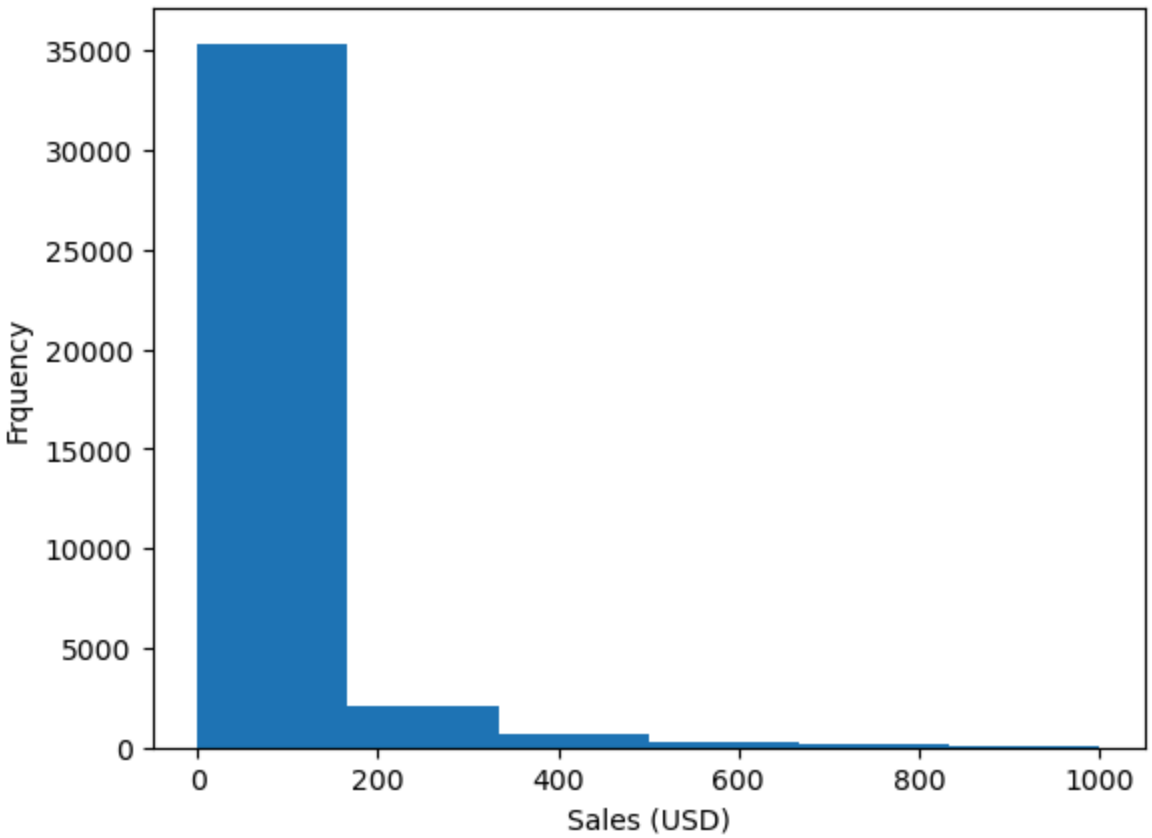


B

Create a second hisogram of Profit, what impact does the number of bins have on the information conveyed?

In [6]:
```
plt.hist(df['Profit'], bins = 6, range=[0,1000])
plt.xlabel("Sales (USD)")
plt.ylabel("Frquency")
plt.plot()
```

Out[6]: []



The number of bins effects how detailed the visual is going to be, to many and it wont communicate the data effectively, to little and it will also fall short.

C

In this case, would it be better to report the median and or the mean of Profit? Explain.

median - this is due to the fact the data contains some outliers

3.

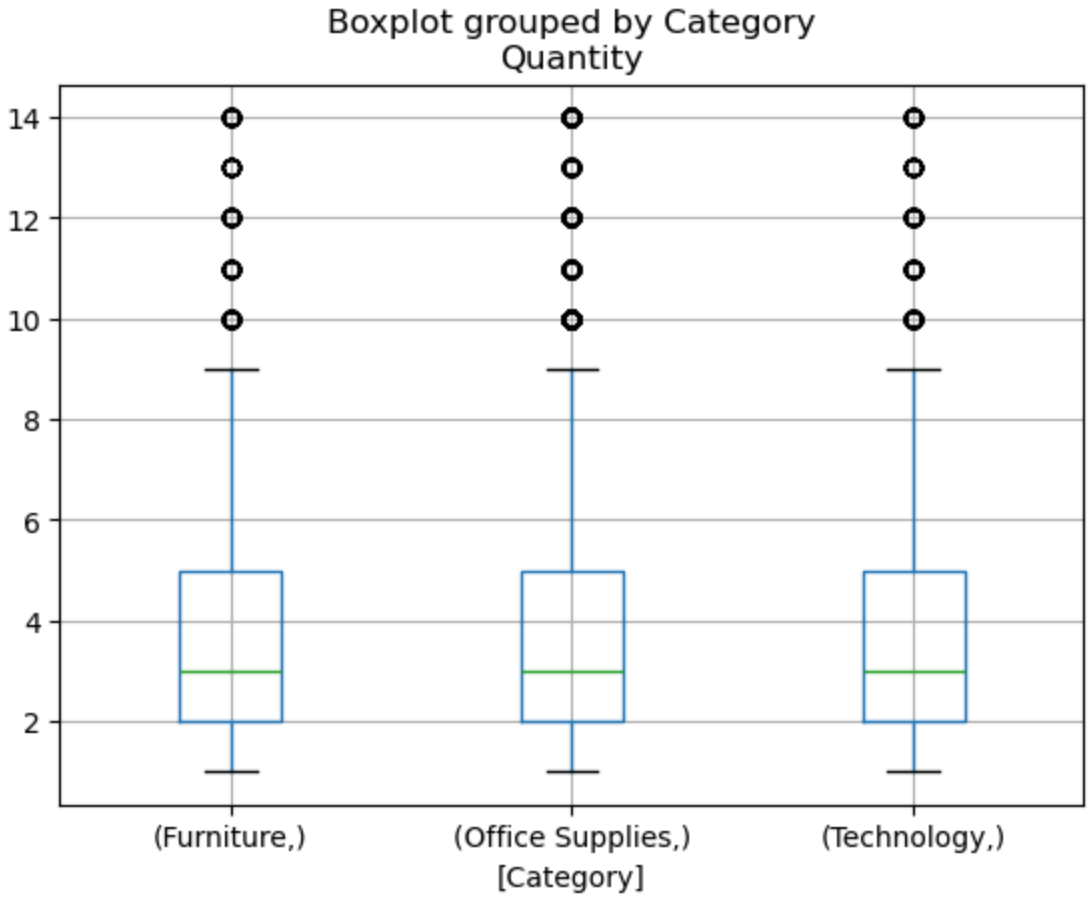
Produce the descriptive statistics for another attribute, Quantity.

In [7]:
```
# describe the quantity column
df['Quantity'].describe()
```

Out[7]:
```
count    51290.000000
mean         3.476545
std          2.278766
min          1.000000
25%          2.000000
50%          3.000000
75%          5.000000
max         14.000000
Name: Quantity, dtype: float64
```

Quantity appears to have a similar mean and median value, but does it have any outliers that could be leading the mean to be larger than the median? Use a boxplot to identify whether there are outliers in Quantity of products in orders by Category.

In [8]:
```
df.boxplot(column=['Quantity'], by=['Category'])
plt.show()
```



Are there outliers? - Yes there are outliers

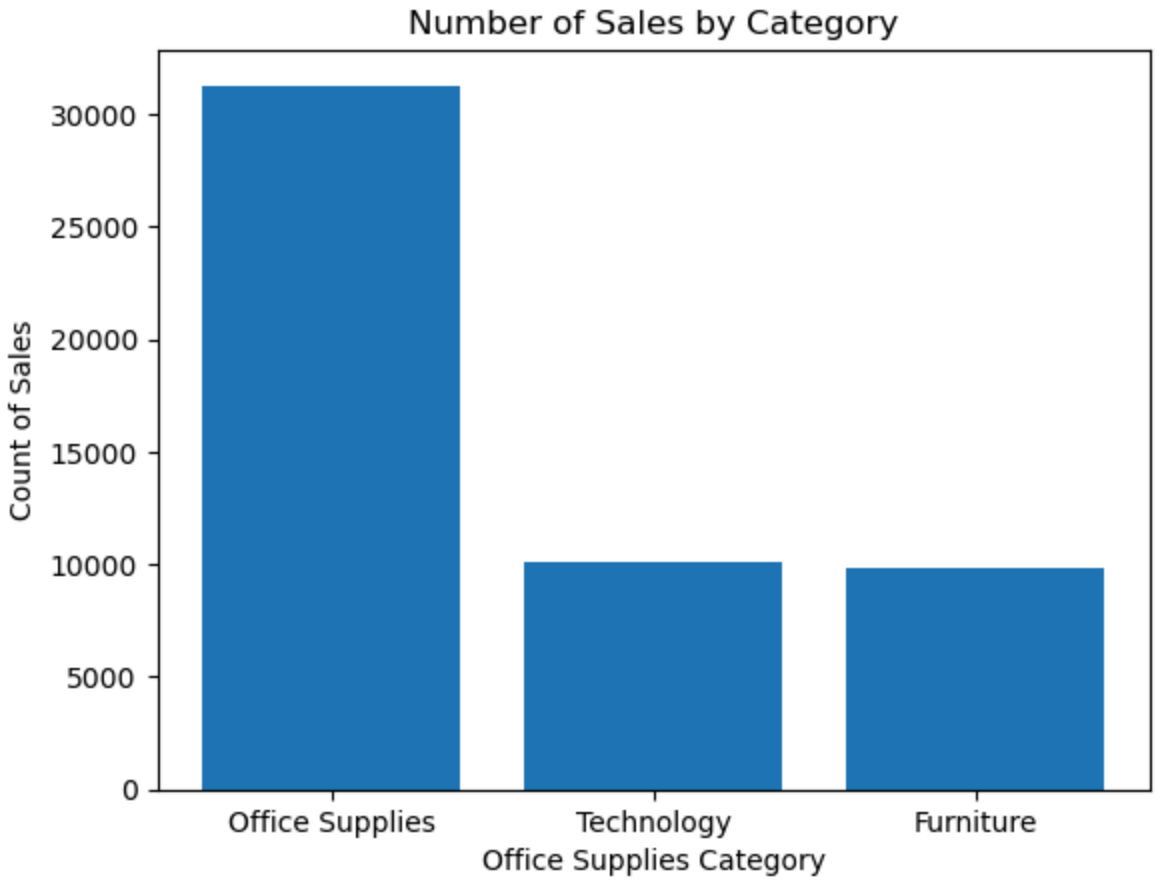
4.

Create a stacked column chart that shows the count of Sales in each category. Add a descriptive title.

In [9]:
```
category_counts = df['Category'].value_counts() # store the value_counts
category_counts
```

Out[9]:
```
Category
Office Supplies    31273
Technology         10141
Furniture           9876
Name: count, dtype: int64
```

In [10]:
```
plt.bar(x = category_counts.index.values, height = category_counts)
plt.title("Number of Sales by Category")
plt.ylabel("Count of Sales")
plt.xlabel("Office Supplies Category")
plt.show()
```



A.

Which category has the highest count of sales? Include the category and sales amount in your answer.

Office Supplies - 31273

B.

Does it make sense that this category has the most sales? Explain.

I would say yes, this category likely contains cheap high volume items. A category such as technology likely has more sales in terms of $$$ but less in terms of quantity.

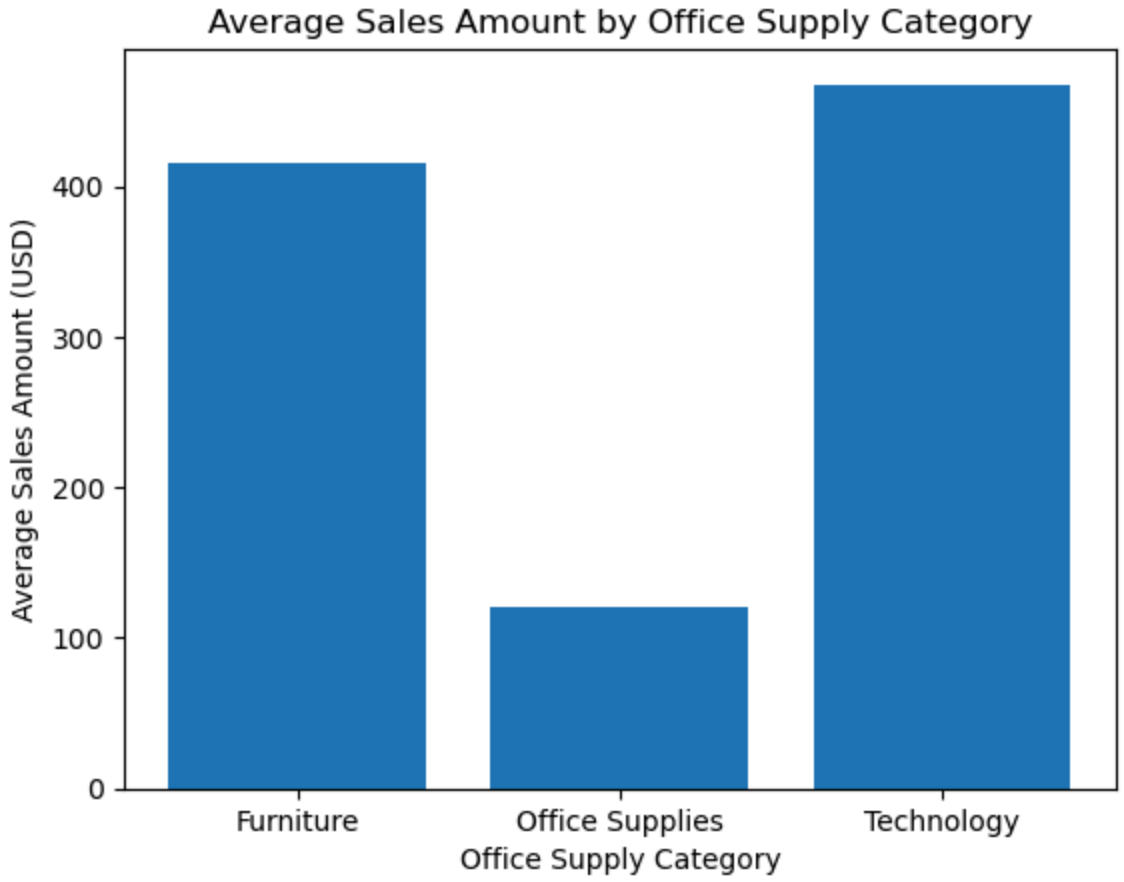
5

Starting with your visualization from Q4, change the aggregation method to Average to show the Average sales amount for each category. Be sure to include a descriptive title.

In [11]:
```
group = df.groupby(by = "Category")["Sales"].describe() # get descriptive stats for specific column
group_averages = group['mean'] # extract the mean
# display group averages
group_averages
```

Out[11]:
```
Category
Furniture          416.248905
Office Supplies    121.097120
Technology         467.858939
Name: mean, dtype: float64
```

In [12]:
```
plt.bar(x = group_averages.index.values, height = group_averages)
plt.title("Average Sales Amount by Office Supply Category")
plt.ylabel("Average Sales Amount (USD)")
plt.xlabel("Office Supply Category")
plt.show()
```



A.

What category has the highest average Sales? Include the category and the average sales amount in your answer.

Technology - 467.858939

B.

Provide a hypothesis as to why the category with the highest average sales has the lowest total sales.

Items in Technology are more expensive than any other categories. Companies will spend a premium on these items due to their ability to increase speed.

6

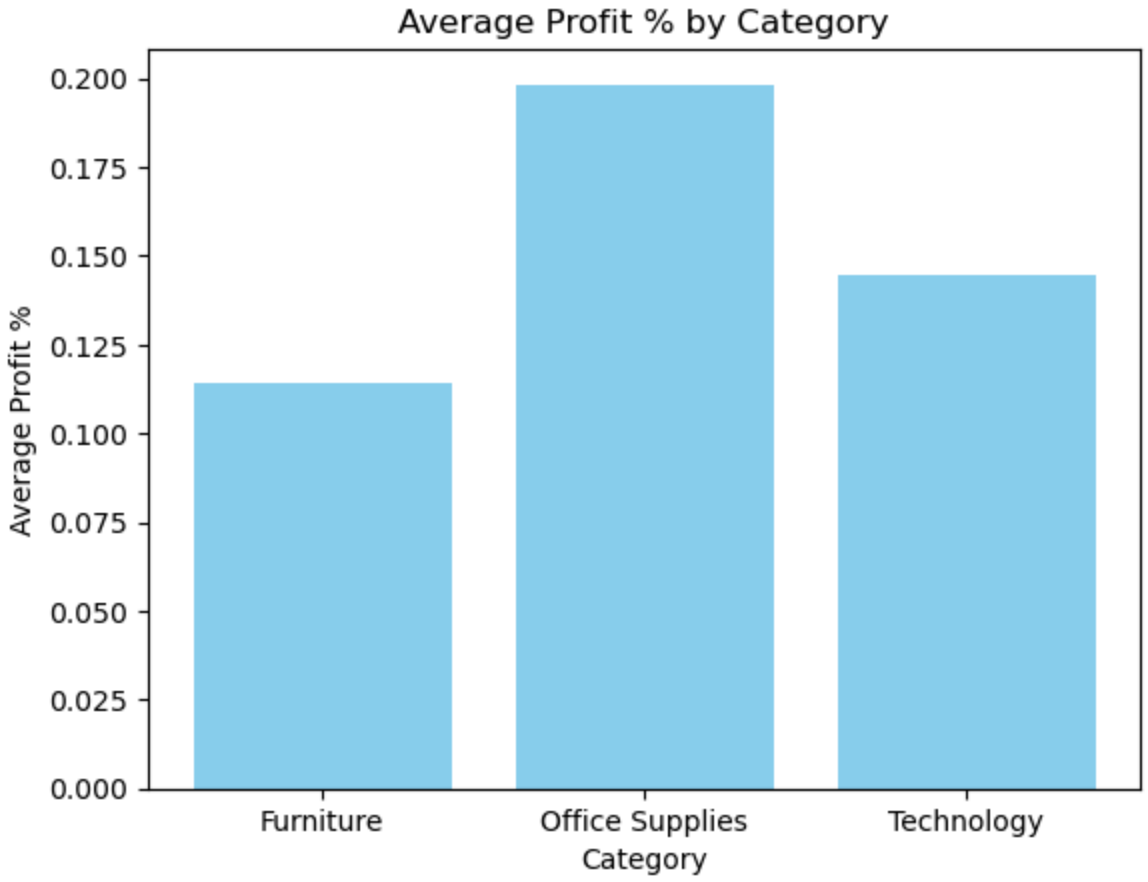
Create a clustered column chart showing the Average Profit % by Category. Add a descriptive title.

In [29]:
```
group  = df.groupby(by = "Category")["Profit %"].describe() # choose how to group the data
# group_averages = group[''] # take the mean of a specific column
group_averages = group['50%']
# display group averages
group_averages
```

Out[29]:
```
Category
Furniture          0.1142
Office Supplies    0.1983
Technology         0.1444
Name: 50%, dtype: float64
```

In [30]:
```
plt.bar(group_averages.index, height=group_averages, color='skyblue')

plt.xlabel("Category")
plt.ylabel("Average Profit %")
plt.title("Average Profit % by Category")
plt.show()
```



A.

Which category earns the highest profit percentage on average? What is that percentage?

Technology

B.

Does it makes sense that this category has the highest average profit percentage?

7

Create a line chart showing the Average Profit % over time (use the Order Date) by Categories. Provide a descriptive title.

In [15]:
```
df['Order Date'] = pd.to_datetime(df['Order Date']) #convert order date to date-time format
df['Year'] = df['Order Date'].dt.year
#display df headers
df.head()
```

Out[15]:

	Row ID	Order ID	Order Date	Ship Date	Segment	State	Country	Region	Product ID	Category	...	Product Name	Sales	Sal Catego
0	34559	CA-2011-140662	2011-11-17	Saturday, November 19, 2011	Corporate	California	United States	West	OFF-PA-10003395	Office Supplies	...	Xerox 1941	733.95	500 10
1	41207	US-2012-129007	2012-09-13	Saturday, September 15, 2012	Corporate	California	United States	West	OFF-PA-10000994	Office Supplies	...	Xerox 1915	209.70	100—2
2	33971	CA-2014-136875	2014-12-04	Thursday, December 4, 2014	Consumer	California	United States	West	OFF-PA-10000357	Office Supplies	...	Xerox 1888	166.44	100—2
3	33459	CA-2014-166296	2014-03-14	Thursday, March 20, 2014	Home Office	California	United States	West	OFF-PA-10004359	Office Supplies	...	Multicolor Computer Printout Paper	314.55	250—5
4	31773	CA-2011-144666	2011-11-09	Friday, November 11, 2011	Consumer	California	United States	West	OFF-PA-10003465	Office Supplies	...	Xerox 1912	94.85	80—1

5 rows × 21 columns

In [23]:
```
df_year = df.groupby(['Category', 'Year'])
#create pivot table of descriptive statistics organized
```

```
# by category and year
# produce descriptive stats
df_year.describe()
```

Out[23]:

		Row ID							Order Date	..
		count	mean	min	25%	50%	75%	max	std	count	mean	..
Category	Year											
Furniture	2011	1762.0	25284.450057	49.0	12513.50	26440.0	36784.50	51193.0	14466.512197	1762	2011-08-08 20:41:24.449489152	.
	2012	2045.0	23862.745721	2.0	10161.00	24000.0	35633.00	51251.0	14502.389576	2045	2012-08-03 05:50:40.195599104	.
	2013	2722.0	23714.965834	13.0	10024.00	24102.0	36082.50	51280.0	14612.750870	2722	2013-07-31 08:41:36.987509248	.
	2014	3347.0	24973.190021	38.0	11867.00	25707.0	37279.00	51284.0	14650.845250	3347	2014-08-03 11:52:28.252166144	.
Office Supplies	2011	5446.0	26671.408924	51.0	14350.00	27066.5	39291.50	51290.0	14605.397799	5446	2011-08-03 17:35:00.771208192	.
	2012	6707.0	25668.455047	4.0	12981.50	25062.0	38922.00	51289.0	14781.160285	6707	2012-08-02 04:08:24.547487744	.
	2013	8391.0	25672.643427	7.0	12326.50	25771.0	39221.50	51279.0	15225.441969	8391	2013-07-29 07:52:06.349660672	.
	2014	10729.0	26335.795694	1.0	13506.00	26097.0	39590.00	51283.0	14801.440791	10729	2014-07-31 00:23:21.211669248	.
Technology	2011	1790.0	25466.106704	52.0	12800.25	25614.0	37443.75	51202.0	14675.163280	1790	2011-08-05 04:56:50.949720832	.
	2012	2210.0	25671.684163	48.0	13049.25	25670.5	37744.50	51287.0	14610.701406	2210	2012-07-30 21:18:24.434389248	.
	2013	2686.0	25189.081162	8.0	12278.75	24882.5	38420.50	51276.0	15022.523382	2686	2013-07-31 01:06:28.682055168	.
	2014	3455.0	25616.910564	26.0	13155.00	25273.0	38184.50	51260.0	14554.655289	3455	2014-08-01 17:52:48.625180928	.

12 rows × 64 columns

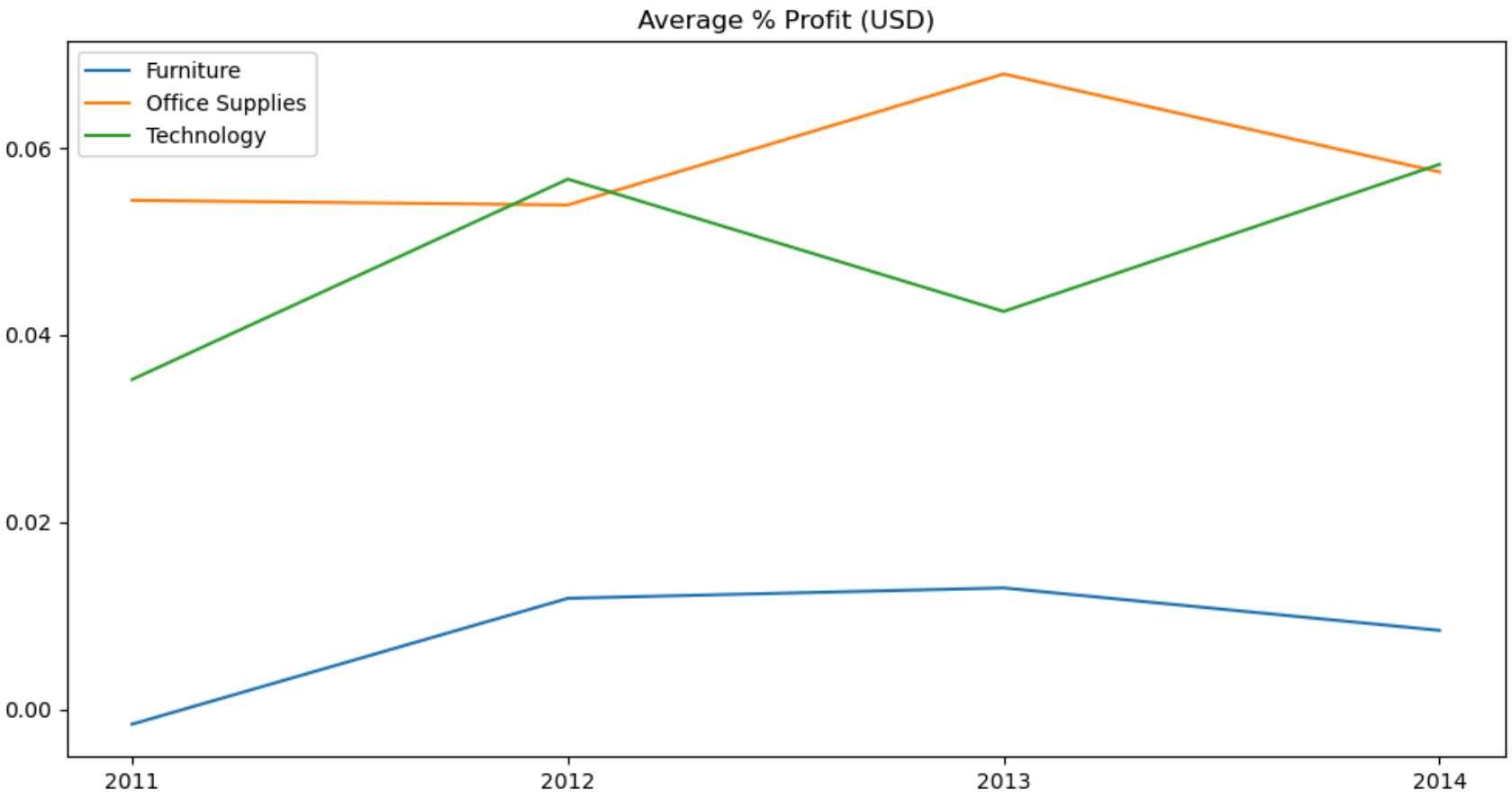
In [24]:
```
average = df_year.describe()['Profit %']
#examine just average profit % grouped by year and category
average = average['mean'] # grab just the mean
average = average.unstack(level=0) # unstack the table
average.head()
```

Out[24]:

Category	Furniture	Office Supplies	Technology
Year			
2011	-0.001608	0.054405	0.035249
2012	0.011851	0.053909	0.056671
2013	0.012962	0.067916	0.042526
2014	0.008425	0.057440	0.058248

In [25]:
```
fig, ax = plt.subplots(1, figsize=(12,6))
for year in average.columns:
    plt.plot(average[year].index, average[year].values)

plt.legend(average.columns)
plt.title("Average % Profit (USD)")
plt.locator_params(nbins=4)
plt.show()
```



A.

Which category has the most constant Average Profit % between 2011 and 2014? Does this make sense?

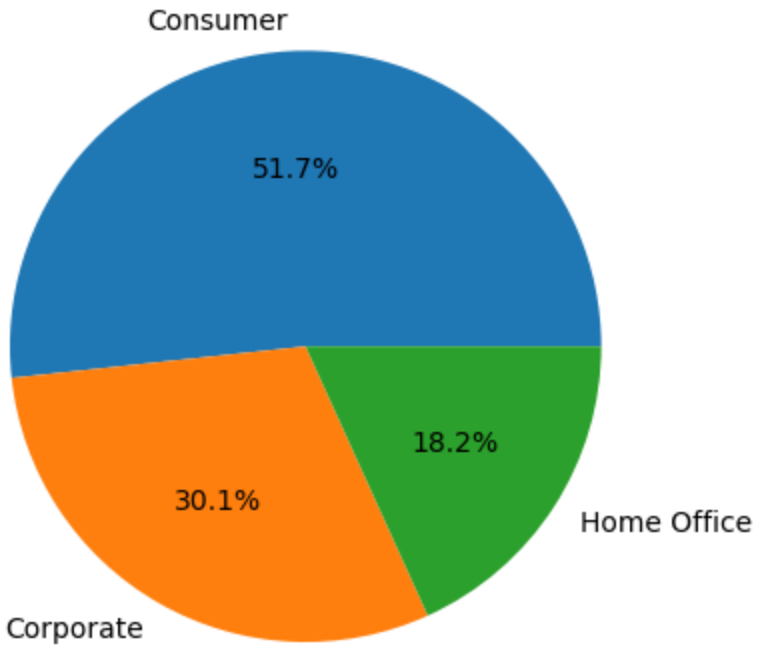
Furniture - I would say it makes sense, I would expect office supplies to change the least. Technology will flucuate very heavily due to the need for capital expenditure.

8

Create a Pie chart showing the number of sales per market segment.

In [27]:
```
segment_counts = df['Segment'].value_counts()

plt.pie(segment_counts.values, labels = segment_counts.index.values, autopct='%1.1f%%')
plt.show()
```



A.

Which Category (Technology, Furniture, or Office Supplies) would you recommend investing in and why?

I would invest in Technology. Furniture would be a terrible investment, we see that above with the percent profit being near non-existent. Technology is much better for profit margin while being a lower volume shipped.