[2]:
```
import pandas as pd

import plotly.express as px
import plotly.graph_objects as go
import plotly.io as pio
import plotly.colors as colors
pio.templates.default = "plotly_white"
```

Data Loading

[3]:
```
data = pd.read_csv("Sample - Superstore.csv", encoding='latin-1')
```

Data Cleaning

[4]:
```
data.describe()
```

[4]:

	Row ID	Postal Code	Sales	Quantity	Discount	Profit
count	9994.000000	9994.000000	9994.000000	9994.000000	9994.000000	9994.000000
mean	4997.500000	55190.379428	229.858001	3.789574	0.156203	28.656896
std	2885.163629	32063.693350	623.245101	2.225110	0.206452	234.260108
min	1.000000	1040.000000	0.444000	1.000000	0.000000	-6599.978000
25%	2499.250000	23223.000000	17.280000	2.000000	0.000000	1.728750
50%	4997.500000	56430.500000	54.490000	3.000000	0.200000	8.666500
75%	7495.750000	90008.000000	209.940000	5.000000	0.200000	29.364000
max	9994.000000	99301.000000	22638.480000	14.000000	0.800000	8399.976000

[6]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 9994 entries, 0 to 9993
Data columns (total 21 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Row ID         9994 non-null   int64
 1   Order ID       9994 non-null   object
 2   Order Date     9994 non-null   object
 3   Ship Date      9994 non-null   object
 4   Ship Mode      9994 non-null   object
 5   Customer ID    9994 non-null   object
 6   Customer Name  9994 non-null   object
 7   Segment        9994 non-null   object
 8   Country        9994 non-null   object
 9   City           9994 non-null   object
 10  State          9994 non-null   object
 11  Postal Code    9994 non-null   int64
 12  Region         9994 non-null   object
 13  Product ID     9994 non-null   object
 14  Category       9994 non-null   object
 15  Sub-Category   9994 non-null   object
 16  Product Name   9994 non-null   object
 17  Sales          9994 non-null   float64
 18  Quantity       9994 non-null   int64
 19  Discount       9994 non-null   float64
 20  Profit         9994 non-null   float64
dtypes: float64(3), int64(3), object(15)
memory usage: 1.6+ MB
```

[7]:
```
data.shape
```

[7]:
```
(9994, 21)
```

Converting Dates on Column

[8]:
```
data['Order Date'] = pd.to_datetime(data['Order Date'])
data['Ship Date'] = pd.to_datetime(data['Ship Date'])
```

[9]:
```
data.head()
```

[9]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID	Category	Sub-Category	Product Name	Sal
0	1	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-BO-10001798	Furniture	Bookcases	Bush Somerset Collection Bookcase	261.96
1	2	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-CH-10000454	Furniture	Chairs	Hon Deluxe Fabric Upholstered Stacking Chairs,...	731.94

[9]:
```
data.head()
```

[9]:

	Row ID	Order ID	Order Date	Ship Date	Ship Mode	Customer ID	Customer Name	Segment	Country	City	...	Postal Code	Region	Product ID	Category	Sub-Category	Product Name	Sal
0	1	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-BO-10001798	Furniture	Bookcases	Bush Somerset Collection Bookcase	261.96
1	2	CA-2016-152156	2016-11-08	2016-11-11	Second Class	CG-12520	Claire Gute	Consumer	United States	Henderson	...	42420	South	FUR-CH-10000454	Furniture	Chairs	Hon Deluxe Fabric Upholstered Stacking Chairs,...	731.94
2	3	CA-2016-138688	2016-06-12	2016-06-16	Second Class	DV-13045	Darrin Van Huff	Corporate	United States	Los Angeles	...	90036	West	OFF-LA-10000240	Office Supplies	Labels	Self-Adhesive Address Labels for Typewriters b...	14.62
3	4	US-2015-108966	2015-10-11	2015-10-18	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	FUR-TA-10000577	Furniture	Tables	Bretford CR4500 Series Slim Rectangular Table	957.57
4	5	US-2015-108966	2015-10-11	2015-10-18	Standard Class	SO-20335	Sean O'Donnell	Consumer	United States	Fort Lauderdale	...	33311	South	OFF-ST-10000760	Office Supplies	Storage	Eldon Fold 'N Roll Cart System	22.36

5 rows × 21 columns

[10]:
```
data['Order Month'] = data['Order Date'].dt.month
data['Order Year'] = data['Order Date'].dt.year
data['Order Day of Week'] = data['Order Date'].dt.dayofweek
```

Data visualization

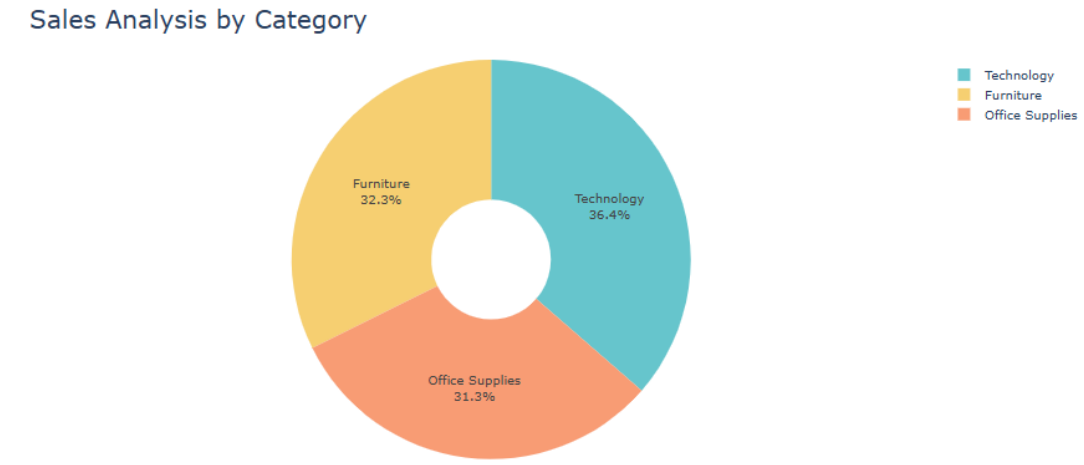
1) Monthy Sales Analysis

[22]:
```
sales_by_month = data.groupby('Order Month')['Sales'].sum().reset_index()
fig = px.line(sales_by_month,
              x='Order Month',
              y='Sales',
              title='Monthly Sales Analysis')
fig.show()
```

Sales are lowest at the start of the year, rise in March, and peak in October and November, showing strong seasonality. Business Growth Advice: Focus marketing campaigns, inventory, and staffing on the last quarter to capitalize on high demand, and use slower months for planning and process improvements.

2) Sales Analysis by Category

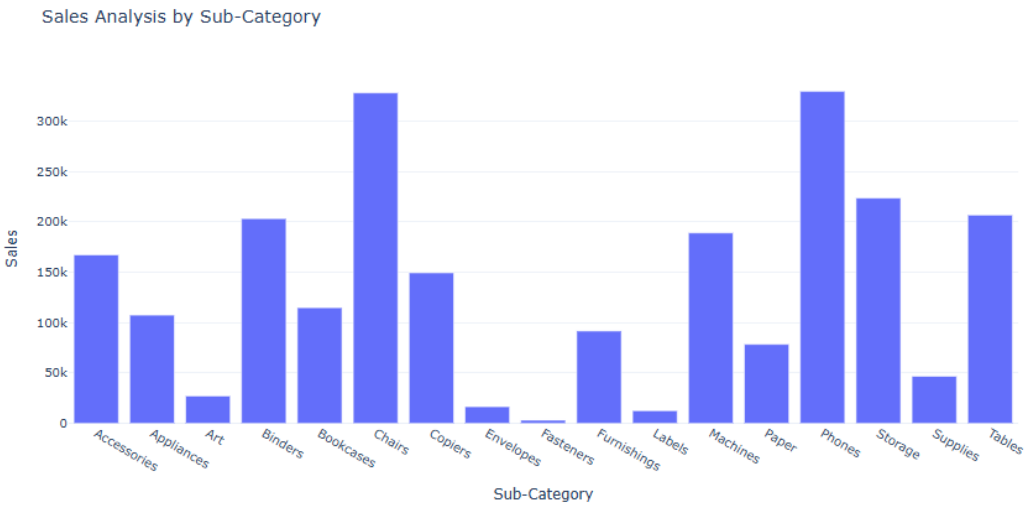
[23]:
```
sales_by_category = data.groupby('Category')['Sales'].sum().reset_index()


fig = px.pie(sales_by_category,
             values='Sales',
             names='Category',
             hole=0.3,
             color_discrete_sequence=px.colors.qualitative.Pastel)

fig.update_traces(textposition='inside', textinfo='percent+label')
fig.update_layout(title_text='Sales Analysis by Category', title_font=dict(size=24))

fig.show()
```



Technology leads with 36.4% of sales, followed by Furniture (32.3%) and Office Supplies (31.3%), making Technology the most profitable segment. Business Growth Advice: Prioritize investments and promotions in Technology products to maximize returns, while maintaining balanced offerings across all categories.

3) Sales Analysis by Sub-Category

[24]:
```
sales_by_subcategory = data.groupby('Sub-Category')['Sales'].sum().reset_index()
fig = px.bar(sales_by_subcategory,
             x='Sub-Category',
             y='Sales',
             title='Sales Analysis by Sub-Category')
fig.show()
```



Phones and Chairs generate the highest sales, while Envelopes, Fasteners, and Art are the lowest performers. Business Growth Advice: Expand and promote top-performing sub-categories like Phones and Chairs, and reassess or optimize inventory for low-performing items to improve overall profitability.

4) Monthly Profit Analysis

[15]:
```
Profit_by_month = data.groupby('Order Month')['Profit'].sum().reset_index()
```

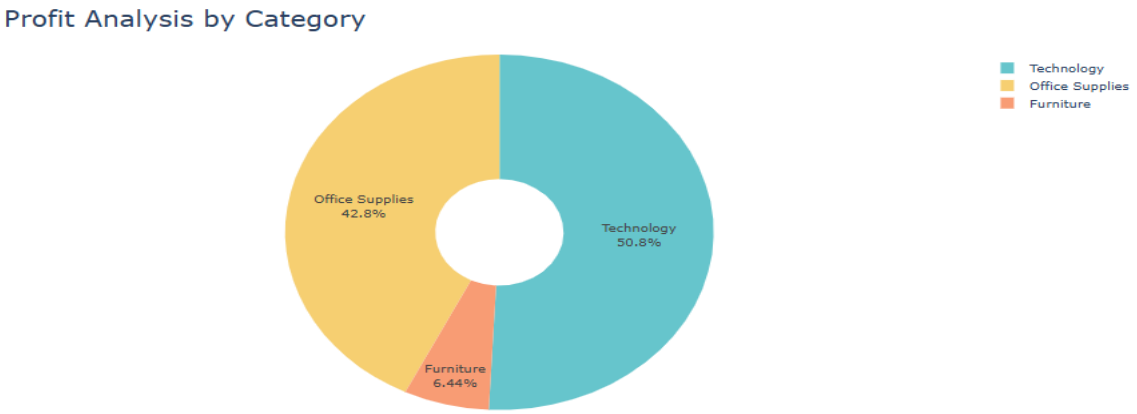
[25]:
```
profit_by_month = data.groupby('Order Month')['Profit'].sum().reset_index()
fig = px.line(profit_by_month,
              x='Order Month',
              y='Profit',
              title='Monthly Profit Analysis')
fig.show()
```

There is an upward trend in profits towards the end of the year, with a significant spike around November and December. Business Growth Advice: Focus efforts on driving sales during the last quarter to maximize profits. The beginning of the year shows slower growth, which could be a good time to plan and optimize internal processes or run targeted campaigns.

5) Profit by category

[17]:
```
profit_by_category = data.groupby('Category')['Profit'].sum().reset_index()
```

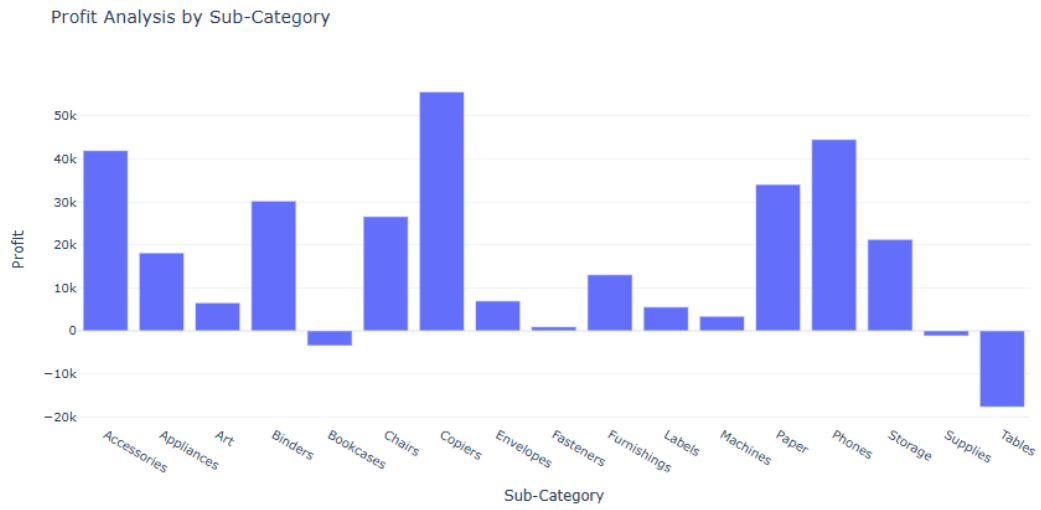
[26]:
```
profit_by_category = data.groupby('Category')['Profit'].sum().reset_index()

fig = px.pie(profit_by_category,
             values='Profit',
             names='Category',
             hole=0.3
             ,
             color_discrete_sequence=px.colors.qualitative.Pastel)

fig.update_traces(textposition='inside', textinfo='percent+label')
fig.update_layout(title_text='Profit Analysis by Category', title_font=dict(size=24))

fig.show()
```



Technology leads with 50.8% of the total profit, followed by Office Supplies (42.8%) and Furniture (6.4%). Business Growth Advice: Prioritize investments and promotions in Technology products, as they are the most profitable. However, balance offerings in Office Supplies, which also make a significant contribution to profits.

6) Profit Analysis by sub - Category

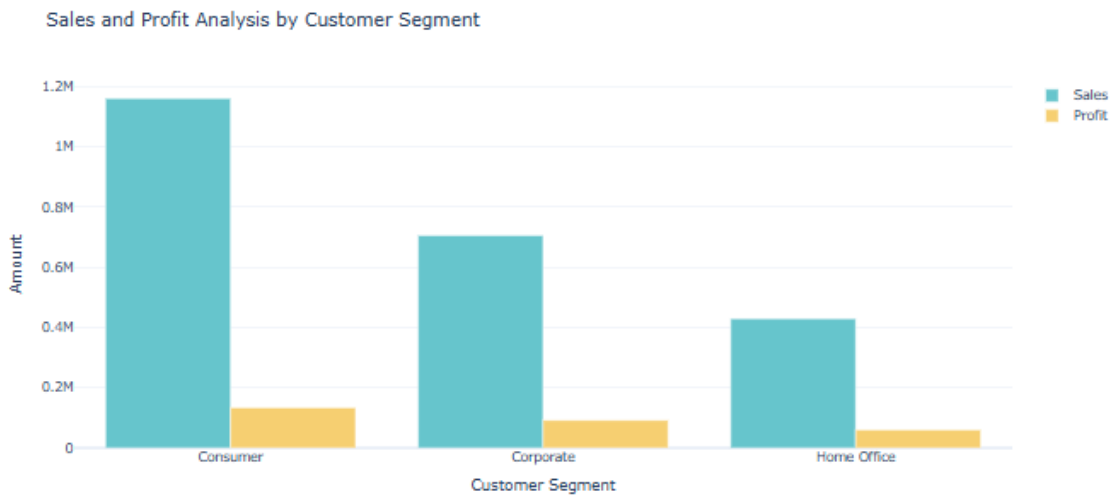
[27]:
```
profit_by_subcategory = data.groupby('Sub-Category')['Profit'].sum().reset_index()
fig = px.bar(profit_by_subcategory, x='Sub-Category',
             y='Profit',
             title='Profit Analysis by Sub-Category')
fig.show()
```



Products like Copiers, Chairs, and Machines contribute the most to profits, while categories like Fasteners and Art are the least profitable. Business Growth Advice: Focus on top-performing sub-categories like Copiers and Chairs for promotions, and consider reevaluating or optimizing inventory for low-performing items like Fasteners and Art to increase overall profitability.

Sales and profit

[28]:
```
sales_profit_by_segment = data.groupby('Segment').agg({'Sales': 'sum', 'Profit': 'sum'}).reset_index()

color_palette = colors.qualitative.Pastel

fig = go.Figure()
fig.add_trace(go.Bar(x=sales_profit_by_segment['Segment'],
                     y=sales_profit_by_segment['Sales'],
                     name='Sales',
                     marker_color=color_palette[0]))

fig.add_trace(go.Bar(x=sales_profit_by_segment['Segment'],
                     y=sales_profit_by_segment['Profit'],
                     name='Profit',
                     marker_color=color_palette[1]))

fig.update_layout(title='Sales and Profit Analysis by Customer Segment',
                  xaxis_title='Customer Segment', yaxis_title='Amount')

fig.show()
```



The Consumer segment generates the highest sales and profit, while Corporate and Home Office segments show lower results. Business Growth Advice: Increase focus on the Consumer segment, as it provides the most significant revenue. Investigate opportunities to grow Corporate and Home Office sales by targeting specific customer needs in these segments.

Sales by Profit Ratio

[21]:
```
sales_profit_by_segment = data.groupby('Segment').agg({'Sales': 'sum', 'Profit': 'sum'}).reset_index()
sales_profit_by_segment['Sales_to_Profit_Ratio'] = sales_profit_by_segment['Sales'] / sales_profit_by_segment['Profit']
print(sales_profit_by_segment[['Segment', 'Sales_to_Profit_Ratio']])
```

```
       Segment  Sales_to_Profit_Ratio
0     Consumer               8.659471
1    Corporate               7.677245
2  Home Office               7.125416
```