Assignment

In [77]:
```
# import libraries
import pandas as pd
import matplotlib.pyplot as plt
from bokeh.plotting import figure, show,output_notebook

output_notebook()

# read "Chocolate_Sales.csv"
df = pd.read_csv("Chocolate_Sales.csv")
```

BokehJS 3.6.0 successfully loaded.

Data Cleaning & Data Processing

In [80]:
```
# find the sum of the duplicated row
df.duplicated().sum()
# Since there are no duplicate records in the dataset, there's no need to perform any data dedupl
```

Out[80]:
```
0
```

In [82]:
```
# find the sum of the null row
df.isnull().sum()
# Since the result is zero for every column, there are no missing values in the dataset.
```

Out[82]:
```
Sales Person     0
Country          0
Product          0
Date             0
Amount           0
Boxes Shipped    0
dtype: int64
```

In [84]:
```
# Format the date and change its type into datetime
df["Date"] = pd.to_datetime(df["Date"], format='%d-%b-%y')
```

In [86]:
```
# remove the dollar sign and , then change its type into int
df["Amount"] = df["Amount"].str.replace('[$,]','',regex=True).astype(int)
```

In [88]:
```
# Check whether there is amount that is negative value
print("[Amount] that is negative value: ",df[df["Amount"] < 0]["Amount"].count())
#There is no Amount that is negative number

# Check whether there is boxes shipped that is negative value
print("[Boxes Shipped] that is negative value: ",df[df["Boxes Shipped"] < 0]["Boxes Shipped"].cou
#There is no Boxes Shipped that is negative number
```

```
[Amount] that is negative value:  0
[Boxes Shipped] that is negative value:  0
```

In [90]:
```
# Create another column called "Month" for later use
df["Month"] = df["Date"].dt.month
```

Exploratory Data Analysis (EDA)

a. The general information about the entire data set Chocolate_Sales.csv

In [94]:
```
df.head(5)
```

Out[94]:

	Sales Person	Country	Product	Date	Amount	Boxes Shipped	Month
0	Jehu Rudeforth	UK	Mint Chip Choco	2022-01-04	5320	180	1
1	Van Tuxwell	India	85% Dark Bars	2022-08-01	7896	94	8
2	Gigi Bohling	India	Peanut Butter Cubes	2022-07-07	4501	91	7
3	Jan Morforth	Australia	Peanut Butter Cubes	2022-04-27	12726	342	4
4	Jehu Rudeforth	UK	Peanut Butter Cubes	2022-02-24	13685	184	2

In [96]:
```
df.tail(5)
```

Out[96]:

	Sales Person	Country	Product	Date	Amount	Boxes Shipped	Month
1089	Karlen McCaffrey	Australia	Spicy Special Slims	2022-05-17	4410	323	5
1090	Jehu Rudeforth	USA	White Choc	2022-06-07	6559	119	6
1091	Ches Bonnell	Canada	Organic Choco Syrup	2022-07-26	574	217	7
1092	Dotty Strutley	India	Eclairs	2022-07-28	2086	384	7
1093	Karlen McCaffrey	India	70% Dark Bites	2022-05-23	5075	344	5

In [98]:
```
df.sample(5)
```

Out[98]:

	Sales Person	Country	Product	Date	Amount	Boxes Shipped	Month
791	Gigi Bohling	New Zealand	Smooth Sliky Salty	2022-01-10	700	97	1
696	Van Tuxwell	Canada	Peanut Butter Cubes	2022-06-24	6342	282	6
346	Curtice Advani	Australia	99% Dark & Pure	2022-01-07	4676	84	1
578	Jehu Rudeforth	UK	Milk Bars	2022-05-03	12068	227	5
22	Marney O'Breen	USA	After Nines	2022-05-30	4753	163	5

In [100…
```
df.shape
```

Out[100…
```
(1094, 7)
```

There are 1094 rows and 7 columns

In [103…
```
df.columns
```

Out[103…
```
Index(['Sales Person', 'Country', 'Product', 'Date', 'Amount', 'Boxes Shipped',
       'Month'],
      dtype='object')
```

In [105…
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1094 entries, 0 to 1093
Data columns (total 7 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Sales Person   1094 non-null   object
 1   Country        1094 non-null   object
 2   Product        1094 non-null   object
 3   Date           1094 non-null   datetime64[ns]
 4   Amount         1094 non-null   int32
 5   Boxes Shipped  1094 non-null   int64
 6   Month          1094 non-null   int32
dtypes: datetime64[ns](1), int32(2), int64(1), object(3)
memory usage: 51.4+ KB
```

In [107…
```
df.dtypes
```

Out[107…
```
Sales Person             object
Country                  object
Product                  object
Date             datetime64[ns]
Amount                    int32
Boxes Shipped             int64
Month                     int32
dtype: object
```

In [109…
```
df[["Amount","Boxes Shipped"]].describe()
```

Out[109…

	Amount	Boxes Shipped
count	1094.000000	1094.000000
mean	5652.308044	161.797989
std	4102.442014	121.544145
min	7.000000	1.000000
25%	2390.500000	70.000000
50%	4868.500000	135.000000
75%	8027.250000	228.750000
max	22050.000000	709.000000

In [111…
```
df.describe(include='object')
```

Out[111…

	Sales Person	Country	Product
count	1094	1094	1094
unique	25	6	22
top	Kelci Walkden	Australia	50% Dark Bites
freq	54	205	60

b. List the chocolates sold out to India.

In [114…
```
# Find all the name of the chocolates that sold out to India
products = df.loc[df["Country"] == "India"]["Product"]
```

```
# Find the name of chocolates
products.unique()
```

Out[114…
```
array(['85% Dark Bars', 'Peanut Butter Cubes', 'Smooth Sliky Salty',
       'Fruit & Nut Bars', 'Manuka Honey Choco', 'Spicy Special Slims',
       'Eclairs', 'Almond Choco', '99% Dark & Pure', '50% Dark Bites',
       'Organic Choco Syrup', 'Raspberry Choco', 'Orange Choco',
       'Caramel Stuffed Bars', "Baker's Choco Chips", 'After Nines',
       'Drinking Coco', '70% Dark Bites', 'Milk Bars', 'Mint Chip Choco',
       'Choco Coated Almonds', 'White Choc'], dtype=object)
```

c. Identify the salesperson with the highest sales by ranking them based on sales amount.

In [117…
```
# Sum the amount based on the sales person and sort it descendingly.
df.groupby(["Sales Person"])["Amount"].sum().sort_values(ascending=False).head(1)
```

Out[117…
```
Sales Person
Ches Bonnell    320901
Name: Amount, dtype: int32
```

Ches Bonnell

d. Find all sales region or store location where the transaction took place.

In [121…
```
# Find all sales region or store location
df["Country"].unique()
```

Out[121…
```
array(['UK', 'India', 'Australia', 'New Zealand', 'USA', 'Canada'],
      dtype=object)
```

Australia, Canada, India, New Zealand, UK and USA

e. Do additional EDA steps to explain your problem definition in detail.

Which chocolate products generate the highest revenue?

In [126…
```
# Use Product and Amount columns
revenue = df[["Product", "Amount"]]

# Find the revenue by grouping the product based on the sum of the amount and sort it ascendingly
max_rev = revenue.groupby("Product")["Amount"].sum().sort_values(ascending=False)
# Get the top 3 revenues
top3_rev = max_rev.head(3)
print(top3_rev)
```

```
Product
Smooth Sliky Salty    349692
50% Dark Bites        341712
White Choc            329147
Name: Amount, dtype: int32
```

Smooth Sliky Salty,50% Dark Bites and White Choc

Which countries contribute most to the total sales?

In [130…
```
# Find the country sales by grouping based on country and sum the amount and sort it in descendin
country_sales = df.groupby("Country")["Amount"].sum().sort_values(ascending=False)
```

```
# Find the top 3 countries sales
top3_country_sales =country_sales.head(3)
print(top3_country_sales)
```

```
Country
Australia    1137367
UK           1051792
India        1045800
Name: Amount, dtype: int32
```

Australia, UK and India

Do sales vary significantly across different months?

In [134…
```
# Group by the month and sum all the amount
amount_according_month = df.groupby(["Month"])["Amount"].sum()
print(amount_according_month)
amount_according_month.describe()
```

```
Month
1    896105
2    699377
3    749483
4    674051
5    752892
6    865144
7    803425
8    743148
Name: Amount, dtype: int32
```

Out[134…
```
count         8.00000
mean     772953.12500
std       77118.45656
min      674051.00000
25%      732205.25000
50%      751187.50000
75%      818854.75000
max      896105.00000
Name: Amount, dtype: float64
```

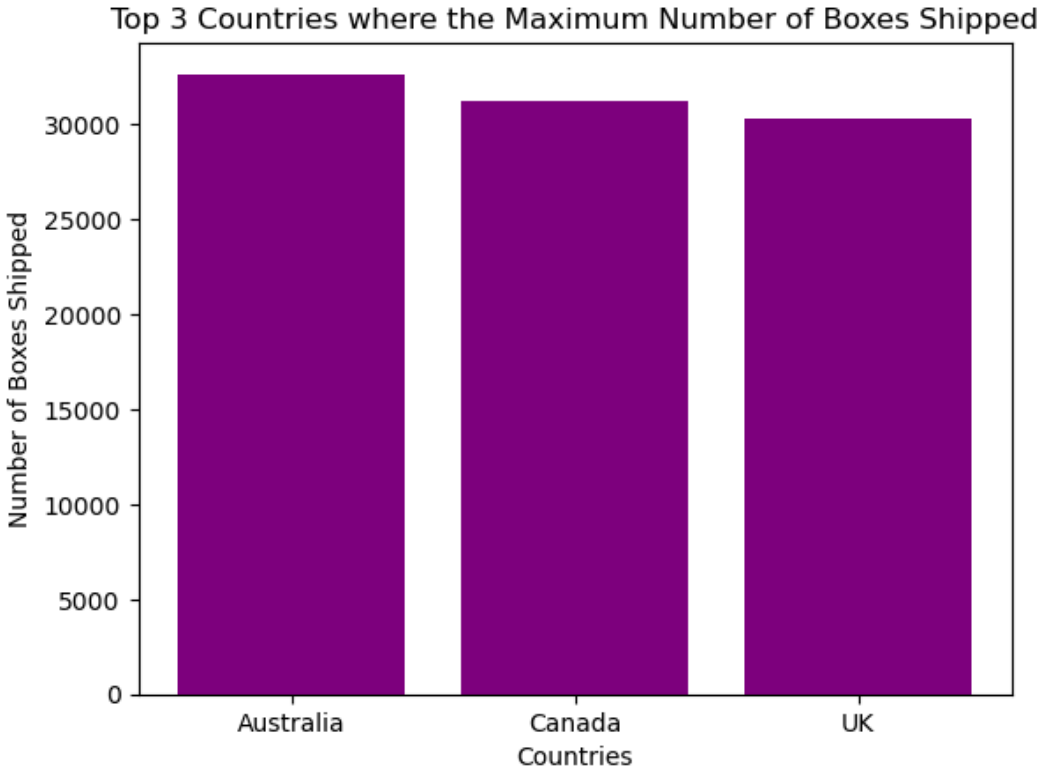
Yes, sales do vary significantly across different months. Month 1 has the highest amount. In Contrast, Month 4 marks the lowest amount.

2.5 Data Visualization

a. Plot the suitable type of chart to the top 3 countries where the maximum number of boxes shipped.

In [139…
```
# Find Top 3 coutries by grouping based on the country and sum the boxes shipped and sort descend
top_3_countries = df.groupby("Country")["Boxes Shipped"].sum().sort_values(ascending=False).head(

# Set the title
plt.title("Top 3 Countries where the Maximum Number of Boxes Shipped")

# Plot a bar chart
plt.bar(x=top_3_countries.index,height=top_3_countries, color="purple")

# Label x-axis
plt.xlabel("Countries")
```

```
# Label y-axis
plt.ylabel("Number of Boxes Shipped")

# Show the plot
plt.show()
```

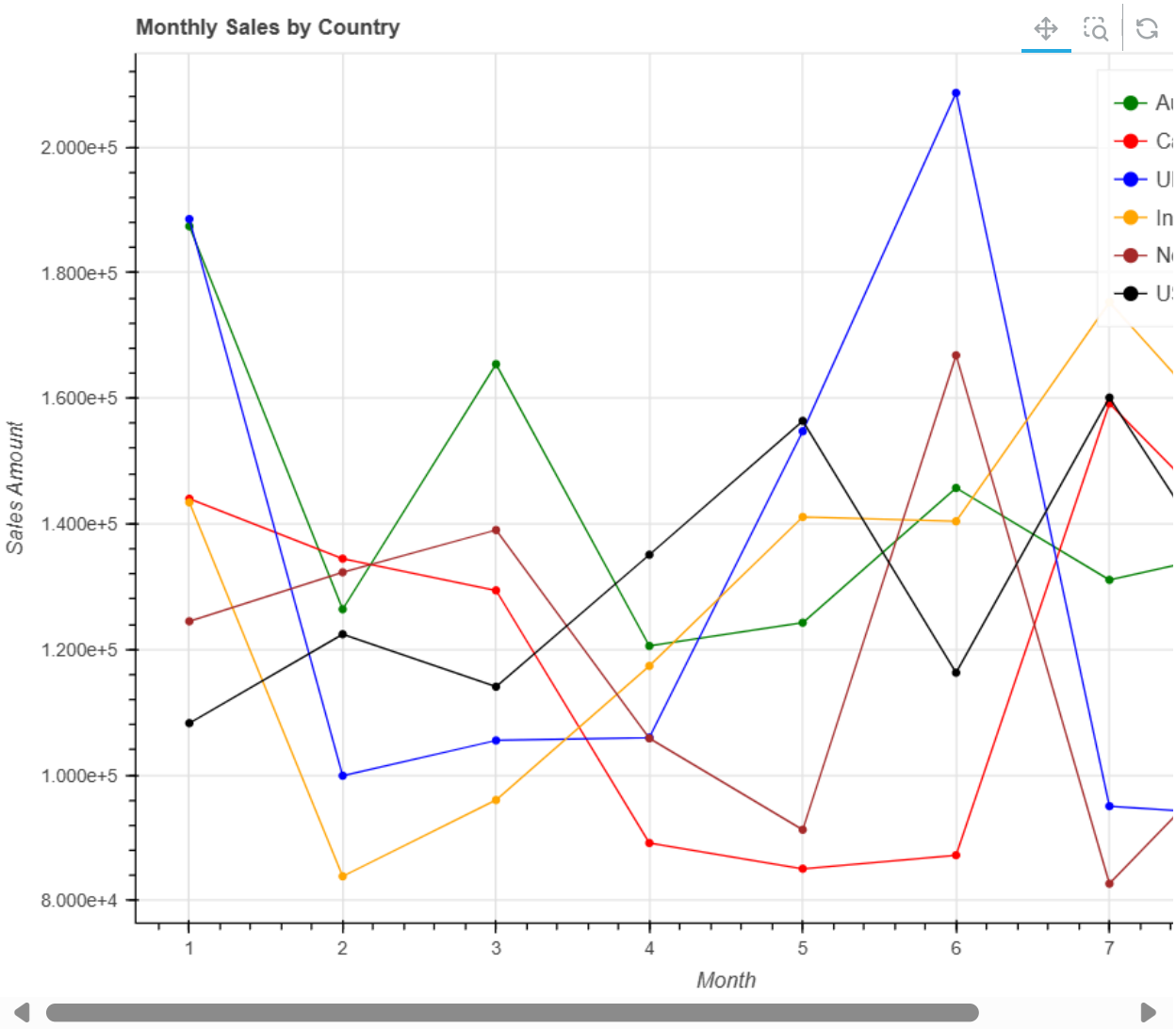


b. Select the appropriate chart type to create an interactive visualization of the monthly sales report categorized by country.

In [142…

```
# Create a Bokeh figure to visualize monthly sales by country
p = figure( height=600, width=800,
           title="Monthly Sales by Country",
             x_axis_label="Month", y_axis_label="Sales Amount",
             toolbar_location="above",
             tooltips=[("Month","@x"),("Sales Amount","@y")],
           tools="pan,box_zoom,reset,save,hover")

# Plot monthly sales as both line and scatter for a specific country
def findMonthlySalesBasedOnCountry(country, color):
  monthlySales = df[df["Country"] == country].groupby("Month")["Amount"].sum()
  p.line(x=monthlySales.index, y=monthlySales,legend_label=country,color=color)
  p.scatter(x=monthlySales.index,y=monthlySales,legend_label=country,color=color)

# Australia's monthly sales
findMonthlySalesBasedOnCountry("Australia", "green")

# Canada's monthly sales
findMonthlySalesBasedOnCountry("Canada", "red")

# United Kingdom's monthly sales
findMonthlySalesBasedOnCountry("UK", "blue")

# India's monthly sales
findMonthlySalesBasedOnCountry("India", "orange")
```

```
# New Zealand's monthly sales
findMonthlySalesBasedOnCountry("New Zealand", "brown")

# USA's monthly sales
findMonthlySalesBasedOnCountry("USA", "black")

# muting glyphs
p.legend.click_policy="mute"

# Show the plot
show(p)
```



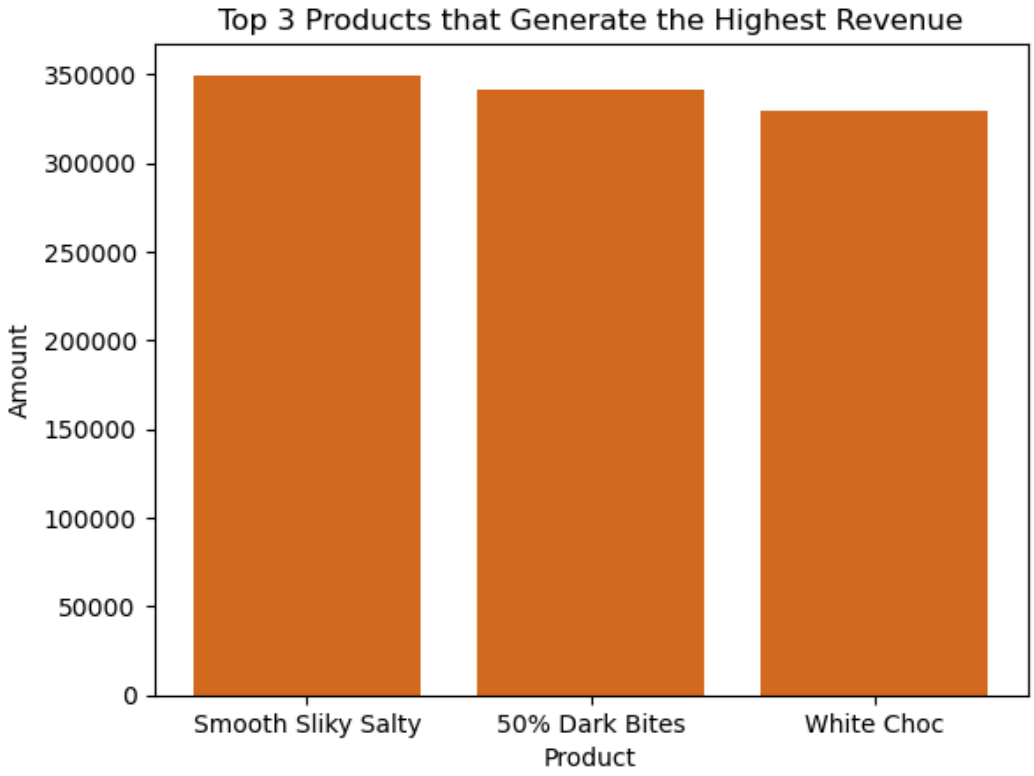
c. Draw more graphs/interactive graphs to explain your problem definition in detail.

Which chocolate products generate the highest revenue?

In [145…

```
# Plot a bar chart with chocolate colour
plt.bar(x=top3_rev.index, height=top3_rev, color="chocolate")

# Set the title
plt.title("Top 3 Products that Generate the Highest Revenue")

# Set the x-axis label
```

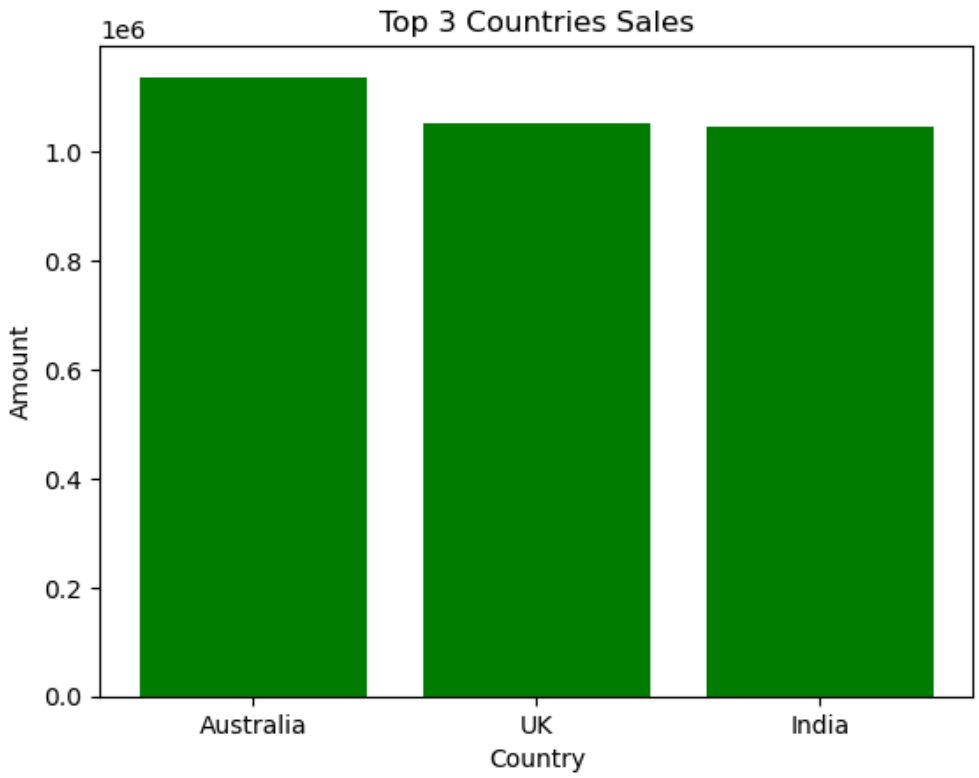
```
plt.xlabel("Product")

# Set the y-axis label
plt.ylabel("Amount")

# Show the plot
plt.show()
```



Which countries contribute most to the total sales?

In [149…

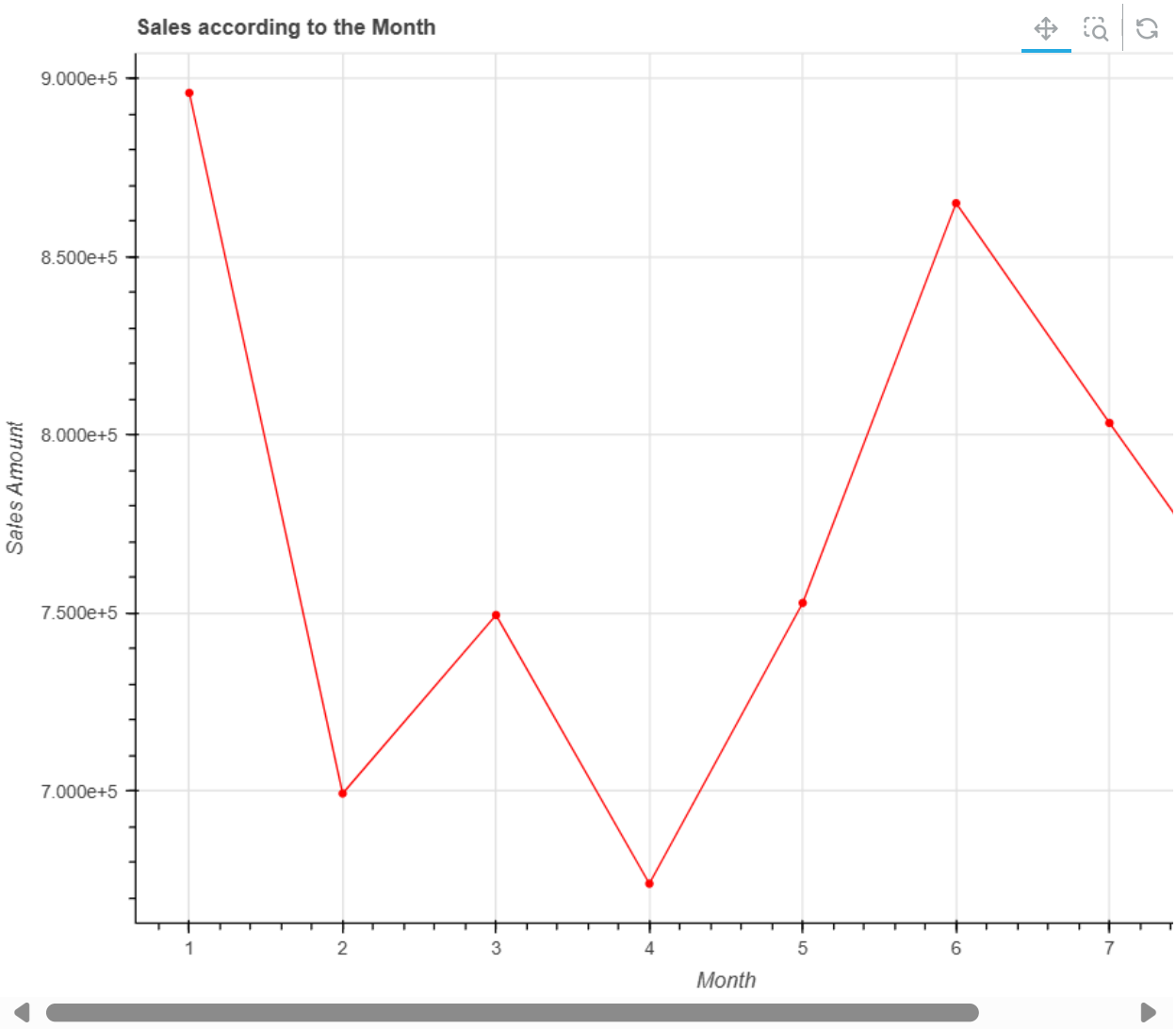
```
# Plot a bar chart with green colour
plt.bar(x=top3_country_sales.index, height=top3_country_sales,color="g")

# Set the title
plt.title("Top 3 Countries Sales")

# Set the x-axis label
plt.xlabel("Country")

# Set the y-axis label
plt.ylabel("Amount")

# Show the plot
plt.show()
```



Do sales vary significantly across different months?

In [152…

```
# Set the title, size of the figure, x-axis label, y-axis label and tools.
p = figure( height=600, width=800,
           title="Sales according to the Month",
             x_axis_label="Month", y_axis_label="Sales Amount",
             toolbar_location="above",
             tooltips=[('Month', '@x'), ('Sales Amount', '@y')],
           tools="pan,box_zoom,reset,save,hover")

# Plot a line with scatter graph
p.line(x=amount_according_month.index, y=amount_according_month,color='red')
p.scatter(x=amount_according_month.index, y=amount_according_month,color='red')


# Show the figure
show(p)
```



From Month 1 to Month 2, there's a sharp drop in sales. Then there is a small recovery in Month 3. Another drop happens in Month 4, reaching the lowest point. Sales rise sharply again in Month 5 and peak around Month 6. After Month 6, sales decreased steadily into Month 8.