Importing Libraries:

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from matplotlib import ticker
import math
%matplotlib inline
```

Loading the data:

In [2]:
```
df=pd.read_csv("C:\Users\HP\Documents\DS INTERNSHIP\Amazon Sales data.csv",parse_dates=["Order Date","Ship Dat
df.head()
```

Out[2]:

	Region	Country	Item Type	Sales Channel	Order Priority	Order Date	Order ID	Ship Date	Units Sold	Unit Price	Unit Cost	Total Revenue	Total Cost	Total Profit
0	Australia and Oceania	Tuvalu	Baby Food	Offline	H	2010-05-28	669165933	2010-06-27	9925	255.28	159.42	2533654.00	1582243.50	951410.50
1	Central America and the Caribbean	Grenada	Cereal	Online	C	2012-08-22	963881480	2012-09-15	2804	205.70	117.11	576782.80	328376.44	248406.36
2	Europe	Russia	Office Supplies	Offline	L	2014-05-02	341417157	2014-05-08	1779	651.21	524.96	1158502.59	933903.84	224598.75
3	Sub-Saharan Africa	Sao Tome and Principe	Fruits	Online	C	2014-06-20	514321792	2014-07-05	8102	9.33	6.92	75591.66	56065.84	19525.82
4	Sub-Saharan Africa	Rwanda	Office Supplies	Offline	L	2013-02-01	115456712	2013-02-06	5062	651.21	524.96	3296425.02	2657347.52	639077.50

Analysing and preprocessing:

In [2]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 100 entries, 0 to 99
Data columns (total 14 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   Region          100 non-null    object
 1   Country         100 non-null    object
 2   Item Type       100 non-null    object
 3   Sales Channel   100 non-null    object
 4   Order Priority  100 non-null    object
 5   Order Date      100 non-null    datetime64[ns]
 6   Order ID        100 non-null    int64
 7   Ship Date       100 non-null    datetime64[ns]
 8   Units Sold      100 non-null    int64
 9   Unit Price      100 non-null    float64
 10  Unit Cost       100 non-null    float64
 11  Total Revenue   100 non-null    float64
 12  Total Cost      100 non-null    float64
 13  Total Profit    100 non-null    float64
dtypes: datetime64[ns](2), float64(5), int64(2), object(5)
memory usage: 11.1+ KB
```

In [3]:
```
df.describe()
```

Out[3]:

	Order ID	Units Sold	Unit Price	Unit Cost	Total Revenue	Total Cost	Total Profit
count	1.000000e+02	100.000000	100.000000	100.000000	1.000000e+02	1.000000e+02	1.000000e+02
mean	5.550204e+08	5128.710000	276.761300	191.048000	1.373488e+06	9.318057e+05	4.416820e+05
std	2.606153e+08	2794.484562	235.592241	188.208181	1.460029e+06	1.083938e+06	4.385379e+05
min	1.146066e+08	124.000000	9.330000	6.920000	4.870260e+03	3.612240e+03	1.258020e+03
25%	3.389225e+08	2836.250000	81.730000	35.840000	2.687212e+05	1.688680e+05	1.214436e+05
50%	5.577086e+08	5382.500000	179.880000	107.275000	7.523144e+05	3.635664e+05	2.907680e+05
75%	7.907551e+08	7369.000000	437.200000	263.330000	2.212045e+06	1.613870e+06	6.358288e+05
max	9.940222e+08	9925.000000	668.270000	524.960000	5.997055e+06	4.509794e+06	1.719922e+06

Insights: There are 5 non numerical columns and 7 numerical columns and 2 date columns in this dataset. Total records - 100 Total attributes - 14

In [14]:
```
df.isnull().sum()
```

Out[14]:
```
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
```

Insights: No null values found in the records.

In [4]:
```
categorical_columns=[col for col in df.columns if df[col].dtype in ['O','Object']]
categorical_columns
```

Out[4]:
```
['Region', 'Country', 'Item Type', 'Sales Channel', 'Order Priority']
```

In [5]:
```
numerical_columns=[col for col in df.columns if df[col].dtype not in ['O','Object']]
numerical_columns
```

Out[5]:
```
['Order Date',
 'Ship Date',
 'Units Sold',
 'Unit Price',
 'Unit Cost',
 'Total Revenue',
 'Total Cost',
 'Total Profit']
```

In [6]:
```
df.drop('Order ID',axis='columns',inplace=True)
```

In [6]:
```
for col in categorical_columns:
    print('COLUMN NAME: ',col)
    print(df[col].value_counts())
    print('\n')
```

```
COLUMN NAME:  Region
Sub-Saharan Africa                   36
Europe                               22
Australia and Oceania                11
Asia                                 11
Middle East and North Africa         10
Central America and the Caribbean     7
North America                         3
Name: Region, dtype: int64


COLUMN NAME:  Country
The Gambia               4
Sierra Leone             3
Sao Tome and Principe    3
Mexico                   3
Australia                3
                        ..
Comoros                  1
Iceland                  1
Macedonia                1
Mauritania               1
Mozambique               1
Name: Country, Length: 76, dtype: int64


COLUMN NAME:  Item Type
Clothes            13
Cosmetics          13
Office Supplies    12
Fruits             10
Personal Care      10
Household           9
Beverages           8
Baby Food           7
Cereal              7
Vegetables          6
Snacks              3
Meat                2
Name: Item Type, dtype: int64


COLUMN NAME:  Sales Channel
Offline    50
Online     50
Name: Sales Channel, dtype: int64


COLUMN NAME:  Order Priority
H    30
L    27
C    22
M    21
Name: Order Priority, dtype: int64
```

Insights: 1. Column Region has 7 unique values. 2. Column Item Type has 12 unique values. 3. Column Sales Channel has 2 unique values. 4. Column Order Priority has 4 unique values.

```
df['Order Date']=pd.to_datetime(df['Order Date'],yearfirst=True)
df['Ship Date']=pd.to_datetime(df['Ship Date'], yearfirst=True)
```

In [8]:
```
df.head()
```

Out[8]:

	Region	Country	Item Type	Sales Channel	Order Priority	Order Date	Ship Date	Units Sold	Unit Price	Unit Cost	Total Revenue	Total Cost	Total Profit
0	Australia and Oceania	Tuvalu	Baby Food	Offline	H	2010-05-28	2010-06-27	9925	255.28	159.42	2533654.00	1582243.50	951410.50
1	Central America and the Caribbean	Grenada	Cereal	Online	C	2012-08-22	2012-09-15	2804	205.70	117.11	576782.80	328376.44	248406.36
2	Europe	Russia	Office Supplies	Offline	L	2014-05-02	2014-05-08	1779	651.21	524.96	1158502.59	933903.84	224598.75
3	Sub-Saharan Africa	Sao Tome and Principe	Fruits	Online	C	2014-06-20	2014-07-05	8102	9.33	6.92	75591.66	56065.84	19525.82
4	Sub-Saharan Africa	Rwanda	Office Supplies	Offline	L	2013-02-01	2013-02-06	5062	651.21	524.96	3296425.02	2657347.52	639077.50

In [9]:
```
df['Ord_Yr']=pd.to_datetime(df['Order Date']).dt.year
df['Ord_Mon']=pd.to_datetime(df['Order Date']).dt.month
df['Ord_Day']=pd.to_datetime(df['Order Date']).dt.day
```

In [10]:
```
df.head()
```

Out[10]:

	Region	Country	Item Type	Sales Channel	Order Priority	Order Date	Ship Date	Units Sold	Unit Price	Unit Cost	Total Revenue	Total Cost	Total Profit	Ord_Yr	Ord_Mon
0	Australia and Oceania	Tuvalu	Baby Food	Offline	H	2010-05-28	2010-06-27	9925	255.28	159.42	2533654.00	1582243.50	951410.50	2010	5
1	Central America and the Caribbean	Grenada	Cereal	Online	C	2012-08-22	2012-09-15	2804	205.70	117.11	576782.80	328376.44	248406.36	2012	8
2	Europe	Russia	Office Supplies	Offline	L	2014-05-02	2014-05-08	1779	651.21	524.96	1158502.59	933903.84	224598.75	2014	5
3	Sub-Saharan Africa	Sao Tome and Principe	Fruits	Online	C	2014-06-20	2014-07-05	8102	9.33	6.92	75591.66	56065.84	19525.82	2014	6
4	Sub-Saharan Africa	Rwanda	Office Supplies	Offline	L	2013-02-01	2013-02-06	5062	651.21	524.96	3296425.02	2657347.52	639077.50	2013	2

In [11]:
```
df['Ship_Yr']=pd.to_datetime(df['Ship Date']).dt.year
df['Ship_Mon']=pd.to_datetime(df['Ship Date']).dt.month
df['Ship_Day']=pd.to_datetime(df['Ship Date']).dt.day
```

In [12]:
```
df.head()
```

Out[12]:

	Region	Country	Item Type	Sales Channel	Order Priority	Order Date	Ship Date	Units Sold	Unit Price	Unit Cost	Total Revenue	Total Cost	Total Profit	Ord_Yr	Ord_Mon
0	Australia and Oceania	Tuvalu	Baby Food	Offline	H	2010-05-28	2010-06-27	9925	255.28	159.42	2533654.00	1582243.50	951410.50	2010	5
1	Central America and the Caribbean	Grenada	Cereal	Online	C	2012-08-22	2012-09-15	2804	205.70	117.11	576782.80	328376.44	248406.36	2012	8
2	Europe	Russia	Office Supplies	Offline	L	2014-05-02	2014-05-08	1779	651.21	524.96	1158502.59	933903.84	224598.75	2014	5
3	Sub-Saharan Africa	Sao Tome and Principe	Fruits	Online	C	2014-06-20	2014-07-05	8102	9.33	6.92	75591.66	56065.84	19525.82	2014	6
4	Sub-Saharan Africa	Rwanda	Office Supplies	Offline	L	2013-02-01	2013-02-06	5062	651.21	524.96	3296425.02	2657347.52	639077.50	2013	2

In [13]:
```
df['Item Type'].value_counts()
```

Out[13]:
```
Clothes            13
Cosmetics          13
Office Supplies    12
Fruits             10
Personal Care      10
Household           9
Beverages           8
Baby Food           7
Cereal              7
Vegetables          6
Snacks              3
Meat                2
Name: Item Type, dtype: int64
```

Insights: Maximum of Clothes,Cosmetics and Office Supplies are purchased by the customers. Minimum of meat and snacks are purchased.

In [14]:
```
df['Sales Channel'].value_counts()
```

Out[14]:
```
Offline    50
Online     50
Name: Sales Channel, dtype: int64
```

Insights: Both online and offline purchases share equal proportions.

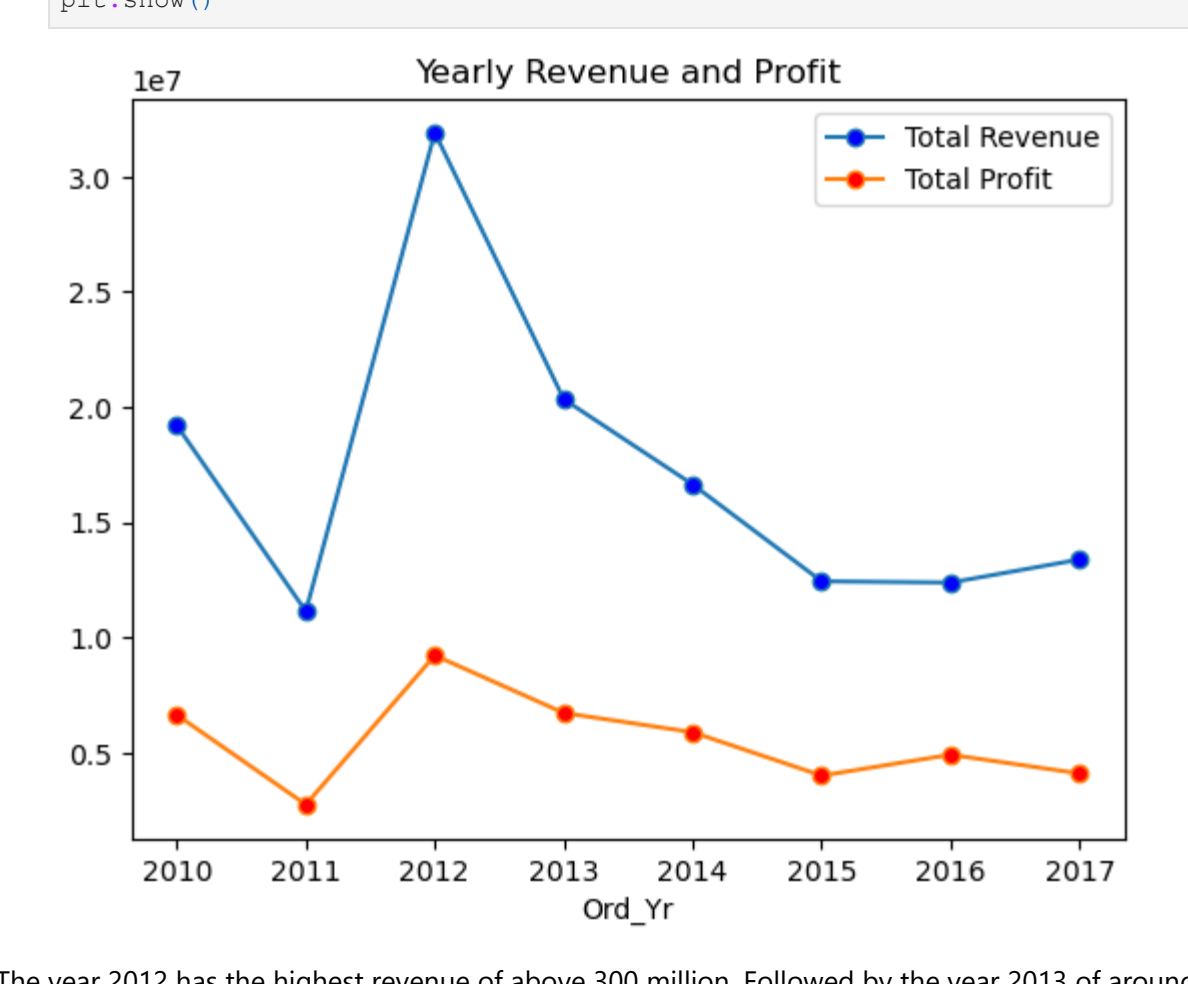
In [15]:
```
df['Region'].value_counts()
```

Out[15]:
```
Sub-Saharan Africa                   36
Europe                               22
Australia and Oceania                11
Asia                                 11
Middle East and North Africa         10
Central America and the Caribbean     7
North America                         3
Name: Region, dtype: int64
```

Yearly sales:

Sales trend by year:

In [29]:
```
(df.groupby('Ord_Yr')['Total Revenue'].sum()).plot(kind='line',marker='o',mfc='b')
(df.groupby('Ord_Yr')['Total Profit'].sum()).plot(kind='line',marker='o',mfc='r')
plt.legend()
plt.title('Yearly Revenue and Profit')
plt.show()
```



Insights: The year 2012 has the highest revenue of above 300 million. Followed by the year 2013 of around 200 million. The lowest revenue was observed in the year 2011 of around 110 million.And moderate revenue in the years 2010,2014. The profits flows along with the revenue obtained each year as revenue increases profit also increases and revenue decreases profit also decreases.

Item Type vs Yearly Revenue:

In [16]:
```
df1=df.groupby(['Ord_Yr','Item Type'])['Total Revenue'].sum().sort_values(ascending=False).reset_index()
df1
```

Out[16]:

	Ord_Yr	Item Type	Total Revenue
0	2013	Cosmetics	11248281.60
1	2016	Cosmetics	9753057.60
2	2012	Office Supplies	9105218.22
3	2012	Household	8374759.64
4	2010	Cosmetics	6620956.80
...	...	...	...
57	2011	Fruits	93775.83
58	2010	Fruits	54319.26
59	2010	Personal Care	22312.29
60	2015	Fruits	6279.09
61	2012	Fruits	4870.26

62 rows × 3 columns

Insights: Cosmetics yielded high revenue in the years 2013 which is the top and followed in the year 2016. Very low revenue was from fruits in most of the years like 2011,2010,2015,2012.

In [18]:
```
df2=df.groupby(['Ord_Yr','Item Type'])['Total Profit'].sum().sort_values(ascending=False).reset_index()
df2
```

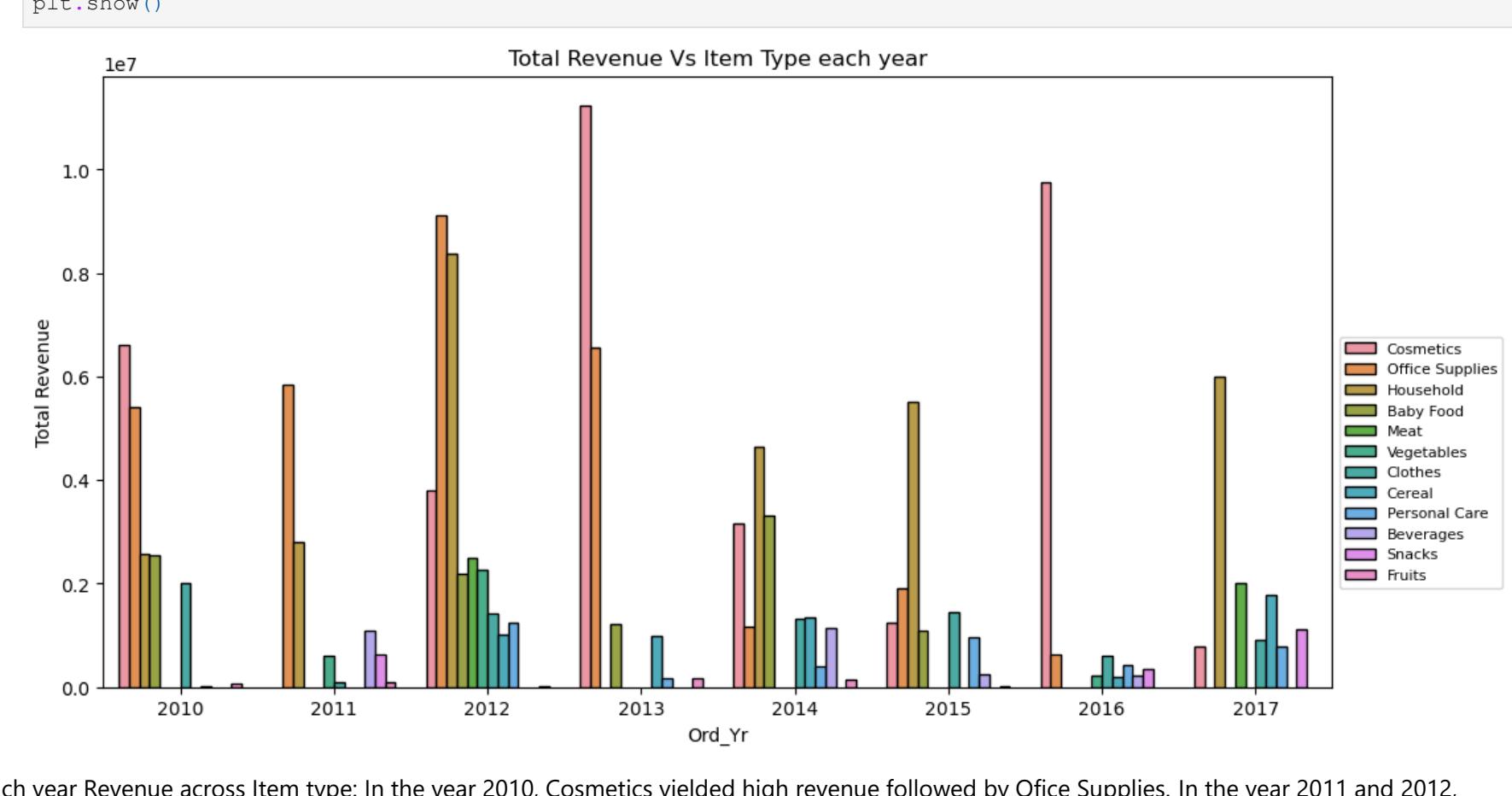
Out[18]:

	Ord_Yr	Item Type	Total Revenue
0	2013	Cosmetics	4473327.36
1	2016	Cosmetics	3878691.96
2	2010	Cosmetics	2633087.28
3	2012	Household	2076928.36
4	2012	Office Supplies	1765227.50
...	...	...	...
57	2011	Fruits	24222.91
58	2010	Fruits	14031.02
59	2010	Personal Care	6841.38
60	2015	Fruits	1621.93
61	2012	Fruits	1258.02

62 rows × 3 columns

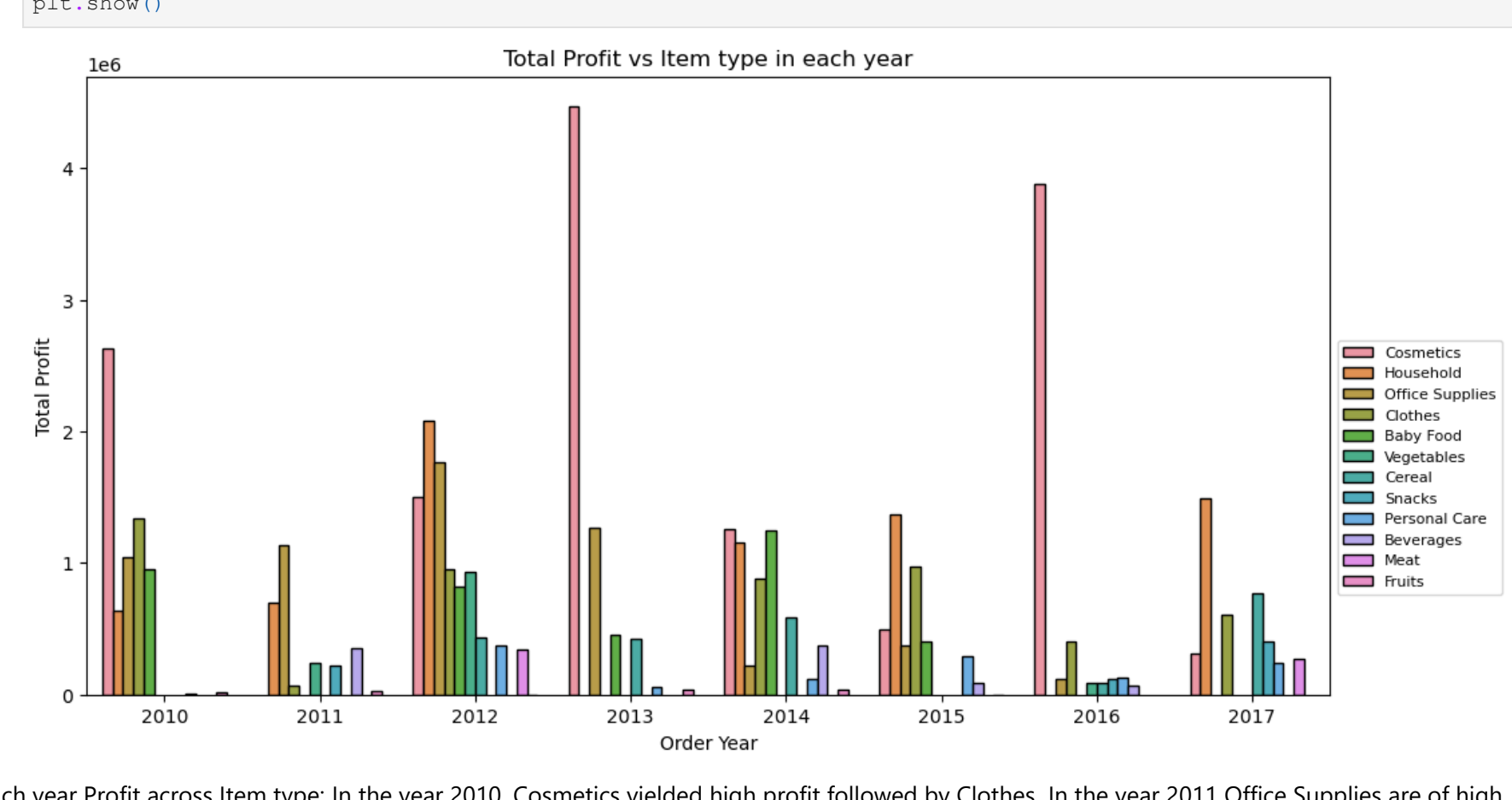
Insights: Cosmetics yields a high profit in the years 2013,2016,2010 by ranking among the years. Lowest profit was from fruits in most of the years like 2011,2010,2015,2012.

In [19]:
```
plt.figure(figsize=(12,6))
sns.barplot(data=df1,x='Ord_Yr',y='Total Revenue',hue='Item Type',ci=100,edgecolor='k')
plt.legend(bbox_to_anchor=(1.0, 0.15),loc='lower left',fontsize=8)
plt.title('Total Revenue Vs Item Type each year')
plt.show()
```



Insights: Each year Revenue across Item type: In the year 2010, Cosmetics yielded high revenue followed by Ofice Supplies. In the year 2011 and 2012, Office Supplies are of high revenue, followed by Household. In the year 2013, Cosmetics are of high revenue, followed by Office Supplies. In the year 2014, House hold are of hgh revenue, followed by Baby Food. In the year 2015, Household are of high revenue, followed by Office Supplies. In the year 2016, Cosmetics are of high revenue, followed by Office Supplies. In the year 2017, Household are of high revenue, followed by Meat.

In [20]:
```
plt.figure(figsize=(12,6))
sns.barplot(data=df2,x='Ord_Yr',y='Total Profit',hue='Item Type',ci=100,edgecolor='k')
plt.legend(bbox_to_anchor=(1.0, 0.15),loc='lower left',fontsize=8)
plt.title('Total Profit vs Item type in each year')
plt.xlabel('Order Year')
plt.show()
```



Insights: Each year Profit across Item type: In the year 2010, Cosmetics yielded high profit followed by Clothes. In the year 2011 Office Supplies are of high proit, followed by Household. In the year 2012, Household yielded high profit, followed by Office Supplies. In the year 2013, Cosmetics are of high proit, followed by Office Supplies. In the year 2014, Cosmetics and Baby food are of high profit, followed by Household. In the year 2015, Household are of high profit, followed by Clothes. In the year 2016, Cosmetics are of high profit,followed by Clothes. In the year 2017, Household are of high profit, followed by Cereal.

Region Vs YearlySales:

In [22]:
```
g1=df.groupby(df['Region'])
df_g1=g1.get_group('Sub-Saharan Africa')

g2=df.groupby(df['Region'])
df_g2=g2.get_group('Europe')

g3=df.groupby(df['Region'])
df_g3=g3.get_group('Australia and Oceania')

g4=df.groupby(df['Region'])
df_g4=g4.get_group('Asia')

g5=df.groupby(df['Region'])
df_g5=g5.get_group('Middle East and North Africa')

g6=df.groupby(df['Region'])
df_g6=g6.get_group('Central America and the Caribbean')

g7=df.groupby(df['Region'])
df_g7=g7.get_group('North America')
```

In [23]:
```
region_list=[df_g1,df_g2,df_g3,df_g4,df_g5,df_g6,df_g7]
region_name=["Sub-Saharan Africa","Europe","Australia and Oceania","Asia","Middle East and North Africa","Centr
sns.set_style("whitegrid")
plt.style.use('fivethirtyeight')
plt.figure(figsize=(25,20))
plt.subplots_adjust(top=1.25,bottom=1.2)
for i,region in enumerate(region_list,1):
    plt.subplot(math.ceil(len(region_list)/2),2,i)
    plt.scatter(region['Order Date'],region["Total Revenue"],marker='o',s=(100),label='Revenue')
    plt.scatter(region['Order Date'],region["Total Profit"],marker='+',s=(100),label='Profit')
    plt.ylabel("Total Revenue")
    plt.xlabel(None)
    plt.legend()
    plt.title(f"Yearwise Total Revenue and Profit of {region_name[i-1]}")
plt.tight_layout()
plt.show()
```

Insights: Highest Revenue of Sub Saharan Africa (around 3.5M) was in the year 2011 and 2012 and the Lowest Revenue (less than a million) was in the year 2010.Highest Profit of this region was in the year 2014 of 1M. Highest Revenue of Europe(around 5.3 million) was in the year 2010 and the Lowest Revenue was in the year 2011.Highest Profit of this region was in the year 2016. Highest Revenue of Australia and Ocenia (around 42 million) was in the year 2013 and the Lowest Revenue was in the years 2011,2016,2017.Highest Profit of this region was in the year 2013. Highest Revenue of Asia(around 5.5 million) was in the year 2015 and Lowest Revenue (less than 0.5 million) was in the year 2014.Highest Profit of this region was in the year 2015. Highest Revenue of Middle East and North Africa (around 4.5 million) was in the year 2013 and the Lowest Revenue was seen in the years 2011,2014 and 2015.Highest Profit of this region was in the year 2013. Highest Revenue of Central America and the Carribean (around 6 million) was seen in the year 2017 and the Lowest Revenue was seen in the year 2014 and 2015.Highest Profit of this region was in the year 2017. Highest Revenue of North America(around 4.5 million) was seen in the year 2014 and the Lowest Revenue was in the year 2011,2013,2016,2017. Highest Profit of this region was in the year 2014.

Sales Trend by Month:

In [24]:
```
monthly_sales=df.groupby('Ord_Mon')['Total Revenue'].sum().reset_index()
monthly_sales
```

Out[24]:

	Ord_Mon	Total Revenue
0	1	10482467.12
1	2	24740517.77
2	3	2274823.87
3	4	16187186.33
4	5	13215739.99
5	6	5230325.77
6	7	15669518.50
7	8	1128164.91
8	9	5314762.56
9	10	15287576.61
10	11	20568222.76
11	12	7249462.12

In [25]:
```
max_sales_month=monthly_sales.loc[monthly_sales['Total Revenue'].idxmax()]
max_sales_month
```

Out[25]:
```
Ord_Mon                 2.00
Total Revenue    24740517.77
Name: 1, dtype: float64
```

In [26]:
```
min_sales_month=monthly_sales.loc[monthly_sales['Total Revenue'].idxmin()]
min_sales_month
```

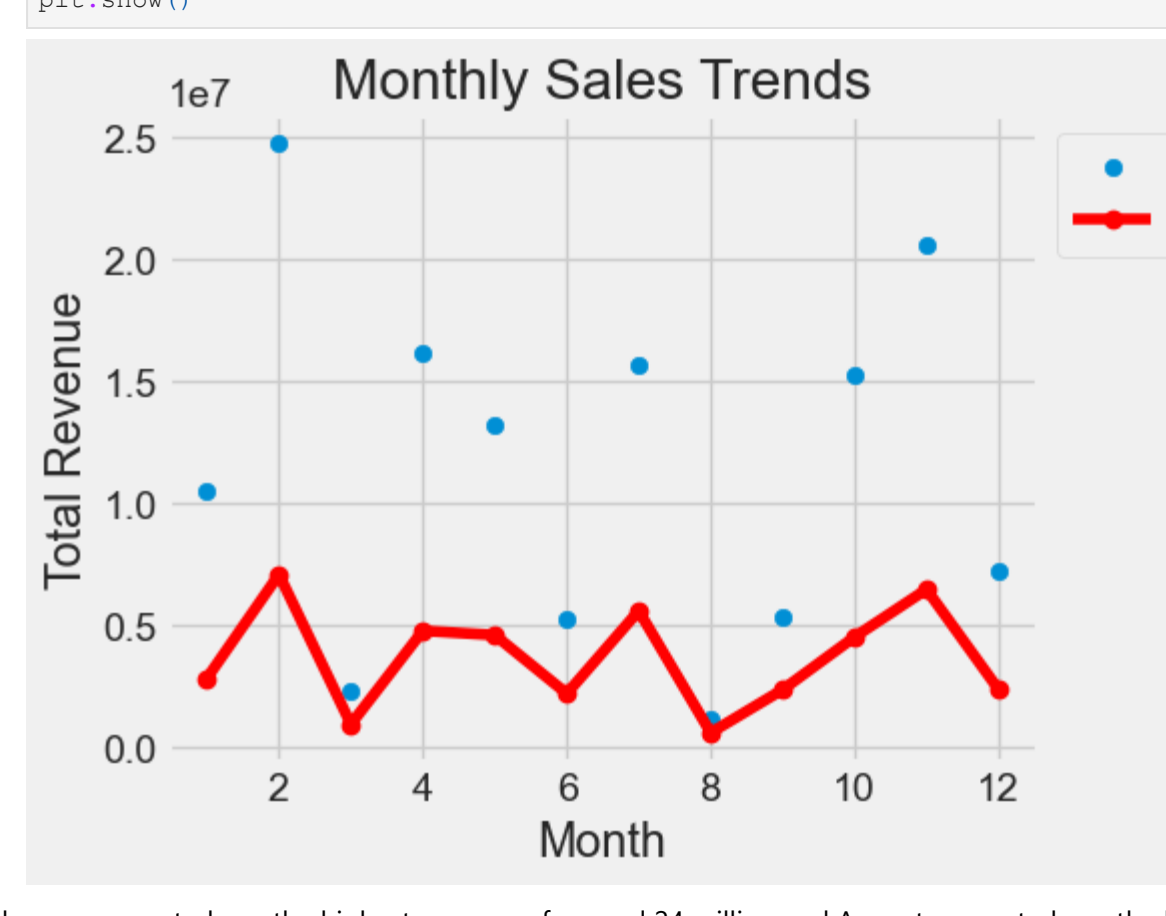
Out[26]:
```
Ord_Mon                8.00
Total Revenue    1128164.91
Name: 7, dtype: float64
```

In [27]:
```
monthly_salesp=df.groupby('Ord_Mon')['Total Profit'].sum().reset_index()
monthly_salesp
```

Out[27]:

	Ord_Mon	Total Profit
0	1	2816857.02
1	2	7072050.51
2	3	928351.06
3	4	4760208.35
4	5	4582692.30
5	6	2185379.43
6	7	5578463.06
7	8	579276.67
8	9	2344166.03
9	10	4506923.25
10	11	6457600.65
11	12	2356230.07

In [28]:
```
plt.figure(figsize=(5,4))
plt.scatter(x=monthly_sales['Ord_Mon'],y=monthly_sales['Total Revenue'],marker='o',label='Revenue')
plt.plot(monthly_salesp['Ord_Mon'],monthly_salesp['Total Profit'],marker='o',color='r',label='Profit')
plt.title('Monthly Sales Trends')
plt.legend(bbox_to_anchor=(1.0,1.0))
plt.xlabel('Month')
plt.ylabel('Total Revenue')
plt.grid(True)
plt.show()
```



Insights: February seems to have the highest revenue of around 24 million and August seems to have the least revenue of around 1 million altogether in all years given in the dataset. November,April,July,October are the moderate revenue months. February yielded high profit and August yielded the lowest profit month wise altogethr the years.

Monthly Product Sales:

In [29]:
```
#Item Type:
items=pd.DataFrame(df[['Units Sold','Total Revenue','Item Type','Ord_Mon','Region']].groupby('Ord_Mon')['Item T
items
```

Out[29]:

Ord_Mon	Item Type	Item Type
1	Household	2
	Beverages	1
	Clothes	1
	Meat	1
	Office Supplies	1
...	...	...
11	Household	1
12	Personal Care	2
	Cosmetics	1
	Household	1
	Office Supplies	1

69 rows × 1 columns

In [30]:
```
items['No. of items']=items['Item Type']
items.drop('Item Type',inplace=True,axis=1)
items=items.reset_index()
items
```

Out[30]:

	Ord_Mon	Item Type	No. of items
0	1	Household	2
1	1	Beverages	1
2	1	Clothes	1
3	1	Meat	1
4	1	Office Supplies	1
...	...	...	...
64	11	Household	1
65	12	Personal Care	2
66	12	Cosmetics	1
67	12	Household	1
68	12	Office Supplies	1

69 rows × 3 columns

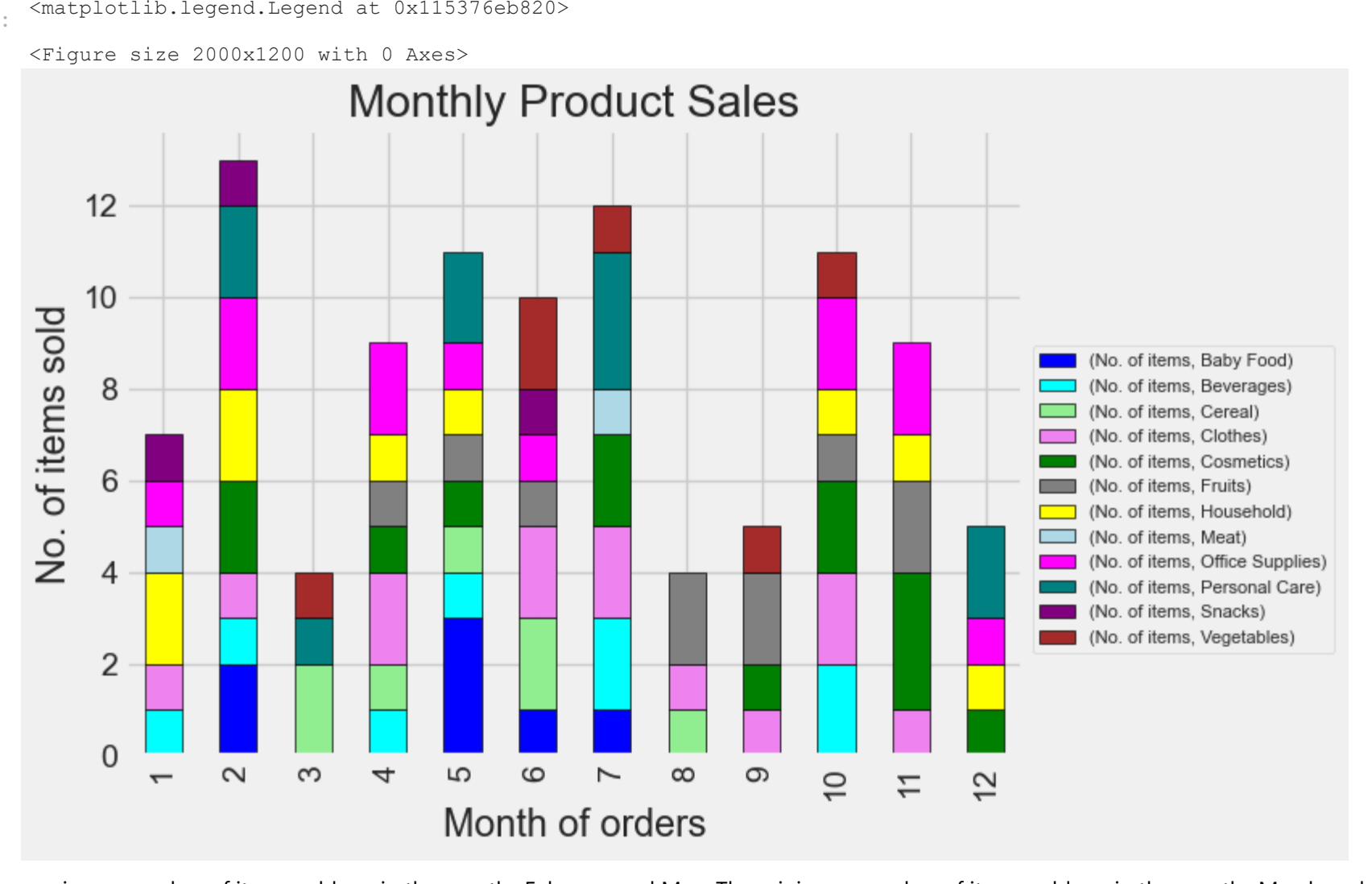
In [31]:
```
items=items.pivot_table(values=['No. of items'],index=['Ord_Mon'],columns=['Item Type'],aggfunc=np.sum)
items
```

Out[31]:

	No. of items											
Item Type	Baby Food	Beverages	Cereal	Clothes	Cosmetics	Fruits	Household	Meat	Office Supplies	Personal Care	Snacks	Vegetables
Ord_Mon												
1	NaN	1.0	NaN	1.0	NaN	NaN	2.0	1.0	1.0	NaN	1.0	NaN
2	2.0	1.0	NaN	1.0	2.0	NaN	2.0	NaN	2.0	2.0	1.0	NaN
3	NaN	NaN	2.0	NaN	NaN	NaN	NaN	NaN	NaN	1.0	NaN	1.0
4	NaN	1.0	1.0	2.0	1.0	1.0	1.0	NaN	2.0	NaN	NaN	NaN
5	3.0	1.0	1.0	NaN	1.0	1.0	1.0	NaN	1.0	2.0	NaN	NaN
6	1.0	NaN	2.0	2.0	NaN	1.0	NaN	NaN	1.0	NaN	1.0	2.0
7	1.0	2.0	NaN	2.0	2.0	NaN	NaN	1.0	NaN	3.0	NaN	1.0
8	NaN	NaN	1.0	1.0	NaN	2.0	NaN	NaN	NaN	NaN	NaN	NaN
9	NaN	NaN	NaN	1.0	1.0	2.0	NaN	NaN	NaN	NaN	NaN	1.0
10	NaN	2.0	NaN	2.0	2.0	1.0	1.0	NaN	2.0	NaN	NaN	1.0
11	NaN	NaN	NaN	1.0	3.0	2.0	1.0	NaN	2.0	NaN	NaN	NaN
12	NaN	NaN	NaN	NaN	1.0	NaN	1.0	NaN	1.0	2.0	NaN	NaN

In [32]:
```
plt.figure(figsize=(20,12))
color=['blue','cyan','lightgreen','violet','green','grey','yellow','lightblue','magenta','teal','purple','brown
items.plot(kind='bar',ylabel='No. of items sold',title='Monthly Product Sales',stacked=True,color= color,edgeco
plt.legend(bbox_to_anchor=(1.0, 0.15),loc='lower left',fontsize=8)
```

Out[32]:
```
<matplotlib.legend.Legend at 0x115376eb820>
<Figure size 2000x1200 with 0 Axes>
```



Insights: The maximum number of items sold are in the months February and May. The minimum number of items sold are in the months March and August. In the month of January,the maximum number of items sold is Household. In the month of February, the maximum number of items sold are Baby Food,Cosmetics,Household,Office Supplies and Personal Care. In the month of March, the maximum number of items sold is Cereal. In the month of April, the maximum number of items sold are Clothes and Office Supplies. In the month of May, the maximum number of items sold are Baby Food and Personal Care. In the month of June, the maximum number of items sold are Cereal, Clothes and Vegetables. In the month of July, the maximum number of items sold are Personal care, Beverages,Clothes and Cosmetics. In the month of August and September, the maximum number of items sold are Fruits. In the month of October, the maximum number of items sold are Beverages,Clothes,Cosmetics and Office Supplies. In the month of November, the maximum number of items sold are Cosmetics, Fruits, Office Supplies. In the month of December, the maximum number of items sold are Personal Care.

Sales Trend Yearly Monthwise :

In [33]:
```
yr_monthly_sales=df.groupby(['Ord_Yr','Ord_Mon'])['Total Revenue'].sum().reset_index()
yr_monthly_sales.head()
```

Out[33]:

	Ord_Yr	Ord_Mon	Total Revenue
0	2010	2	3410661.12
1	2010	5	2587973.26
2	2010	6	1082418.40
3	2010	10	6064933.75
4	2010	11	3458252.00

In [34]:
```
yr_monthly_salesp=df.groupby(['Ord_Yr','Ord_Mon'])['Total Profit'].sum().reset_index()
yr_monthly_salesp.head()
```

Out[34]:

	Ord_Yr	Ord_Mon	Total Profit
0	2010	2	1424410.94
1	2010	5	965441.52
2	2010	6	727423.20
3	2010	10	1495392.79
4	2010	11	1375311.70

In [35]:
```
max_sales_yr_month=yr_monthly_sales.loc[yr_monthly_sales['Total Revenue'].idxmax()]
max_sales_yr_month
```

Out[35]:
```
Ord_Yr              2013.0
Ord_Mon                7.0
Total Revenue    8545511.2
Name: 28, dtype: float64
```

In [37]:
```
min_sales_yr_month=yr_monthly_sales.loc[yr_monthly_sales['Total Revenue'].idxmin()]
min_sales_yr_month
```

```
Out[37]: Ord_Yr           2015.00
         Ord_Mon             8.00
         Total Revenue    6279.09
         Name: 44, dtype: float64
```

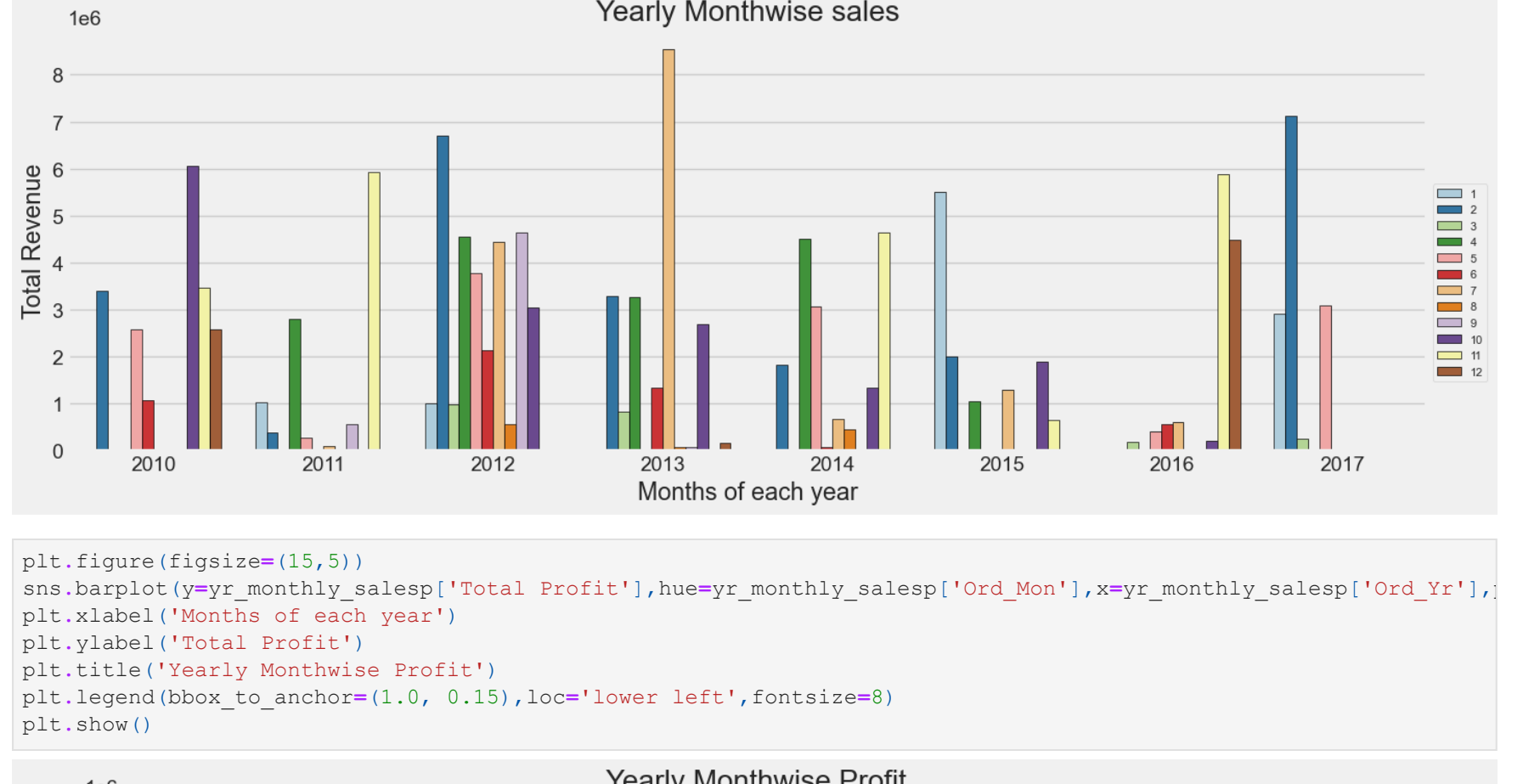
```
In [38]: maxp_sale_yr_month=yr_monthly_salesp.loc[yr_monthly_salesp['Total Profit'].idxmax()]
         maxp_sale_yr_month
```

```
Out[38]: Ord_Yr            2013.00
         Ord_Mon              7.00
         Total Profit    3398463.02
         Name: 28, dtype: float64
```

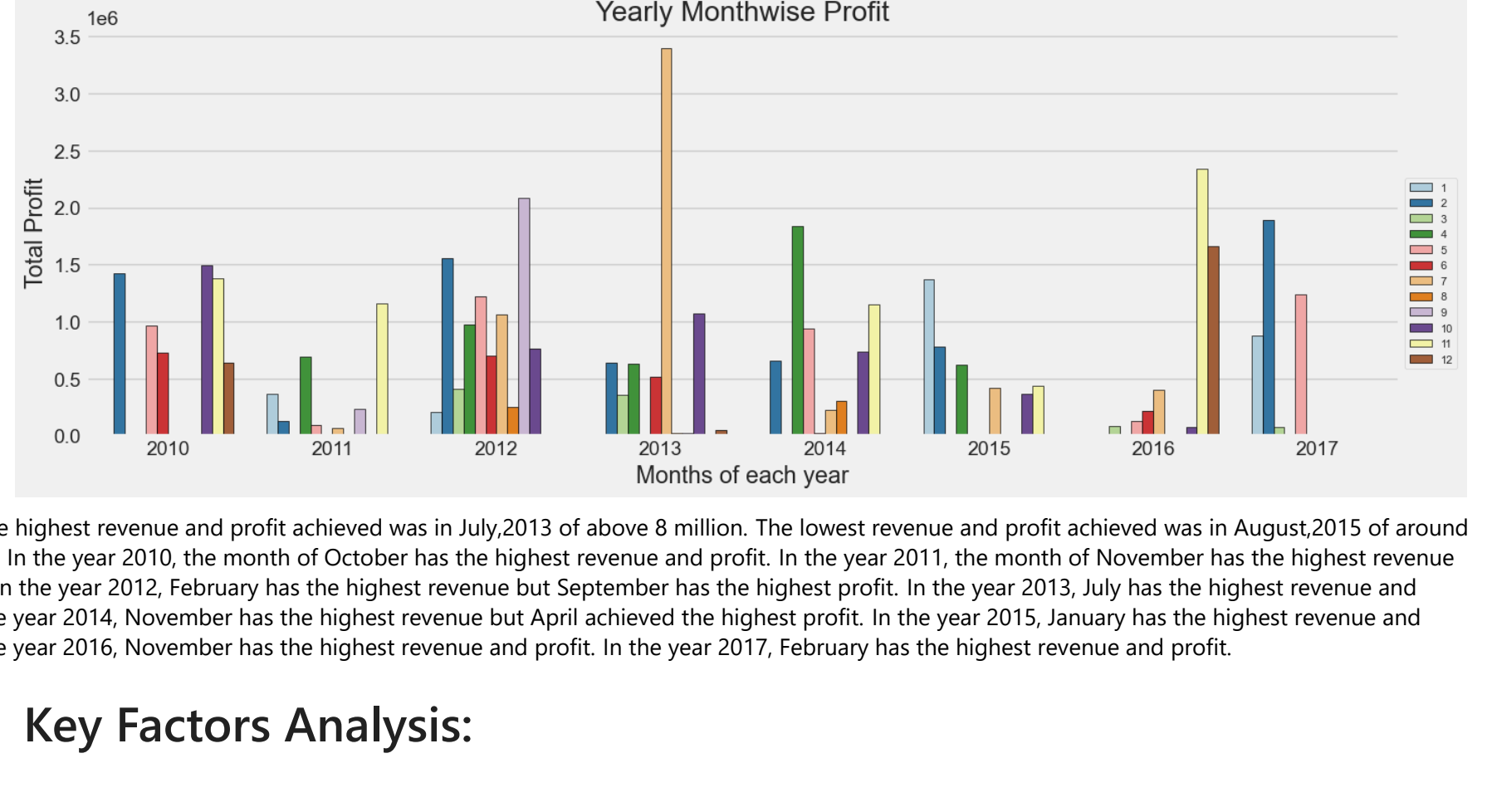
```
In [39]: minp_sale_yr_month=yr_monthly_salesp.loc[yr_monthly_salesp['Total Profit'].idxmin()]
         minp_sale_yr_month
```

```
Out[39]: Ord_Yr          2015.00
         Ord_Mon            8.00
         Total Profit    1621.93
         Name: 44, dtype: float64
```

```
In [55]: plt.figure(figsize=(15,5))
         sns.barplot(y=yr_monthly_sales['Total Revenue'],hue=yr_monthly_sales['Ord_Mon'],x=yr_monthly_sales['Ord_Yr'],pa
         plt.xlabel('Months of each year')
         plt.ylabel('Total Revenue')
         plt.title('Yearly Monthwise sales')
         plt.legend(bbox_to_anchor=(1.0, 0.15),loc='lower left',fontsize=8)
         plt.show()
```




```
In [56]: plt.figure(figsize=(15,5))
         sns.barplot(y=yr_monthly_salesp['Total Profit'],hue=yr_monthly_salesp['Ord_Mon'],x=yr_monthly_salesp['Ord_Yr'],
         plt.xlabel('Months of each year')
         plt.ylabel('Total Profit')
         plt.title('Yearly Monthwise Profit')
         plt.legend(bbox_to_anchor=(1.0, 0.15),loc='lower left',fontsize=8)
         plt.show()
```



Insights: The highest revenue and profit achieved was in July,2013 of above 8 million. The lowest revenue and profit achieved was in August,2015 of around 6 thousand. In the year 2010, the month of October has the highest revenue and profit. In the year 2011, the month of November has the highest revenue and profit. In the year 2012, February has the highest revenue but September has the highest profit. In the year 2013, July has the highest revenue and profit. In the year 2014, November has the highest revenue but April achieved the highest profit. In the year 2015, January has the highest revenue and profit. In the year 2016, November has the highest revenue and profit. In the year 2017, February has the highest revenue and profit.

Key Factors Analysis:

Region Vs Revenue:

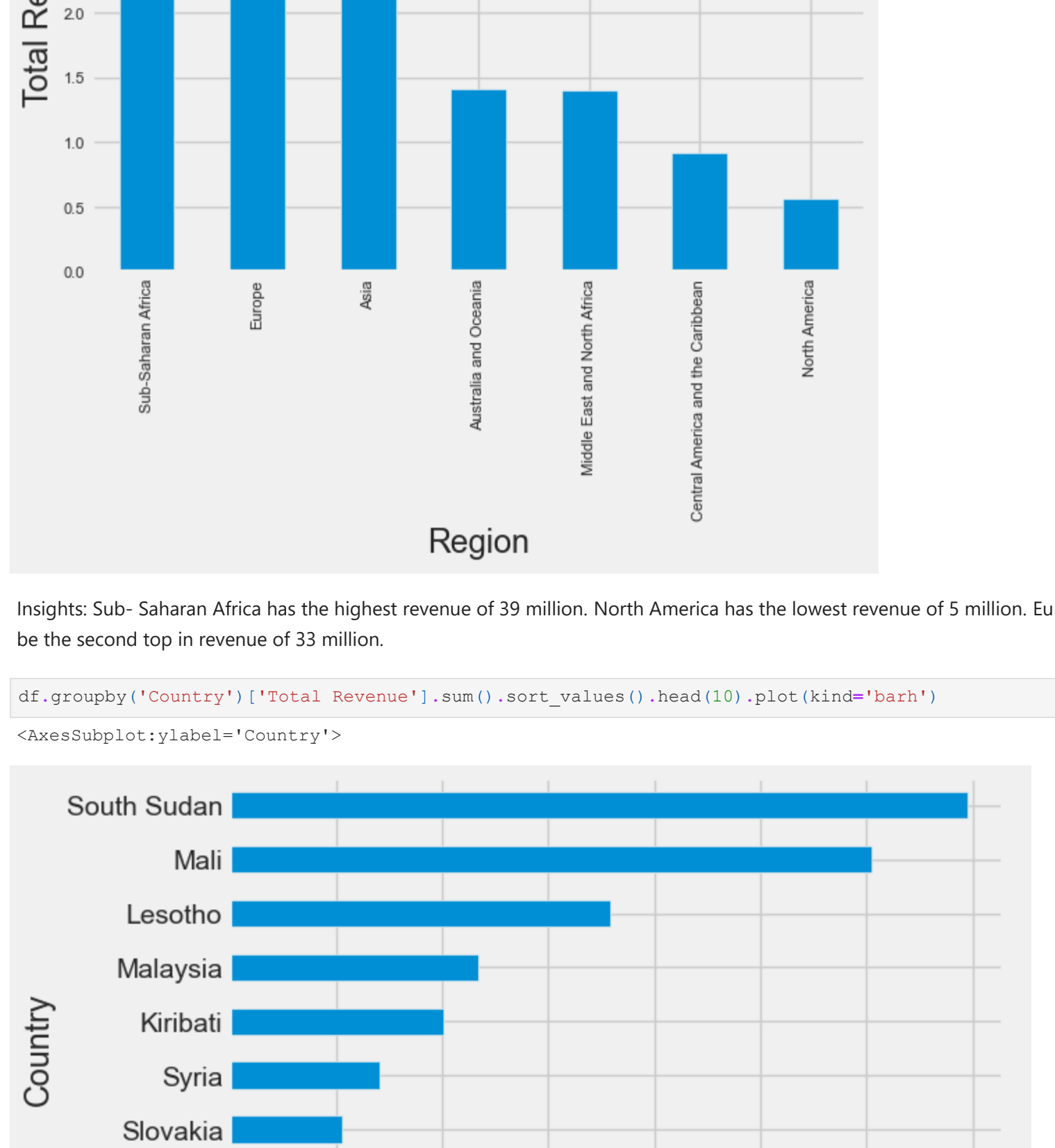
```
In [40]: rev_region=pd.DataFrame(df.groupby('Region').agg('Total Revenue').sum().sort_values(ascending=False))
         rev_region
```

Out[40]:

Region	Total Revenue
Sub-Saharan Africa	39672031.43
Europe	33368932.11
Asia	21347091.02
Australia and Oceania	14094265.13
Middle East and North Africa	14052706.58
Central America and the Caribbean	9170385.49
North America	5643356.55

```
In [41]: rev_region.plot(kind='bar',ylabel='Total Revenue',title='Region vs Revenue impact',fontsize=8)
```

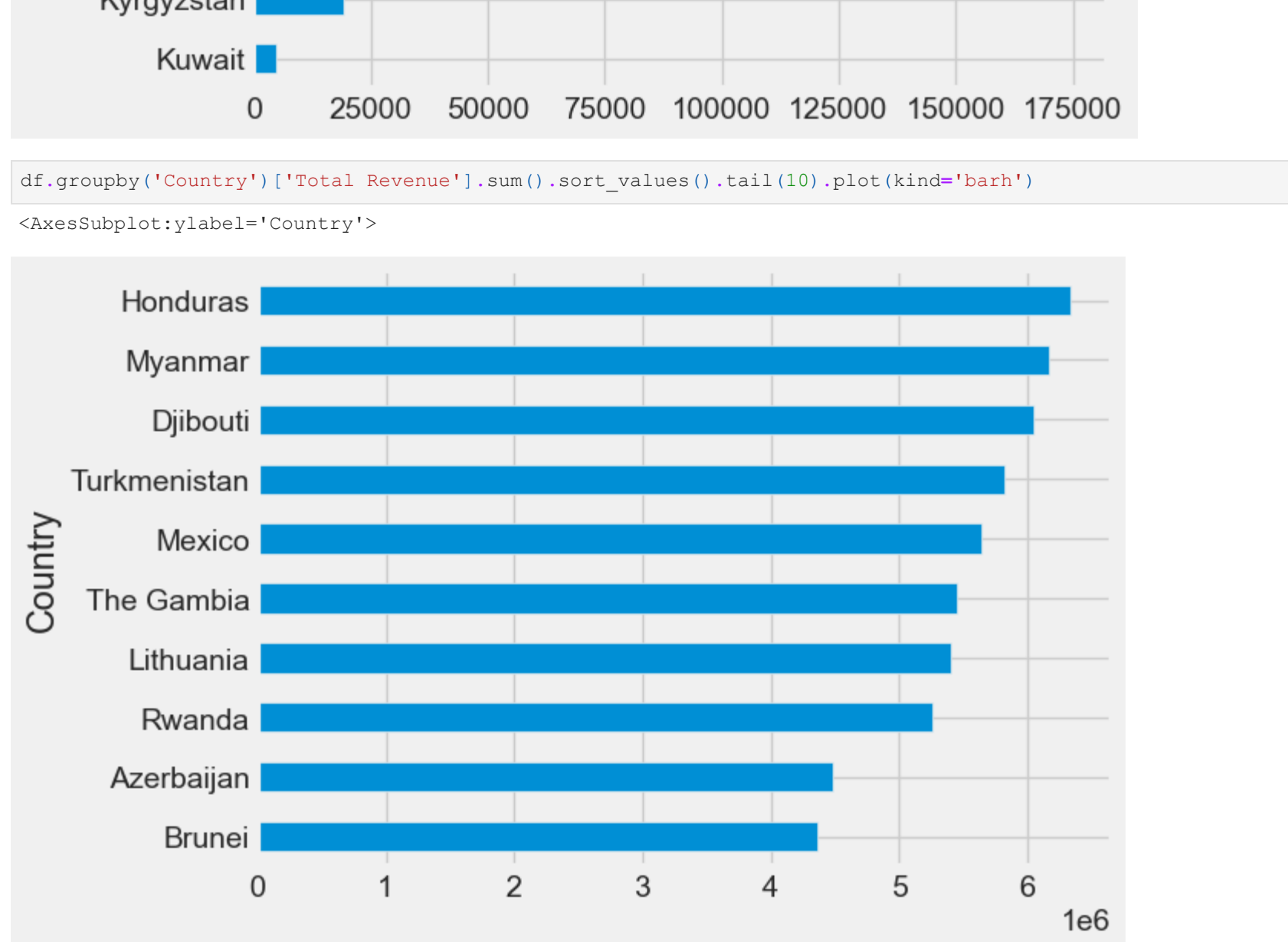
```
Out[41]: <AxesSubplot:title={'center':'Region vs Revenue impact'}, xlabel='Region', ylabel='Total Revenue'>
```



Insights: Sub- Saharan Africa has the highest revenue of 39 million. North America has the lowest revenue of 5 million. Europe is found to be the second top in revenue of 33 million.

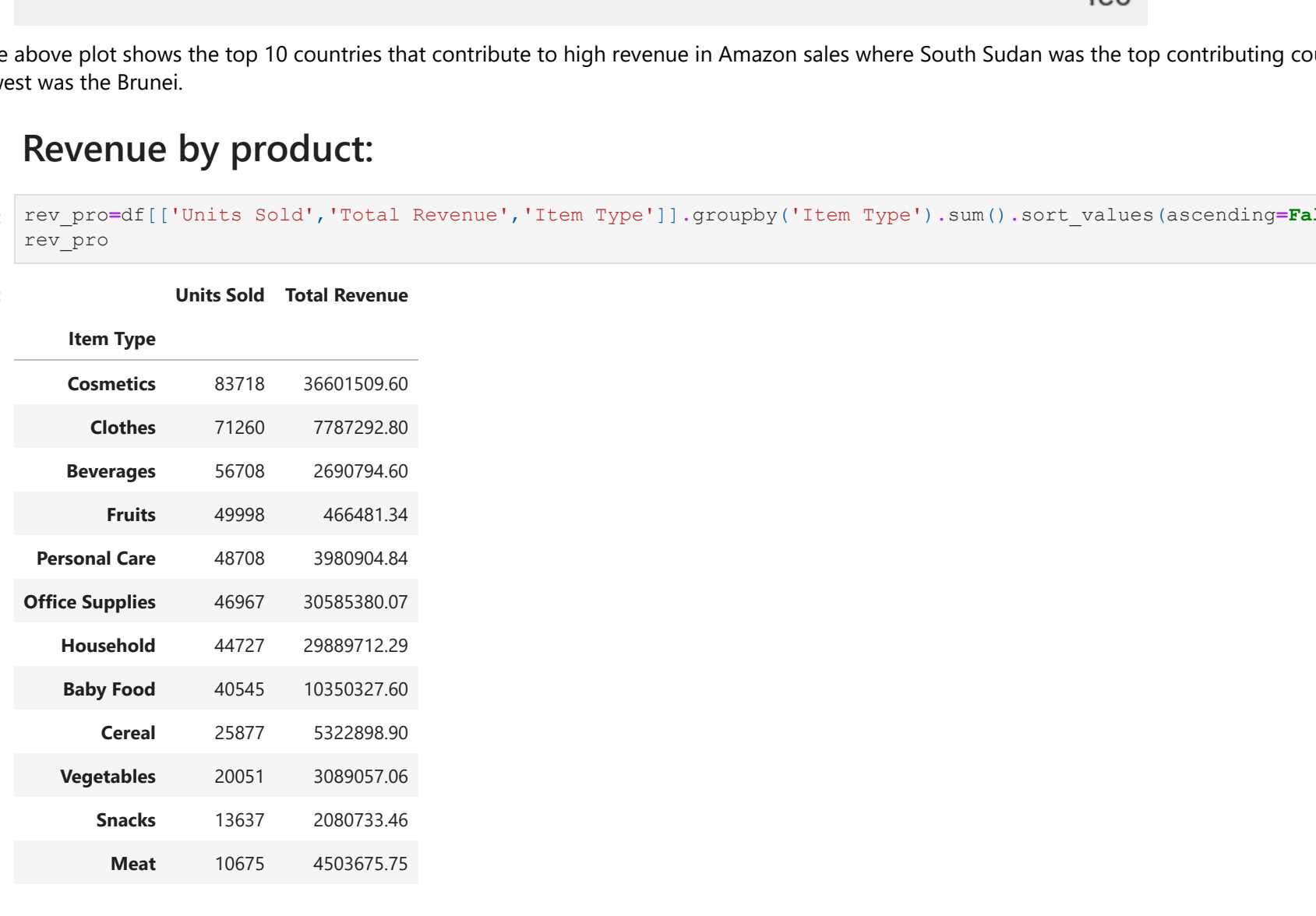
```
In [42]: df.groupby('Country')['Total Revenue'].sum().sort_values().head(10).plot(kind='barh')
```

```
Out[42]: <AxesSubplot:ylabel='Country'>
```




```
In [43]: df.groupby('Country')['Total Revenue'].sum().sort_values().tail(10).plot(kind='barh')
```

```
Out[43]: <AxesSubplot:ylabel='Country'>
```



Insights: The above plot shows the top 10 countries that contribute to high revenue in Amazon sales where South Sudan was the top contributing country. And the lowest was the Brunei.

Revenue by product:

```
In [45]: rev_pro=df[['Units Sold','Total Revenue','Item Type']].groupby('Item Type').sum().sort_values(ascending=False,b
         rev_pro
```

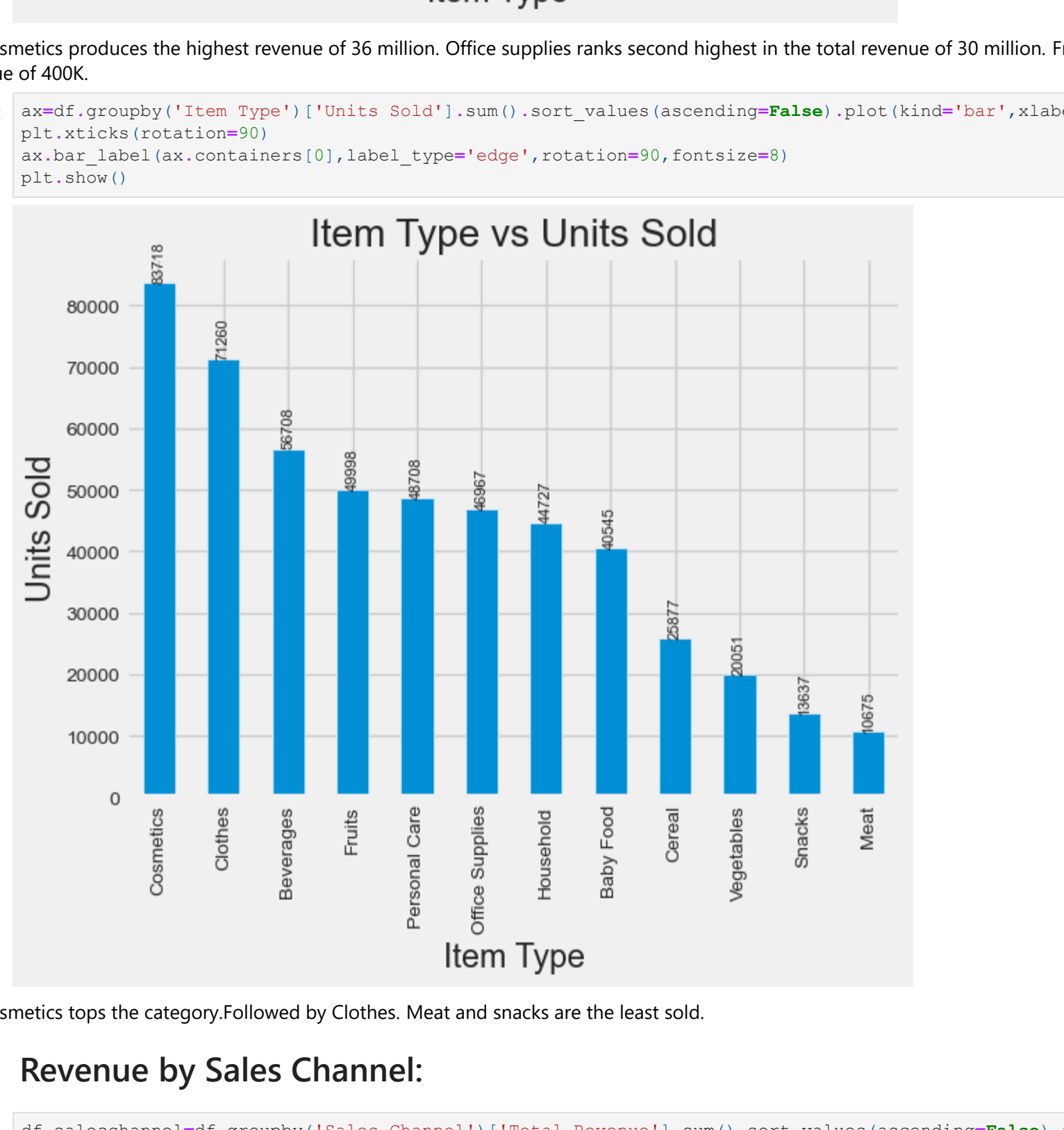
Out[45]:

Item Type	Units Sold	Total Revenue
Cosmetics	83718	36601509.60
Clothes	71260	7787292.80
Beverages	56708	2690794.60
Fruits	49998	466481.34
Personal Care	48708	3980904.84
Office Supplies	46967	30585380.07
Household	44727	29889712.29
Baby Food	40545	10350327.60
Cereal	25877	5322898.90
Vegetables	20051	3089057.06
Snacks	13637	2080733.46
Meat	10675	4503675.75

Insights: Maximum number of units sold are of Cosmetics followed by clothes. Least units sold are meat.

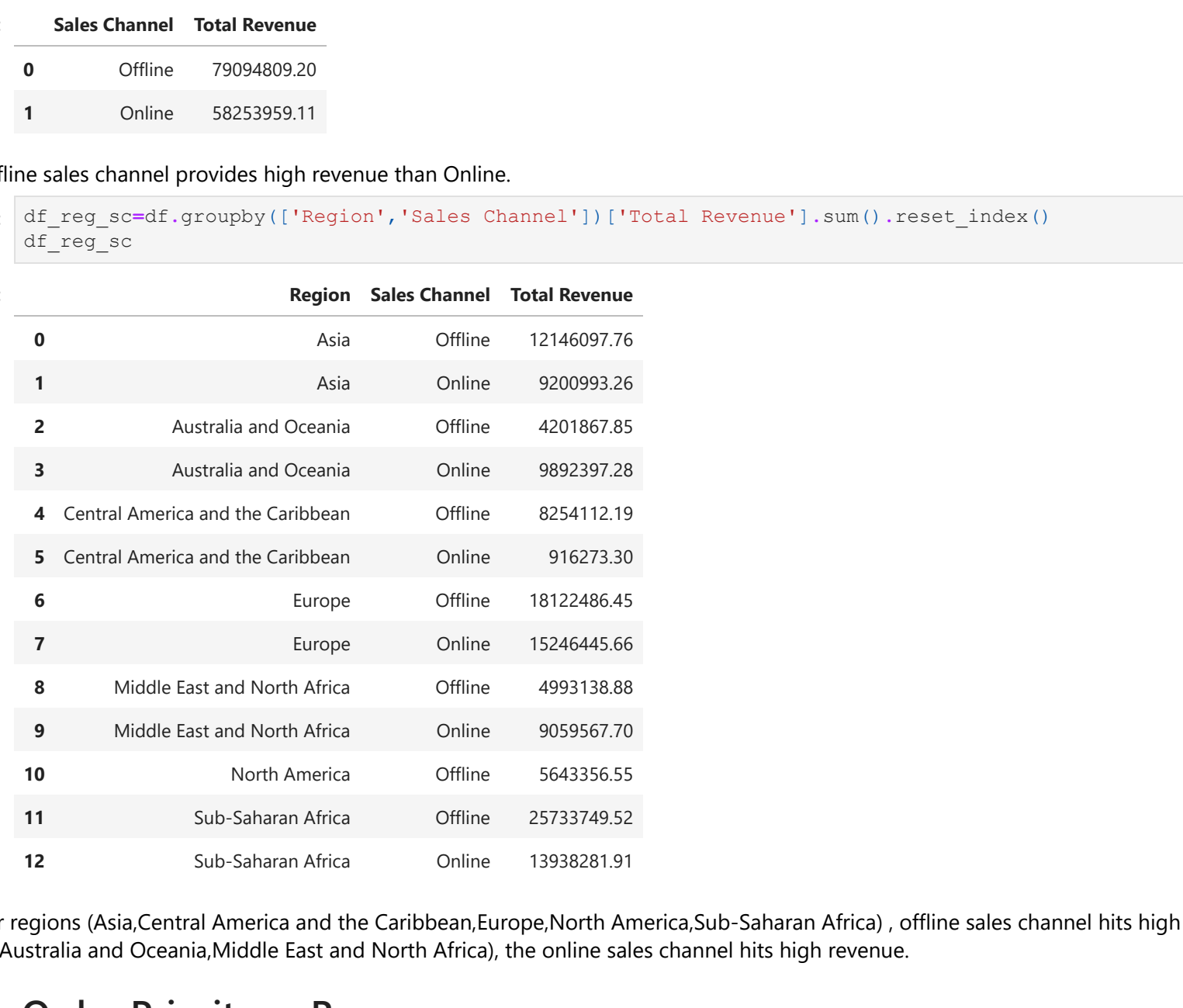
```
In [46]: rev_pro.groupby('Item Type')['Total Revenue'].sum().sort_values(ascending=False).plot(kind='bar',ylabel='Total
```

```
Out[46]: <AxesSubplot:title={'center':'Item Type vs Revenue'}, xlabel='Item Type', ylabel='Total Revenue'>
```



Insights: Cosmetics produces the highest revenue of 36 million. Office supplies ranks second highest in the total revenue of 30 million. Fruits produces the least revenue of 400K.

```
In [48]: ax=df.groupby('Item Type')['Units Sold'].sum().sort_values(ascending=False).plot(kind='bar',xlabel='Item Type',
         plt.xticks(rotation=90)
         ax.bar_label(ax.containers[0],label_type='edge',rotation=90,fontsize=8)
         plt.show()
```



Insights: Cosmetics tops the category.Followed by Clothes. Meat and snacks are the least sold.

Revenue by Sales Channel:

```
In [50]: df_saleschannel=df.groupby('Sales Channel')['Total Revenue'].sum().sort_values(ascending=False).reset_index()
         df_saleschannel
```

Out[50]:

	Sales Channel	Total Revenue
0	Offline	79094809.20
1	Online	58253959.11

Insights: Offline sales channel provides high revenue than Online.

```
In [51]: df_reg_sc=df.groupby(['Region','Sales Channel'])['Total Revenue'].sum().reset_index()
         df_reg_sc
```

Out[51]:

	Region	Sales Channel	Total Revenue
0	Asia	Offline	12146097.76
1	Asia	Online	9200993.26
2	Australia and Oceania	Offline	4201867.85
3	Australia and Oceania	Online	9892397.28
4	Central America and the Caribbean	Offline	8254112.19
5	Central America and the Caribbean	Online	916273.30
6	Europe	Offline	18122486.45
7	Europe	Online	15246445.66
8	Middle East and North Africa	Offline	4993138.88
9	Middle East and North Africa	Online	9059567.70
10	North America	Offline	5643356.55
11	Sub-Saharan Africa	Offline	25733749.52
12	Sub-Saharan Africa	Online	13938281.91

Insights: For regions (Asia,Central America and the Caribbean,Europe,North America,Sub-Saharan Africa) , offline sales channel hits high revenue wheareas for regions(Australia and Oceania,Middle East and North Africa), the online sales channel hits high revenue.

Order Priority vs Revenue:

```
In [52]: df_ordpri=df.groupby('Order Priority')['Total Revenue'].sum().sort_values(ascending=False).reset_index()
         df_ordpri
```

Out[52]:

	Order Priority	Total Revenue
0	H	48749546.05
1	L	36628127.46
2	M	33116031.75
3	C	18855063.05

```
In [53]: df_reg_op=df.groupby(['Region','Order Priority'])['Total Revenue'].sum().reset_index()
         df_reg_op
```

Out[53]:

	Region	Order Priority	Total Revenue
0	Asia	C	975510.65
1	Asia	H	6180361.34
2	Asia	L	7889242.53
3	Asia	M	6301976.50
4	Australia and Oceania	C	4190792.71
5	Australia and Oceania	H	7360582.96
6	Australia and Oceania	L	2492526.12
7	Australia and Oceania	M	50363.34
8	Central America and the Caribbean	C	963785.00
9	Central America and the Caribbean	H	6742480.98
10	Central America and the Caribbean	L	863298.07
11	Central America and the Caribbean	M	600821.44
12	Europe	C	5445833.28
13	Europe	H	13443353.29
14	Europe	L	7891644.34
15	Europe	M	6588101.20
16	Middle East and North Africa	C	3505347.28
17	Middle East and North Africa	H	5227929.73
18	Middle East and North Africa	M	5319429.57
19	North America	C	4647149.58
20	North America	L	524870.06
21	North America	M	471336.91
22	Sub-Saharan Africa	C	2631991.83
23	Sub-Saharan Africa	H	11517420.20
24	Sub-Saharan Africa	L	11738616.61
25	Sub-Saharan Africa	M	13784002.79

Insights: Asia hits high revenue from 'L' type order priority. Australia and Oceania, Europe, Central america and Caribbean hits high revenue from 'H'type order priority. Sub-Saharan Africa, Middle East and North Africa hits high revenue from 'M'type order priority. North America hits high revenue from 'C' type order priority. 'L' type order priority doesnot yield maximum revenue in any of the regions. Altogether, 'H' type order priority yields maximum revenue and the 'C' type order priority yields very less revenue comparatively.

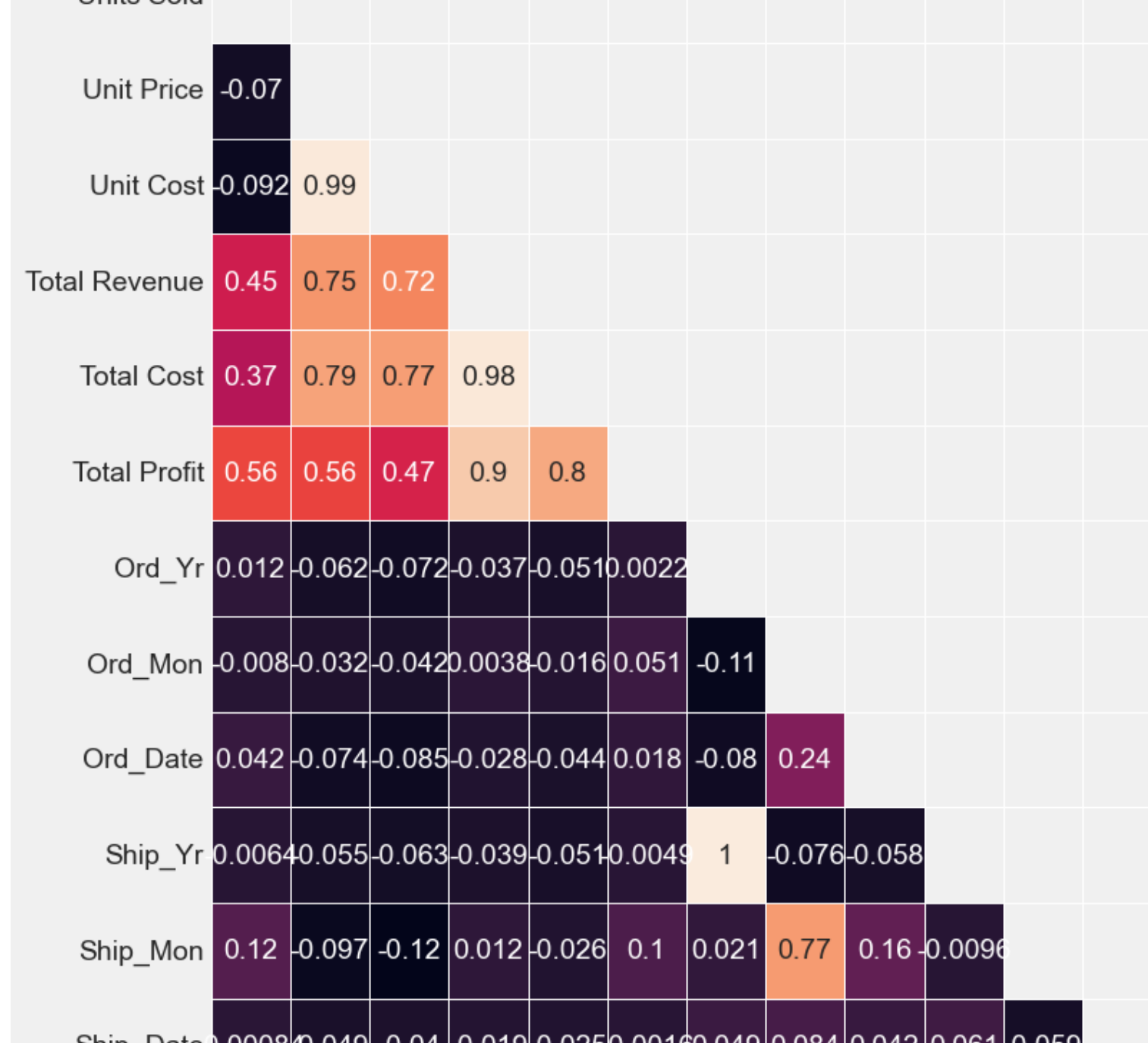
Item Type vs Sales:

```
In [56]: df_item_unc=df[['Item Type','Unit Cost']].drop_duplicates()
         df_item_unc
```

Out[56]:

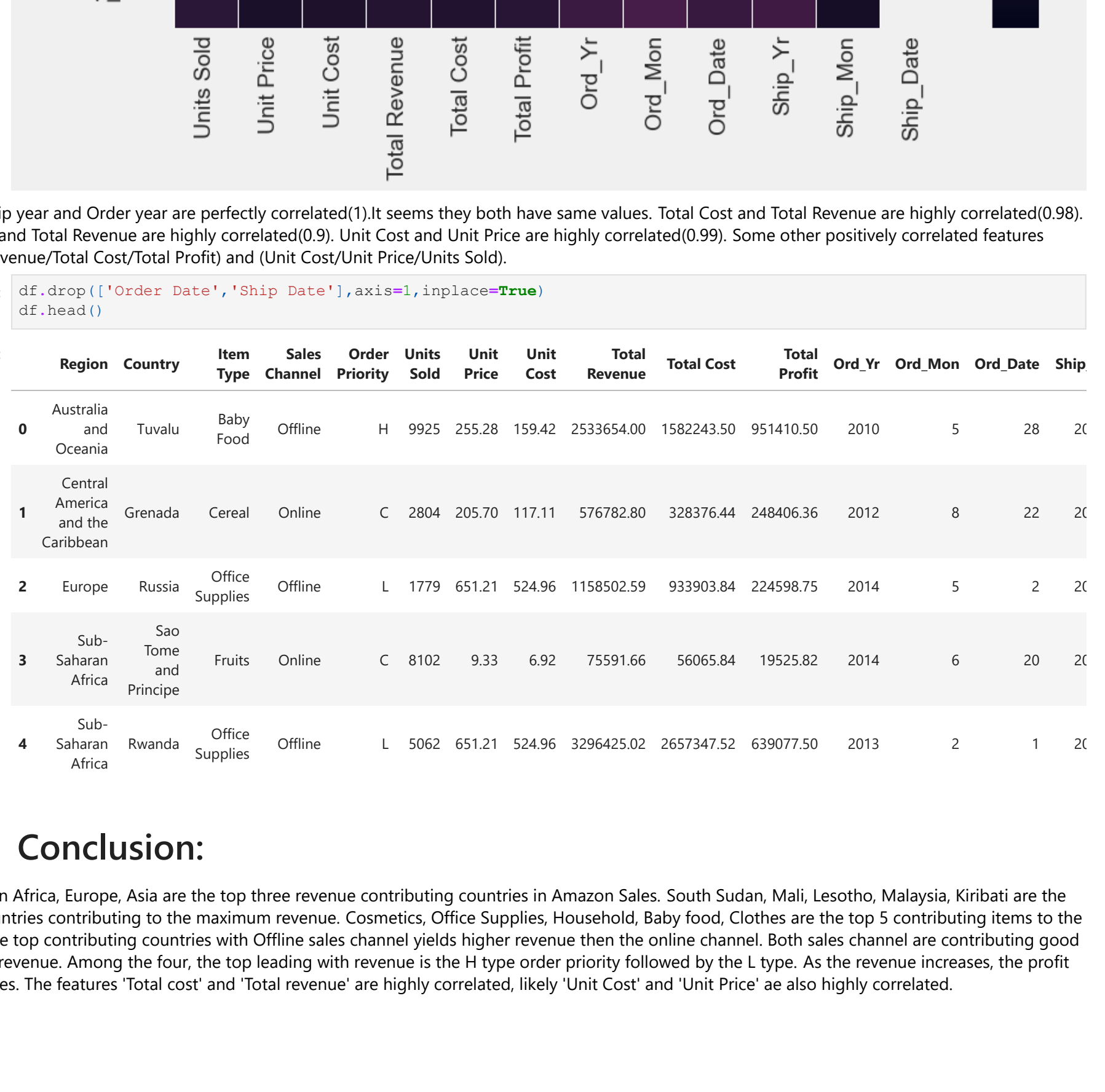
	Item Type	Unit Cost
0	Baby Food	159.42
1	Cereal	117.11
2	Office Supplies	524.96
3	Fruits	6.92
6	Household	502.54
7	Vegetables	90.93
8	Personal Care	56.67
11	Clothes	35.84
16	Cosmetics	263.33
17	Beverages	31.79
19	Meat	364.69
22	Snacks	97.44

```
In [51]: fig,ax=plt.subplots()
         p=ax.bar(x=df_item_unc['Item Type'],height=df_item_unc['Unit Cost'])
         plt.xticks(rotation=90,fontsize=10)
         ax.bar_label(p,fontsize=8)
         plt.title('Unit cost of Each Item')
         plt.xlabel('Item Type',fontsize=12)
         plt.ylabel('Unit Cost',fontsize=12)
         plt.show()
```



Insights: Unit cost of Office Supplies are the highest, followed by household and lowest are the fruits.

```
In [54]: plt.figure(figsize=(10,10))
         mask=np.triu(np.ones_like(df.corr(),dtype=bool))
         sns.heatmap(df.corr(),annot=True,mask=mask,linewidths=0.5)
         plt.title('Correlation of features in the dataset')
         plt.tight_layout()
         plt.show()
```



Insights: Ship year and Order year are perfectly correlated(1).It seems they both have same values. Total Cost and Total Revenue are highly correlated(0.98). Total Profit and Total Revenue are highly correlated(0.9). Unit Cost and Unit Price are highly correlated(0.99). Some other positively correlated features are(Total Revenue/Total Cost/Total Profit) and (Unit Cost/Unit Price/Units Sold).

```
In [57]: df.drop(['Order Date','Ship Date'],axis=1,inplace=True)
         df.head()
```

Out[57]:

	Region	Country	Item Type	Sales Channel	Order Priority	Units Sold	Unit Price	Unit Cost	Total Revenue	Total Cost	Total Profit	Ord_Yr	Ord_Mon	Ord_Date	Ship
0	Australia and Oceania	Tuvalu	Baby Food	Offline	H	9925	255.28	159.42	2533654.00	1582243.50	951410.50	2010	5	28	20
1	Central America and the Caribbean	Grenada	Cereal	Online	C	2804	205.70	117.11	576782.80	328376.44	248406.36	2012	8	22	20
2	Europe	Russia	Office Supplies	Offline	L	1779	651.21	524.96	1158502.59	933903.84	224598.75	2014	5	2	20
3	Sub-Saharan Africa	Sao Tome and Principe	Fruits	Online	C	8102	9.33	6.92	75591.66	56065.84	19525.82	2014	6	20	20
4	Sub-Saharan Africa	Rwanda	Office Supplies	Offline	L	5062	651.21	524.96	3296425.02	2657347.52	639077.50	2013	2	1	20

Conclusion:

Sub-Saharan Africa, Europe, Asia are the top three revenue contributing countries in Amazon Sales. South Sudan, Mali, Lesotho, Malaysia, Kiribati are the top five countries contributing to the maximum revenue. Cosmetics, Office Supplies, Household, Baby food, Clothes are the top 5 contributing items to the revenue. The top contributing countries with Offline sales channel yields higher revenue then the online channel. Both sales channel are contributing good in terms of revenue. Among the four, the top leading with revenue is the H type order priority followed by the L type. As the revenue increases, the profit also increases. The features 'Total cost' and 'Total revenue' are highly correlated, likely 'Unit Cost' and 'Unit Price' ae also highly correlated.