In [1]:
```
import pandas as pd
import numpy as np
import plotly.express as px
from matplotlib import pyplot as plt
import seaborn as sns

pd.options.display.float_format = '{:,.2f}'.format
pd.options.display.max_rows = None
pd.options.display.max_columns = None

sns.set()
```

In [2]:
```
def wrangle(filename, encoding= None, dropna_columnnames = None, change_column_name
    # Loading Data From csv file
    df = pd.read_csv(filename, encoding=encoding)

    # Get Orders NaN Rows
    df.dropna(subset= dropna_columnnames, inplace=True)

    # Rename Columns
    df = df.rename(columns = change_column_name)

    # Change Orderdate and ID Columns type to Date, integer
    df[date_column] = pd.to_datetime(df[date_column])

    # Drop duplicated Rows
    df = df.drop_duplicates(subset = remove_duplicated_rows_columnsname)

    # Strip and Lowercase Columns names
    df.columns = df.columns.str.strip().str.lower()

    return df
```

In [3]:
```
orders = wrangle('all_data.csv', encoding= 'latin-1', dropna_columnnames=['OrderID'

for cols in orders.columns:
    if 'id' in cols or 'ordernumber' in cols:
        orders[cols] = orders[cols].astype(int)

orders = orders[['customerid', 'firstname', 'lastname', 'city', 'country', 'orderid
orders.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 830 entries, 0 to 2130
Data columns (total 9 columns):
 #   Column       Non-Null Count  Dtype         
---  ------       --------------  -----         
 0   customerid   830 non-null    int64         
 1   firstname    830 non-null    object        
 2   lastname     830 non-null    object        
 3   city         830 non-null    object        
 4   country      830 non-null    object        
 5   orderid      830 non-null    int64         
 6   ordernumber  830 non-null    int64         
 7   orderdate    830 non-null    datetime64[ns]
 8   totalamount  830 non-null    float64       
dtypes: datetime64[ns](1), float64(1), int64(3), object(4)
memory usage: 64.8+ KB
```

In [ ]:

In [ ]:

In [ ]:

In [4]:
```
orders.columns
```

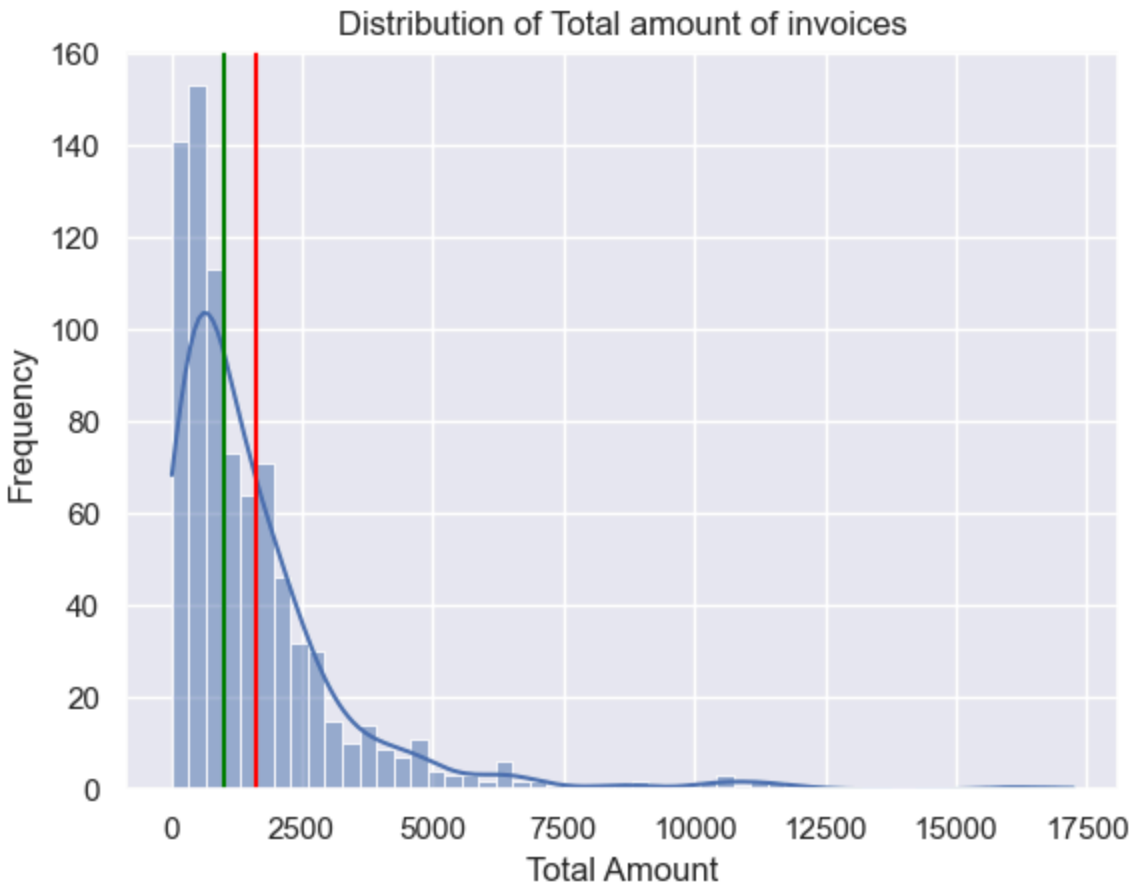
Out[4]:
```
Index(['customerid', 'firstname', 'lastname', 'city', 'country', 'orderid',
       'ordernumber', 'orderdate', 'totalamount'],
      dtype='object')
```

In [5]:
```
orders['totalamount'].describe()
```

Out[5]:
```
count      830.00
mean     1,631.88
std      1,990.61
min         12.50
25%        480.00
50%      1,015.90
75%      2,028.65
max     17,250.00
Name: totalamount, dtype: float64
```

In [6]:
```
sns.histplot(data=orders, x='totalamount', kde= True)
plt.title('Distribution of Total amount of invoices')
plt.xlabel('Total Amount')
plt.ylabel('Frequency')
plt.axvline(orders.totalamount.mean(), color='red')
plt.axvline(orders.totalamount.median(), color='green')
```

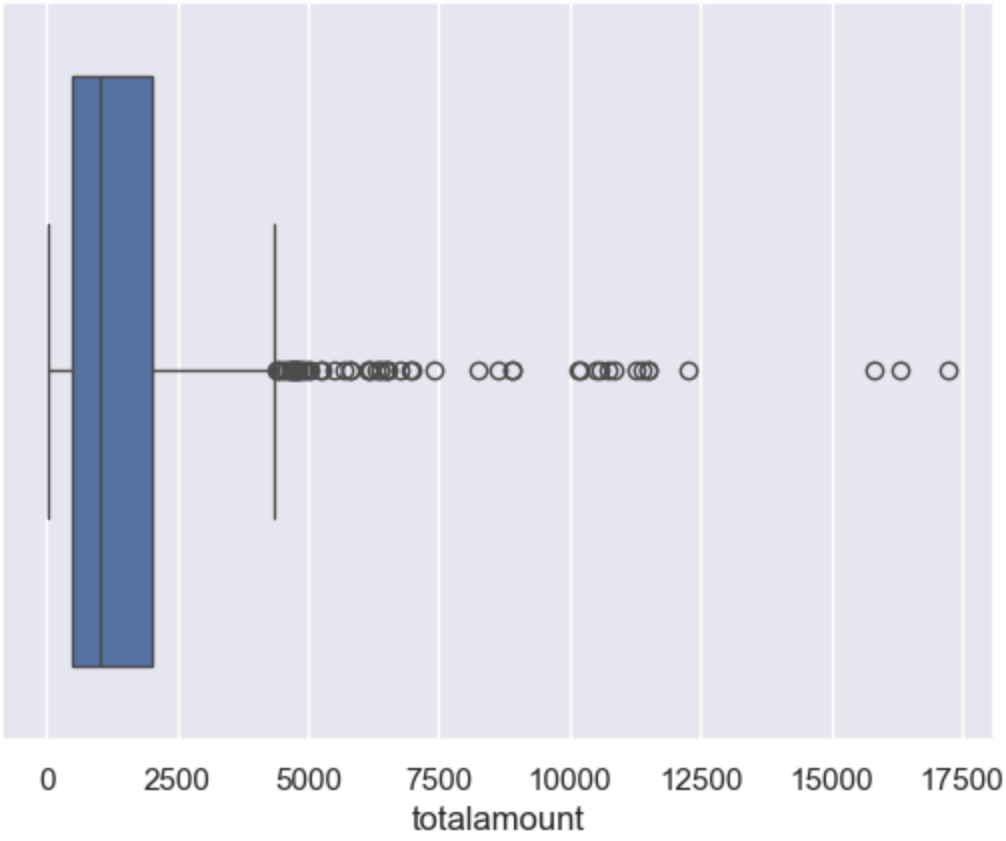
Out[6]:
```
<matplotlib.lines.Line2D at 0x1f9e963b110>
```



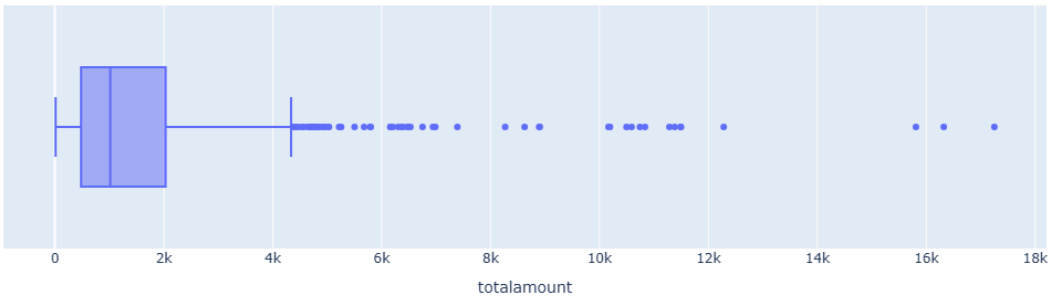
In [7]:
```
min = orders.totalamount.min()
q1 = orders.totalamount.quantile(0.25)
q2 = orders.totalamount.median()
q3 = orders.totalamount.quantile(0.75)

IQR = q3 - q1

LB = q1 - (1.5 * IQR)
UB = q3 + (1.5 * IQR)
```

In [8]:
```
sns.boxplot(data = orders, x = 'totalamount')
```

Out[8]:
```
<Axes: xlabel='totalamount'>
```



In [9]:
```
px.box(data_frame = orders, x= 'totalamount')
```



In [10]:
```
orders= orders[orders.totalamount < 15000 ]
```

In [11]:
```
orders.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 827 entries, 0 to 2130
Data columns (total 9 columns):
 #   Column       Non-Null Count  Dtype         
---  ------       --------------  -----         
 0   customerid   827 non-null    int64         
 1   firstname    827 non-null    object        
 2   lastname     827 non-null    object        
 3   city         827 non-null    object        
 4   country      827 non-null    object        
 5   orderid      827 non-null    int64         
 6   ordernumber  827 non-null    int64         
 7   orderdate    827 non-null    datetime64[ns]
 8   totalamount  827 non-null    float64       
dtypes: datetime64[ns](1), float64(1), int64(3), object(4)
memory usage: 64.6+ KB
```

In [ ]:

Univariate Analysis

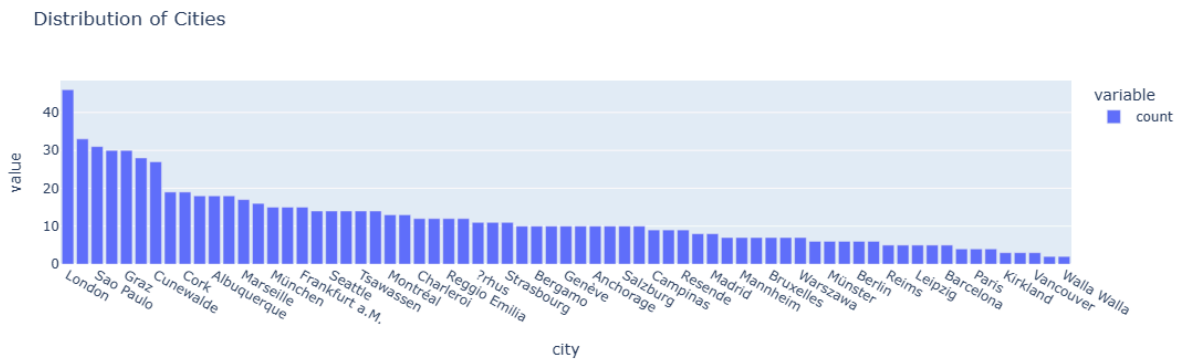
In [12]:
```
orders.city.value_counts()
```

Out[12]:

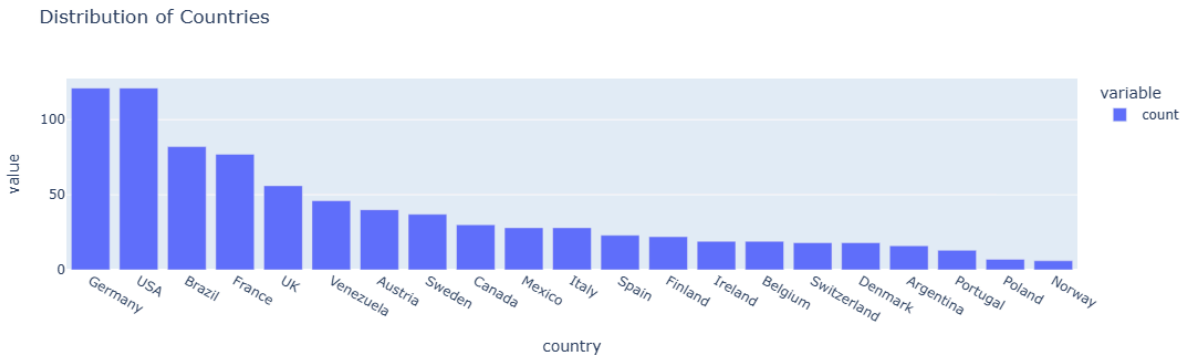
city	
London	46
Rio de Janeiro	33
Sao Paulo	31
Boise	30
Graz	30
México D.F.	28
Cunewalde	27
Br?cke	19
Cork	19
Lule?	18
Albuquerque	18
San Crist?bal	18
Marseille	17
Buenos Aires	16
München	15
Oulu	15
Frankfurt a.M.	15
Brandenburg	14
Seattle	14
Toulouse	14
Tsawassen	14
Barquisimeto	14
Montréal	13
Lisboa	13
Charleroi	12
Portland	12
Reggio Emilia	12
I. de Margarita	12
?rhus	11
Eugene	11
Strasbourg	11
Lyon	10
Bergamo	10
Stuttgart	10
Genève	10
Sevilla	10
Anchorage	10
Cowes	10
Salzburg	10
K?ln	10
Campinas	9
Lander	9
Resende	9
Bern	8
Madrid	8
Helsinki	7
Mannheim	7
Nantes	7
Bruxelles	7
Kobenhavn	7
Warszawa	7
Torino	6
Münster	6
Aachen	6
Berlin	6

```
Stavern             6
Reims               5
Lille               5
Leipzig             5
Elgin               5
Barcelona           5
Versailles          4
Paris               4
San Francisco       4
Kirkland            3
Butte               3
Vancouver           3
Caracas             2
Walla Walla         2
Name: count, dtype: int64
```

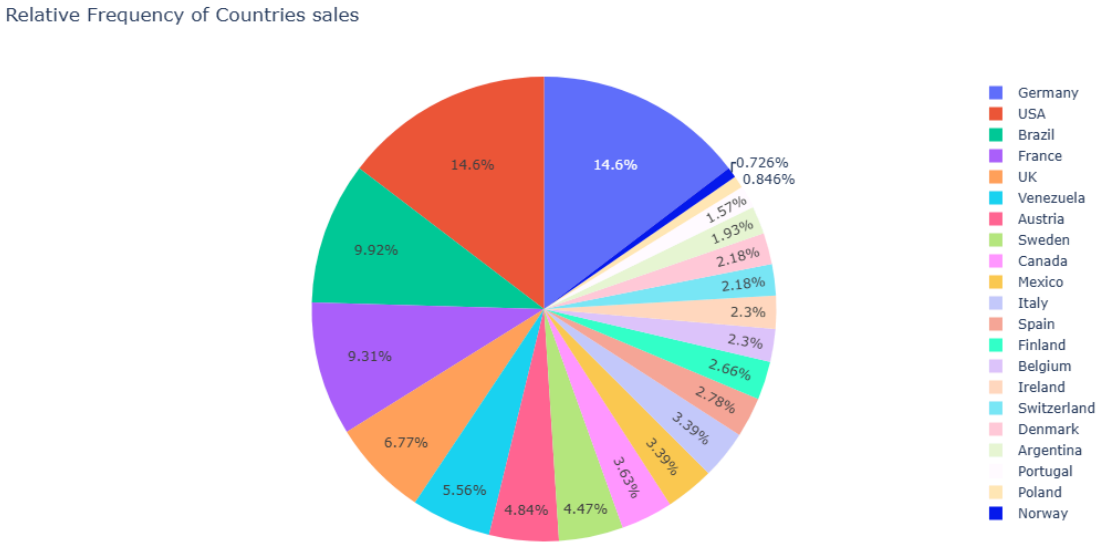
In [13]:
```
px.bar(data_frame = orders.city.value_counts(), title='Distribution of Cities')
```



In [14]:
```
px.bar(data_frame = orders.country.value_counts(), title='Distribution of Countries
```



In [15]:
```
fig = px.pie(data_frame = orders, names= 'country', title= 'Relative Frequency of C
fig.show()
```



In [ ]:

Bivariate Analysis

Countries Vs. Total Amount

Cities Vs. Total Amount

In [16]:
```
orders.groupby('country', as_index= False)['totalamount'].sum().sort_values('totala
```

Out[16]:

	country	totalamount
19	USA	247,245.08
8	Germany	227,390.63
1	Austria	139,496.63
3	Brazil	99,158.48
7	France	85,498.76
20	Venezuela	60,814.89
18	UK	60,616.51
16	Sweden	59,523.70
9	Ireland	57,317.39
4	Canada	55,334.10
2	Belgium	35,134.98
5	Denmark	34,782.25
17	Switzerland	32,919.50
11	Mexico	24,073.45
6	Finland	19,778.45
15	Spain	19,431.89
10	Italy	16,705.15
14	Portugal	12,468.65
0	Argentina	8,119.10
12	Norway	5,735.15
13	Poland	3,531.95

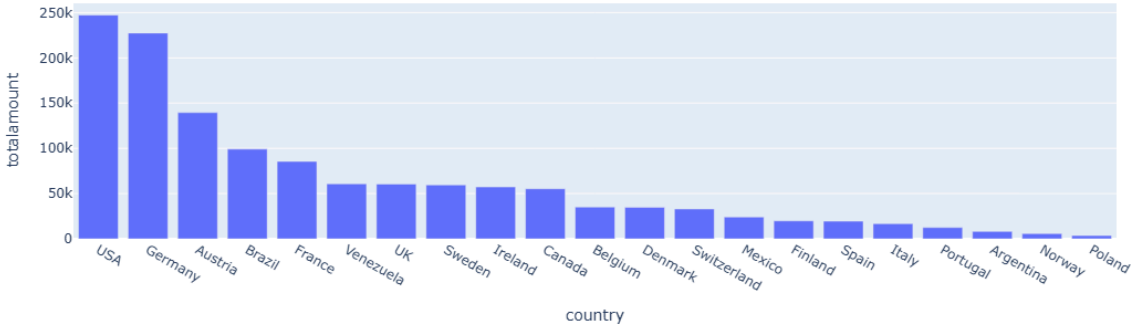
In [17]:

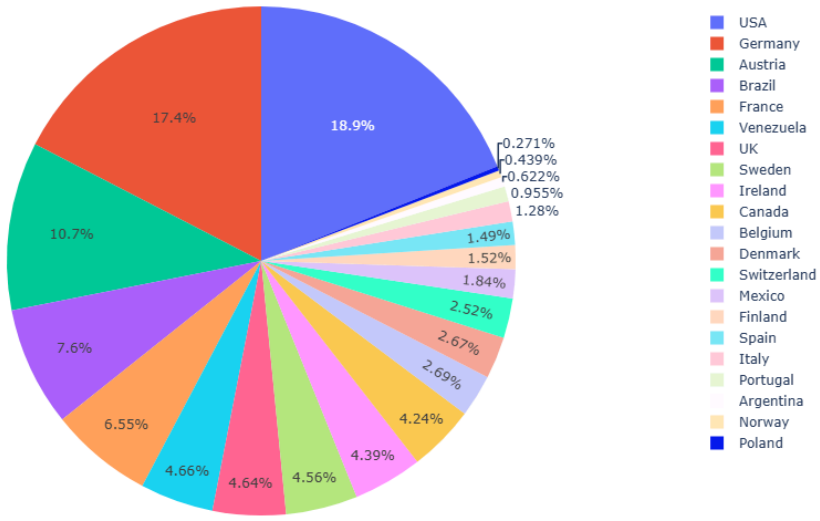
```
def plots(columname, Top10=False):
    prop = orders.groupby(columname, as_index=False)['totalamount'].sum()  # غیرت p
    prop['proportion'] = (prop.totalamount / orders.totalamount.sum()) * 100
    prop = prop.sort_values('proportion', ascending=False)
    print('Describe of all Total Amount Values', prop.totalamount.describe())

    if Top10:
        prop = prop.head(10)


    fig1 = px.bar(data_frame = prop, x= columname, y= 'totalamount')
    fig2 = px.pie(data_frame = prop, names = columname, values='totalamount', width
        height=600)

    fig1.show()
```

```
    fig2.show()
```

In [18]:
```
plots('country')
```

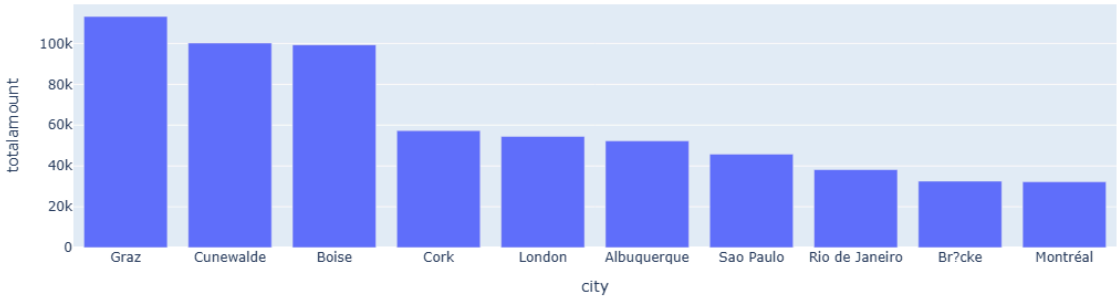
```
Describe of all Total Amount Values count        21.00
mean     62,146.51
std      67,460.19
min       3,531.95
25%      19,431.89
50%      35,134.98
75%      60,814.89
max     247,245.08
Name: totalamount, dtype: float64
```

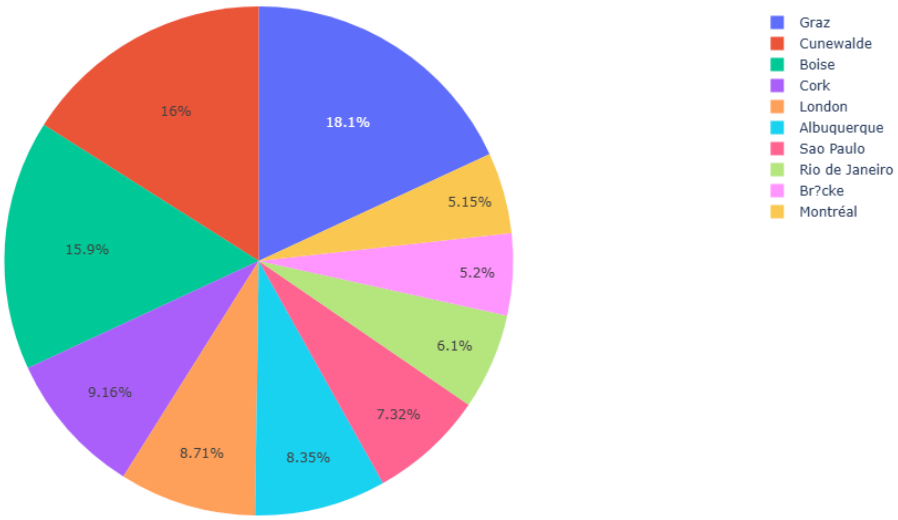




In [19]:
```
plots('city', True)
```

```
Describe of all Total Amount Values count        69.00
mean     18,914.15
std      22,692.99
min         357.00
25%       4,788.06
50%      11,830.10
75%      23,850.95
max     113,236.68
Name: totalamount, dtype: float64
```





In [20]:
```
orders.groupby('city', as_index= False)['totalamount'].sum().sort_values('totalamou
```

Out[20]:

	city	totalamount
25	Graz	113,236.68
20	Cunewalde	100,233.39
9	Boise	99,351.49
18	Cork	57,317.39
35	London	54,470.21
2	Albuquerque	52,245.90
56	Sao Paulo	45,786.37
52	Rio de Janeiro	38,189.18
10	Br?cke	32,555.55
41	Montréal	32,203.90
11	Brandenburg	31,745.75
57	Seattle	29,073.45
43	München	28,722.71
36	Lule?	26,968.15
53	Salzburg	26,259.95
17	Charleroi	24,704.40
42	México D.F.	24,073.45
40	Marseille	23,850.95
54	San Crist?bal	23,611.58
64	Tsawassen	22,607.70
23	Frankfurt a.M.	21,282.02
24	Genève	20,033.20
22	Eugene	19,711.13
60	Strasbourg	19,088.00
30	Kobenhavn	18,138.45
27	I. de Margarita	17,889.55
5	Barquisimeto	17,825.06
0	?rhus	16,643.80
46	Oulu	16,617.10
3	Anchorage	16,325.15

	city	totalamount
28	K?ln	13,157.50
8	Bern	12,886.30
31	Lander	12,489.70
34	Lisboa	12,468.65
58	Sevilla	11,830.10
33	Lille	11,666.90
61	Stuttgart	10,653.85
12	Bruxelles	10,430.58
63	Toulouse	10,272.35
37	Lyon	9,937.10
15	Campinas	8,702.23
13	Buenos Aires	8,119.10
48	Portland	7,619.60
6	Bergamo	7,603.85
49	Reggio Emilia	7,555.60
38	Madrid	6,765.09
51	Resende	6,480.70
19	Cowes	6,146.30
59	Stavern	5,735.15
32	Leipzig	5,042.20
44	Münster	4,954.00
45	Nantes	4,788.06
7	Berlin	4,596.20
1	Aachen	3,763.21
68	Warszawa	3,531.95
55	San Francisco	3,490.02
39	Mannheim	3,239.80
26	Helsinki	3,161.35
21	Elgin	3,063.20
47	Paris	2,423.35

	city	totalamount
66	Versailles	1,992.05
14	Butte	1,947.24
29	Kirkland	1,571.20
62	Torino	1,545.70
16	Caracas	1,488.70
50	Reims	1,480.00
4	Barcelona	836.70
65	Vancouver	522.50
67	Walla Walla	357.00

In [ ]:

Orderdate Vs. Total Amount

In [21]:
```
date_total = orders[['orderdate', 'totalamount']]
date_total = date_total.set_index('orderdate')
```

In [22]:
```
fig = px.line(data_frame = date_total, width=800, height=600)
fig.show()
```

In [ ]:

OrderDate and Country

In [23]:
```
date_country = orders[['orderdate', 'country']]
date_country = date_country.set_index('orderdate')
date_country = date_country.country.resample(rule = '1ME').nunique() ## group by mo
date_country.head()
```

Out[23]:
```
orderdate
2012-07-31    11
2012-08-31    11
2012-09-30    11
2012-10-31    13
2012-11-30    11
Freq: ME, Name: country, dtype: int64
```

In [24]:
```
px.line(data_frame=date_country,y='country')
```

In [ ]:

```
```

In [25]:

```
cust_orders = {
    'fullname' : orders.firstname + ' ' + orders.lastname,
    'totalamount' : orders.totalamount
}

cust_orders = pd.DataFrame(cust_orders)
cust_orders.sort_values('fullname').head()
```

Out[25]:

	fullname	totalamount
1738	Alejandra Camino	365.89
89	Alejandra Camino	155.40
86	Alejandra Camino	86.50
1976	Alejandra Camino	361.00
156	Alejandra Camino	498.50

In [26]:

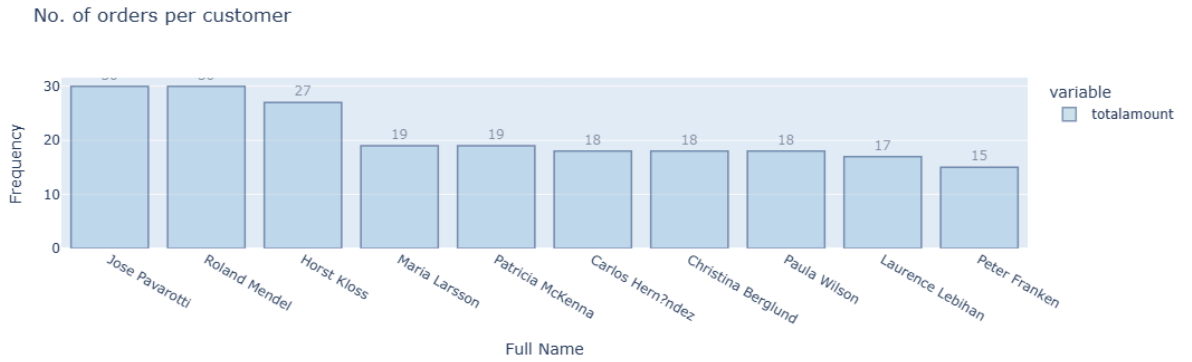
```
cust_orders.head()
```

Out[26]:

	fullname	totalamount
0	Paul Henriot	440.00
3	Karin Josephs	1,863.40
5	Mario Pontes	1,813.00
8	Mary Saveley	670.80
11	Pascale Cartrain	3,730.00

In [27]:

```
fig = px.bar(cust_orders.groupby('fullname')['totalamount'].count().sort_values(asc
             labels={'fullname': 'Full Name', 'value': 'Frequency'})
#Customize aspect
fig.update_traces(marker_color='rgb(158,202,225)', marker_line_color='rgb(8,48,107)
                  marker_line_width=1.5, opacity=0.5, textposition = 'outside')
```



In [ ]:

Multivariate Analysis

In [29]:
```
orders.head()
```

Out[29]:

	customerid	firstname	lastname	city	country	orderid	ordernumber	orderdate
0	85	Paul	Henriot	Reims	France	1	542378	2012-07-04
3	79	Karin	Josephs	Münster	Germany	2	542379	2012-07-05
5	34	Mario	Pontes	Rio de Janeiro	Brazil	3	542380	2012-07-08
8	84	Mary	Saveley	Lyon	France	4	542381	2012-07-08
11	76	Pascale	Cartrain	Charleroi	Belgium	5	542382	2012-07-09

In [ ]:

We Interested in Knowing the number of countries and the grand total amount of them per month

In [30]:
```
multivar = orders[['orderdate','country','totalamount']]
multivar = multivar.set_index('orderdate')
multivar.head()
```

Out[30]:

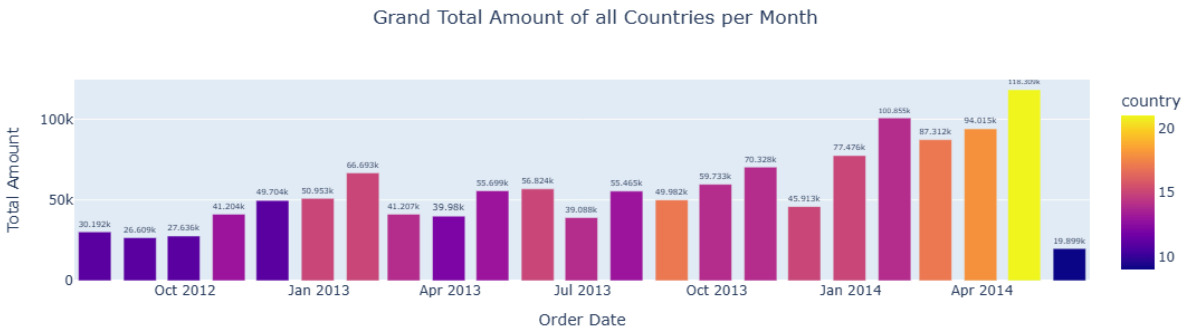
orderdate	country	totalamount
2012-07-04	France	440.00
2012-07-05	Germany	1,863.40
2012-07-08	Brazil	1,813.00
2012-07-08	France	670.80
2012-07-09	Belgium	3,730.00

In [31]:
```
multivar = multivar.resample('1ME').agg({'country': 'nunique', 'totalamount': 'sum'
multivar.head()
```

Out[31]:

orderdate	country	totalamount
2012-07-31	11	30,192.10
2012-08-31	11	26,609.40
2012-09-30	11	27,636.00
2012-10-31	13	41,203.60
2012-11-30	11	49,704.00

In [33]:
```
fig= px.bar(data_frame = multivar, x=multivar.index, y = round(multivar.totalamount
           labels={'orderdate': 'Order Date', 'y': 'Total Amount'})
fig.update_traces(textposition='outside')
fig.update_layout(title_x=0.5)
fig.show()
```



In [ ]:
```

```

Grand total amount of each Country per month

In [34]:
```
multivar = orders[['orderdate','country','totalamount']]
```

In [35]:
```
multivar.head()
```

Out[35]:

	orderdate	country	totalamount
0	2012-07-04	France	440.00
3	2012-07-05	Germany	1,863.40
5	2012-07-08	Brazil	1,813.00
8	2012-07-08	France	670.80
11	2012-07-09	Belgium	3,730.00

In [36]:
```
multivar.orderdate = multivar.orderdate.dt.to_period('M')
```

```
C:\Users\alhef\AppData\Local\Temp\ipykernel_12428\1183903935.py:1: SettingWithCopyWa
rning:


A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/u
ser_guide/indexing.html#returning-a-view-versus-a-copy
```

In [37]:
```
multivar.head()
```

Out[37]:

	orderdate	country	totalamount
0	2012-07	France	440.00
3	2012-07	Germany	1,863.40
5	2012-07	Brazil	1,813.00
8	2012-07	France	670.80
11	2012-07	Belgium	3,730.00

In [38]:
```
multivar = multivar.groupby(['orderdate', 'country'], as_index=False)['totalamount'
multivar.head()
```

Out[38]:

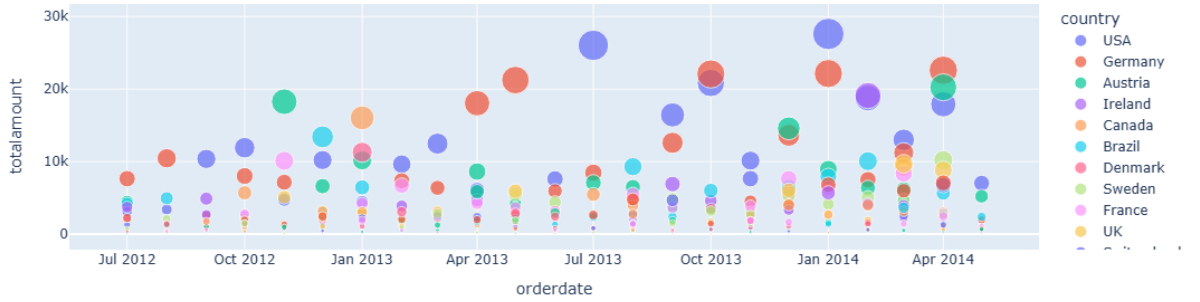
	orderdate	country	totalamount
255	2014-01	USA	27,594.45
166	2013-07	USA	26,022.30
300	2014-04	Germany	22,584.49
249	2014-01	Germany	22,135.55
206	2013-10	Germany	22,079.05

In [39]:
```
multivar.info()
```

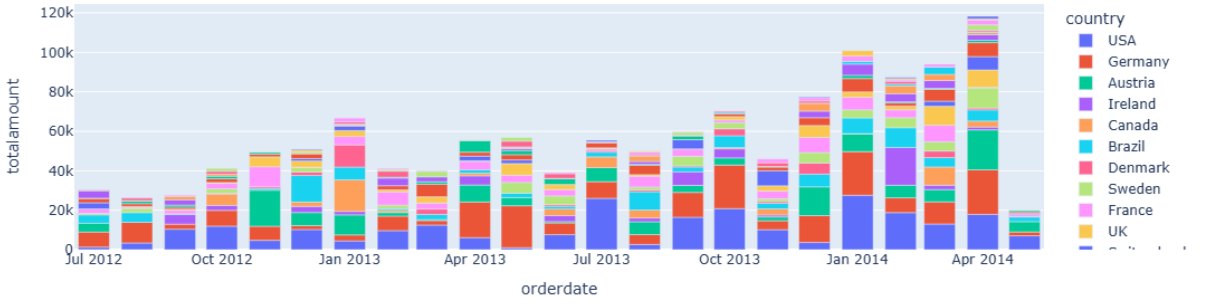
```
<class 'pandas.core.frame.DataFrame'>
Index: 322 entries, 255 to 228
Data columns (total 3 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   orderdate    322 non-null    period[M]
 1   country      322 non-null    object
 2   totalamount  322 non-null    float64
dtypes: float64(1), object(1), period[M](1)
memory usage: 10.1+ KB
```

In [40]:
```
multivar.orderdate = multivar.orderdate.astype('datetime64[ns]')
```

In [42]:
```
px.scatter(data_frame=multivar, x=multivar.orderdate, y='totalamount', color='count
```



In [43]:
```
px.bar(data_frame=multivar, x=multivar.orderdate, y='totalamount', color='country')
```



In [ ]: