Importing required libraries

In [1]:

```
import pandas as pd
import numpy as np
```

Loading the DataSet

In [2]:

```
df = pd.read_csv('data.csv', encoding = 'ISO-8859-1')
```

In [3]:

```
# ecom_data = pd.read_csv('data.csv', encoding = 'ISO-8859-1')
```

Number of rows and columns

In [4]:

```
df.shape
```

Out[4]:

```
(541909, 8)
```

Access first five rows

In [5]:

```
df.head()
```

Out[5]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Countr
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/2010 8:26	2.55	17850.0	Unite Kingdo
1	536365	71053	WHITE METAL LANTERN	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	12/1/2010 8:26	2.75	17850.0	Unite Kingdo
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo

Access last five rows

In [6]:

```
df.tail()
```

Out[6]:

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID
541904	581587	22613	PACK OF 20 SPACEBOY NAPKINS	12	12/9/2011 12:50	0.85	12680.0
541905	581587	22899	CHILDREN'S APRON DOLLY GIRL	6	12/9/2011 12:50	2.10	12680.0
541906	581587	23254	CHILDRENS CUTLERY DOLLY GIRL	4	12/9/2011 12:50	4.15	12680.0
541907	581587	23255	CHILDRENS CUTLERY CIRCUS PARADE	4	12/9/2011 12:50	4.15	12680.0
541908	581587	22138	BAKING SET 9 PIECE RETROSPOT	3	12/9/2011 12:50	4.95	12680.0

Displaying total columns from Dataset

In [7]:

```
df.columns
```

Out[7]:

```
Index(['InvoiceNo', 'StockCode', 'Description', 'Quantity', 'InvoiceDat
e',
       'UnitPrice', 'CustomerID', 'Country'],
      dtype='object')
```

Getting all columns one by one

In [8]:

```
for column in df.columns:
    print(column)
```

```
InvoiceNo
StockCode
Description
Quantity
InvoiceDate
UnitPrice
CustomerID
Country
```

Renaming columns names

In [9]:

```
d = {
        'InvoiceNo': 'invoice_num',
        'StockCode' : 'stock_code',
        'Description' : 'description',
        'Quantity' : 'quantity',
        'InvoiceDate' : 'invoice_date',
        'UnitPrice' : 'unit_price',
        'CustomerID' : 'cust_id',
        'Country' : 'country'
}
```

In [10]:

```
d
```

Out[10]:

```
{'InvoiceNo': 'invoice_num',
 'StockCode': 'stock_code',
 'Description': 'description',
 'Quantity': 'quantity',
 'InvoiceDate': 'invoice_date',
 'UnitPrice': 'unit_price',
 'CustomerID': 'cust_id',
 'Country': 'country'}
```

In [11]:

```
df.rename(columns = d, inplace = True)
```

After changing column names Checking new column names

In [12]:

```
df.columns
```

Out[12]:

```
Index(['invoice_num', 'stock_code', 'description', 'quantity', 'invoice_d
ate',
       'unit_price', 'cust_id', 'country'],
      dtype='object')
```

In [13]:

```
for i in df.columns:
    print(i)
```

```
invoice_num
stock_code
description
quantity
invoice_date
unit_price
cust_id
country
```

Lets check initial data

In [14]:

```
df.head()
```

Out[14]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	count
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/2010 8:26	2.55	17850.0	Unite Kingdo
1	536365	71053	WHITE METAL LANTERN	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	12/1/2010 8:26	2.75	17850.0	Unite Kingdo
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo

Checking first five rows

In [15]:

```
df.head()
```

Out[15]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	count
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/2010 8:26	2.55	17850.0	Unite Kingdo
1	536365	71053	WHITE METAL LANTERN	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	12/1/2010 8:26	2.75	17850.0	Unite Kingdo
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo

Data Cleaning

Checking column types

In [16]:

```
df.dtypes
```

Out[16]:

```
invoice_num      object
stock_code       object
description      object
quantity          int64
invoice_date     object
unit_price      float64
cust_id         float64
country          object
dtype: object
```

DataFrame information

In [17]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 541909 entries, 0 to 541908
Data columns (total 8 columns):
 #   Column        Non-Null Count   Dtype  
---  ------        --------------   -----  
 0   invoice_num   541909 non-null  object 
 1   stock_code    541909 non-null  object 
 2   description   540455 non-null  object 
 3   quantity      541909 non-null  int64  
 4   invoice_date  541909 non-null  object 
 5   unit_price    541909 non-null  float64
 6   cust_id       406829 non-null  float64
 7   country       541909 non-null  object 
dtypes: float64(2), int64(1), object(5)
memory usage: 33.1+ MB
```

Checking missing values for each column

In [18]:

```
df.isnull()
```

Out[18]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	c
0	False	False	False	False	False	False	False	
1	False	False	False	False	False	False	False	
2	False	False	False	False	False	False	False	
3	False	False	False	False	False	False	False	
4	False	False	False	False	False	False	False	
...	...	...	...	...	...	...	...	
541904	False	False	False	False	False	False	False	
541905	False	False	False	False	False	False	False	
541906	False	False	False	False	False	False	False	
541907	False	False	False	False	False	False	False	
541908	False	False	False	False	False	False	False	

541909 rows × 8 columns

Checkcing number of columns

In [19]:

```
len(df.columns)
```

Out[19]:

```
8
```

In [20]:

```
df.shape
```

Out[20]:

```
(541909, 8)
```

Checking missing values count on each column

In [21]:

```
df.isnull().sum()
```

Out[21]:

```
invoice_num          0
stock_code           0
description       1454
quantity             0
invoice_date         0
unit_price           0
cust_id         135080
country              0
dtype: int64
```

Checking missing values count on each column, applying sorting

In [22]:

```
df.isnull().sum().sort_values()
```

Out[22]:

```
invoice_num          0
stock_code           0
quantity             0
invoice_date         0
unit_price           0
country              0
description       1454
cust_id         135080
dtype: int64
```

In [23]:

```
df.isnull().sum().sort_values(ascending = False)
```

Out[23]:

```
cust_id         135080
description       1454
invoice_num          0
stock_code           0
quantity             0
invoice_date         0
unit_price           0
country              0
dtype: int64
```

Checking type of invoice_date column

In [24]:

```
df.dtypes
```

Out[24]:

```
invoice_num      object
stock_code       object
description      object
quantity          int64
invoice_date     object
unit_price      float64
cust_id         float64
country          object
dtype: object
```

Access intial data

In [25]:

```
df.head(2)
```

Out[25]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	count
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	12/1/2010 8:26	2.55	17850.0	Unite Kingdo
1	536365	71053	WHITE METAL LANTERN	6	12/1/2010 8:26	3.39	17850.0	Unite Kingdo

Converting invoice_date data type into datatime data type

In [26]:

```
df['invoice_date'] = pd.to_datetime(df.invoice_date, format='%m/%d/%Y %H:
```

Checking type of invoice_date

In [27]:

```
df.dtypes
```

Out[27]:

```
invoice_num             object
stock_code              object
description             object
quantity                 int64
invoice_date    datetime64[ns]
unit_price             float64
cust_id                float64
country                 object
dtype: object
```

In [28]:

```
df.head()
```

Out[28]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	countr
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	Unite Kingdo
1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17850.0	Unite Kingdo
3	536365	84029G	KNITTED UNION FLAG HOT WATER BOTTLE	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo
4	536365	84029E	RED WOOLLY HOTTIE WHITE HEART.	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo

Let us check description column

In [29]:

```
df.description
```

Out[29]:

```
0                 WHITE HANGING HEART T-LIGHT HOLDER
1                                WHITE METAL LANTERN
2                     CREAM CUPID HEARTS COAT HANGER
3                KNITTED UNION FLAG HOT WATER BOTTLE
4                     RED WOOLLY HOTTIE WHITE HEART.
                              ...
541904                 PACK OF 20 SPACEBOY NAPKINS
541905                CHILDREN'S APRON DOLLY GIRL
541906               CHILDRENS CUTLERY DOLLY GIRL
541907             CHILDRENS CUTLERY CIRCUS PARADE
541908               BAKING SET 9 PIECE RETROSPOT
Name: description, Length: 541909, dtype: object
```

We need to call lower() method

In [30]:

```
df.description.str.lower()
```

Out[30]:

```
0                 white hanging heart t-light holder
1                                white metal lantern
2                     cream cupid hearts coat hanger
3                knitted union flag hot water bottle
4                     red woolly hottie white heart.
                              ...
541904                   pack of 20 spaceboy napkins
541905                  children's apron dolly girl
541906                 childrens cutlery dolly girl
541907               childrens cutlery circus parade
541908                 baking set 9 piece retrospot
Name: description, Length: 541909, dtype: object
```

In [31]:

```
df.head(3)
```

Out[31]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	countr
0	536365	85123A	WHITE HANGING HEART T-LIGHT HOLDER	6	2010-12-01 08:26:00	2.55	17850.0	Unite Kingdo
1	536365	71053	WHITE METAL LANTERN	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo
2	536365	84406B	CREAM CUPID HEARTS COAT HANGER	8	2010-12-01 08:26:00	2.75	17850.0	Unite Kingdo

In [32]:

```
df['description'] = df.description.str.lower()
```

In [33]:

```
df.head()
```

Out[33]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	countr
0	536365	85123A	white hanging heart t-light holder	6	2010-12-01 08:26:00	2.55	17850.0	Unite Kingdo
1	536365	71053	white metal lantern	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo
2	536365	84406B	cream cupid hearts coat hanger	8	2010-12-01 08:26:00	2.75	17850.0	Unite Kingdo
3	536365	84029G	knitted union flag hot water bottle	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo
4	536365	84029E	red woolly hottie white heart.	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo

Missing values

Based on team meeting/client discussion we will need to perform accordingly

In [34]:

```
df.isnull().sum().sort_values(ascending = False)
```

Out[34]:

```
cust_id         135080
description       1454
invoice_num          0
stock_code           0
quantity             0
invoice_date         0
unit_price           0
country              0
dtype: int64
```

Dropping missing values

In [35]:

```
df_new = df.dropna()
```

After dropping missing values then again Checking missing values for each columns

In [36]:

```
df_new.isnull().sum()
```

Out[36]:

```
invoice_num     0
stock_code      0
description     0
quantity        0
invoice_date    0
unit_price      0
cust_id         0
country         0
dtype: int64
```

DataFrame information

In [37]:

```
df_new.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 406829 entries, 0 to 541908
Data columns (total 8 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   invoice_num   406829 non-null  object        
 1   stock_code    406829 non-null  object        
 2   description   406829 non-null  object        
 3   quantity      406829 non-null  int64         
 4   invoice_date  406829 non-null  datetime64[ns]
 5   unit_price    406829 non-null  float64       
 6   cust_id       406829 non-null  float64       
 7   country       406829 non-null  object        
dtypes: datetime64[ns](1), float64(2), int64(1), object(4)
memory usage: 27.9+ MB
```

In [38]:

```
df_new.head()
```

Out[38]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	countr
0	536365	85123A	white hanging heart t-light holder	6	2010-12-01 08:26:00	2.55	17850.0	Unite Kingdo
1	536365	71053	white metal lantern	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo
2	536365	84406B	cream cupid hearts coat hanger	8	2010-12-01 08:26:00	2.75	17850.0	Unite Kingdo
3	536365	84029G	knitted union flag hot water bottle	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo
4	536365	84029E	red woolly hottie white heart.	6	2010-12-01 08:26:00	3.39	17850.0	Unite Kingdo

Check type of cust_id data type

In [39]:

```
df_new.dtypes
```

Out[39]:

```
invoice_num             object
stock_code              object
description             object
quantity                 int64
invoice_date    datetime64[ns]
unit_price             float64
cust_id                float64
country                 object
dtype: object
```

Converting cust_id float type into integer type

In [40]:

```
df_new['cust_id']
```

Out[40]:

```
0         17850.0
1         17850.0
2         17850.0
3         17850.0
4         17850.0
           ...
541904    12680.0
541905    12680.0
541906    12680.0
541907    12680.0
541908    12680.0
Name: cust_id, Length: 406829, dtype: float64
```

Ignoring warnings in jupyter

In [41]:

```
import warnings
warnings.filterwarnings('ignore')
```

In [42]:

```
df_new['cust_id'] = df_new['cust_id'].astype('int64')
```

Accessing first five rows

In [43]:

```
df_new.head()
```

Out[43]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	countr
0	536365	85123A	white hanging heart t-light holder	6	2010-12-01 08:26:00	2.55	17850	Unite Kingdo
1	536365	71053	white metal lantern	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo
2	536365	84406B	cream cupid hearts coat hanger	8	2010-12-01 08:26:00	2.75	17850	Unite Kingdo
3	536365	84029G	knitted union flag hot water bottle	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo
4	536365	84029E	red woolly hottie white heart.	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo

New DataFrame information

In [44]:

```
df_new.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 406829 entries, 0 to 541908
Data columns (total 8 columns):
 #   Column        Non-Null Count   Dtype         
---  ------        --------------   -----         
 0   invoice_num   406829 non-null  object        
 1   stock_code    406829 non-null  object        
 2   description   406829 non-null  object        
 3   quantity      406829 non-null  int64         
 4   invoice_date  406829 non-null  datetime64[ns]
 5   unit_price    406829 non-null  float64       
 6   cust_id       406829 non-null  int64         
 7   country       406829 non-null  object        
dtypes: datetime64[ns](1), float64(1), int64(2), object(4)
memory usage: 27.9+ MB
```

DataFrame description

In [45]:

```
df_new.describe()
```

Out[45]:

	quantity	unit_price	cust_id
count	406829.000000	406829.000000	406829.000000
mean	12.061303	3.460471	15287.690570
std	248.693370	69.315162	1713.600303
min	-80995.000000	0.000000	12346.000000
25%	2.000000	1.250000	13953.000000
50%	5.000000	1.950000	15152.000000
75%	12.000000	3.750000	16791.000000
max	80995.000000	38970.000000	18287.000000

Rounding the values in DataFrame

In [46]:

```
df_new.describe().round(2)
```

Out[46]:

	quantity	unit_price	cust_id
count	406829.00	406829.00	406829.00
mean	12.06	3.46	15287.69
std	248.69	69.32	1713.60
min	-80995.00	0.00	12346.00
25%	2.00	1.25	13953.00
50%	5.00	1.95	15152.00
75%	12.00	3.75	16791.00
max	80995.00	38970.00	18287.00

Let us do some analysis

Conclusion is: quantity column having negative values

So, we need to remove/delete negative values

Example to delete negative values from list object

In [47]:
```
values = [1, 2, 3, -4, -5, 6, 7]
```

In [48]:
```
for value in values:
    print(value)
```

```
1
2
3
-4
-5
6
7
```

In [49]:
```
for value in values:
    if value >= 0:
        print(value)
```

```
1
2
3
6
7
```

Remove negative values from quantity column

In [50]:
```
df_new.quantity > 0
```

Out[50]:
```
0         True
1         True
2         True
3         True
4         True
          ...
541904    True
541905    True
541906    True
541907    True
541908    True
Name: quantity, Length: 406829, dtype: bool
```

In [51]:

```
con = df_new.quantity > 0
```

In [52]:

```
df_new = df_new[con]
```

In [53]:

```
df_new.describe().round(2)
```

Out[53]:

	quantity	unit_price	cust_id
count	397924.00	397924.00	397924.00
mean	13.02	3.12	15294.32
std	180.42	22.10	1713.17
min	1.00	0.00	12346.00
25%	2.00	1.25	13969.00
50%	6.00	1.95	15159.00
75%	12.00	3.75	16795.00
max	80995.00	8142.75	18287.00

Access initial Data

In [54]:

```
df_new.head()
```

Out[54]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	countr
0	536365	85123A	white hanging heart t-light holder	6	2010-12-01 08:26:00	2.55	17850	Unite Kingdo
1	536365	71053	white metal lantern	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo
2	536365	84406B	cream cupid hearts coat hanger	8	2010-12-01 08:26:00	2.75	17850	Unite Kingdo
3	536365	84029G	knitted union flag hot water bottle	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo
4	536365	84029E	red woolly hottie white heart.	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo

Checking total number of rows and columns

In [55]:

```
df_new.shape
```

Out[55]:

```
(397924, 8)
```

Adding the column - amount_spent

In [56]:

```
df_new['amount_spent'] = df_new['quantity'] * df_new['unit_price']
```

In [57]:

```
df_new.head()
```

Out[57]:

	invoice_num	stock_code	description	quantity	invoice_date	unit_price	cust_id	countr
0	536365	85123A	white hanging heart t-light holder	6	2010-12-01 08:26:00	2.55	17850	Unite Kingdo
1	536365	71053	white metal lantern	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo
2	536365	84406B	cream cupid hearts coat hanger	8	2010-12-01 08:26:00	2.75	17850	Unite Kingdo
3	536365	84029G	knitted union flag hot water bottle	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo
4	536365	84029E	red woolly hottie white heart.	6	2010-12-01 08:26:00	3.39	17850	Unite Kingdo

Lets read the column names from DataFrame

In [58]:

```
for col in df_new.columns:
    print(col)
```

```
invoice_num
stock_code
description
quantity
invoice_date
unit_price
cust_id
country
amount_spent
```

Rearranging columns for more readability

In [59]:

```
col_order = ['invoice_num','invoice_date','stock_code','description','qua
```

In [60]:

```
df_new = df_new[col_order]
```

Access initial data

In [61]:

```
df_new.head()
```

Out[61]:

	invoice_num	invoice_date	stock_code	description	quantity	unit_price	amount_spent
0	536365	2010-12-01 08:26:00	85123A	white hanging heart t-light holder	6	2.55	15.30
1	536365	2010-12-01 08:26:00	71053	white metal lantern	6	3.39	20.34
2	536365	2010-12-01 08:26:00	84406B	cream cupid hearts coat hanger	8	2.75	22.00
3	536365	2010-12-01 08:26:00	84029G	knitted union flag hot water bottle	6	3.39	20.34
4	536365	2010-12-01 08:26:00	84029E	red woolly hottie white heart.	6	3.39	20.34

Number of rows and columns

In [62]:

```
df_new.shape
```

Out[62]:

```
(397924, 9)
```

Let us do analysis on invoice_date column

number of columns in the dataset

In [63]:

```
len(df_new.columns)
```

Out[63]:

```
9
```

Accessing invoice_date column

Method - 1 to access column

In [64]:

```
df_new['invoice_date']
```

Out[64]:

```
0         2010-12-01 08:26:00
1         2010-12-01 08:26:00
2         2010-12-01 08:26:00
3         2010-12-01 08:26:00
4         2010-12-01 08:26:00
                  ...
541904    2011-12-09 12:50:00
541905    2011-12-09 12:50:00
541906    2011-12-09 12:50:00
541907    2011-12-09 12:50:00
541908    2011-12-09 12:50:00
Name: invoice_date, Length: 397924, dtype: datetime64[ns]
```

Method - 2 to access column

In [65]:

```
df_new.invoice_date
```

Out[65]:

```
0         2010-12-01 08:26:00
1         2010-12-01 08:26:00
2         2010-12-01 08:26:00
3         2010-12-01 08:26:00
4         2010-12-01 08:26:00
                  ...
541904    2011-12-09 12:50:00
541905    2011-12-09 12:50:00
541906    2011-12-09 12:50:00
541907    2011-12-09 12:50:00
541908    2011-12-09 12:50:00
Name: invoice_date, Length: 397924, dtype: datetime64[ns]
```

Accessing year value from invoice_date

In [66]:

```
df_new['invoice_date'].dt.year
```

Out[66]:

```
0          2010
1          2010
2          2010
3          2010
4          2010
           ...
541904     2011
541905     2011
541906     2011
541907     2011
541908     2011
Name: invoice_date, Length: 397924, dtype: int64
```

Accessing month value from invoice_date

In [67]:

```
df_new['invoice_date'].dt.month
```

Out[67]:

```
0         12
1         12
2         12
3         12
4         12
          ..
541904    12
541905    12
541906    12
541907    12
541908    12
Name: invoice_date, Length: 397924, dtype: int64
```

Access initial Data

In [68]:

```
df_new.head(2)
```

Out[68]:

	invoice_num	invoice_date	stock_code	description	quantity	unit_price	amount_spent
0	536365	2010-12-01 08:26:00	85123A	white hanging heart t-light holder	6	2.55	15.30
1	536365	2010-12-01 08:26:00	71053	white metal lantern	6	3.39	20.34

Lets insert year_month colum in 2nd position

Need to restart from here

In [ ]:

```

```

small calculation

In [69]:

```
y = 2010
m = 12
```

In [70]:

```
y_m = 100*2010 + 12
```

In [71]:

```
y_m
```

Out[71]:

```
201012
```

In [72]:

```
c1 = 'year_month'
```

In [73]:

```
v1 = df_new['invoice_date'].map(lambda col: 100*(col.year) + col.month)
```

In [74]:

```
df_new.insert(loc = 2, column = c1, value = v1)
```

In [75]:

```
df_new
```

Out[75]:

	invoice_num	invoice_date	year_month	stock_code	description	quantity	unit_pric
0	536365	2010-12-01 08:26:00	201012	85123A	white hanging heart t-light holder	6	2.5
1	536365	2010-12-01 08:26:00	201012	71053	white metal lantern	6	3.3
2	536365	2010-12-01 08:26:00	201012	84406B	cream cupid hearts coat hanger	8	2.7
3	536365	2010-12-01 08:26:00	201012	84029G	knitted union flag hot water bottle	6	3.3
4	536365	2010-12-01 08:26:00	201012	84029E	red woolly hottie white heart.	6	3.3
...	...	...	...	...	...	...	
541904	581587	2011-12-09 12:50:00	201112	22613	pack of 20 spaceboy napkins	12	0.8
541905	581587	2011-12-09 12:50:00	201112	22899	children's apron dolly girl	6	2.1
541906	581587	2011-12-09 12:50:00	201112	23254	childrens cutlery dolly girl	4	4.1
541907	581587	2011-12-09 12:50:00	201112	23255	childrens cutlery circus parade	4	4.1
541908	581587	2011-12-09 12:50:00	201112	22138	baking set 9 piece retrospot	3	4.9

397924 rows × 10 columns

Access initial data

In [76]:

```
df_new.head()
```

Out[76]:

	invoice_num	invoice_date	year_month	stock_code	description	quantity	unit_price	an
0	536365	2010-12-01 08:26:00	201012	85123A	white hanging heart t-light holder	6	2.55	
1	536365	2010-12-01 08:26:00	201012	71053	white metal lantern	6	3.39	
2	536365	2010-12-01 08:26:00	201012	84406B	cream cupid hearts coat hanger	8	2.75	
3	536365	2010-12-01 08:26:00	201012	84029G	knitted union flag hot water bottle	6	3.39	
4	536365	2010-12-01 08:26:00	201012	84029E	red woolly hottie white heart.	6	3.39	

Adding month column to the exisint DataFrame

In [77]:

```
c2 = 'month'
```

In [78]:

```
v2 = df_new.invoice_date.dt.month
```

In [79]:

```
df_new.insert(loc = 3, column = c2, value = v2)
```

In [80]:

```
df_new.head()
```

Out[80]:

	invoice_num	invoice_date	year_month	month	stock_code	description	quantity	unit_p
0	536365	2010-12-01 08:26:00	201012	12	85123A	white hanging heart t-light holder	6	
1	536365	2010-12-01 08:26:00	201012	12	71053	white metal lantern	6	
2	536365	2010-12-01 08:26:00	201012	12	84406B	cream cupid hearts coat hanger	8	
3	536365	2010-12-01 08:26:00	201012	12	84029G	knitted union flag hot water bottle	6	
4	536365	2010-12-01 08:26:00	201012	12	84029E	red woolly hottie white heart.	6	

Lets access invoice_date column

In [81]:

```
df_new.invoice_date
```

Out[81]:

```
0         2010-12-01 08:26:00
1         2010-12-01 08:26:00
2         2010-12-01 08:26:00
3         2010-12-01 08:26:00
4         2010-12-01 08:26:00
                  ...
541904   2011-12-09 12:50:00
541905   2011-12-09 12:50:00
541906   2011-12-09 12:50:00
541907   2011-12-09 12:50:00
541908   2011-12-09 12:50:00
Name: invoice_date, Length: 397924, dtype: datetime64[ns]
```

We can get day of the week

In [82]:

```
df_new.invoice_date.dt.dayofweek
```

Out[82]:

```
0         2
1         2
2         2
3         2
4         2
         ..
541904    4
541905    4
541906    4
541907    4
541908    4
Name: invoice_date, Length: 397924, dtype: int64
```

In pandas, the day formate starts from 0 to 6

Monday = 0 Tuesday = 1 .... Sunday = 6

Apply +1 to make Monday = 1.....until Sunday = 7

In [83]:

```
c3 = 'day'
```

In [84]:

```
v3 = (df_new.invoice_date.dt.dayofweek)+1
```

In [85]:

```
df_new.insert(loc = 4, column = c3, value = v3)
```

In [86]:

```
df_new.head()
```

Out[86]:

	invoice_num	invoice_date	year_month	month	day	stock_code	description	quantity
0	536365	2010-12-01 08:26:00	201012	12	3	85123A	white hanging heart t-light holder	6
1	536365	2010-12-01 08:26:00	201012	12	3	71053	white metal lantern	6
2	536365	2010-12-01 08:26:00	201012	12	3	84406B	cream cupid hearts coat hanger	8
3	536365	2010-12-01 08:26:00	201012	12	3	84029G	knitted union flag hot water bottle	6
4	536365	2010-12-01 08:26:00	201012	12	3	84029E	red woolly hottie white heart.	6

Adding hour column to existing DataFrame

In [87]:

```
df_new.invoice_date
```

Out[87]:

```
0         2010-12-01 08:26:00
1         2010-12-01 08:26:00
2         2010-12-01 08:26:00
3         2010-12-01 08:26:00
4         2010-12-01 08:26:00
                  ...
541904    2011-12-09 12:50:00
541905    2011-12-09 12:50:00
541906    2011-12-09 12:50:00
541907    2011-12-09 12:50:00
541908    2011-12-09 12:50:00
Name: invoice_date, Length: 397924, dtype: datetime64[ns]
```

In [88]:

```
# dir(df_new.invoice_date)
```

In [89]:

```
# dir(df_new.invoice_date.dt)
```

In [90]:

```
# df_new.invoice_date.dt.hour
```

In [91]:

```
c4 = "hour"
```

In [92]:

```
v4 = df_new.invoice_date.dt.hour
```

In [93]:

```
df_new.insert(loc = 5, column = c4, value = v4)
```

In [94]:

```
df_new.head()
```

Out[94]:

	invoice_num	invoice_date	year_month	month	day	hour	stock_code	description	qua
0	536365	2010-12-01 08:26:00	201012	12	3	8	85123A	white hanging heart t-light holder	
1	536365	2010-12-01 08:26:00	201012	12	3	8	71053	white metal lantern	
2	536365	2010-12-01 08:26:00	201012	12	3	8	84406B	cream cupid hearts coat hanger	
3	536365	2010-12-01 08:26:00	201012	12	3	8	84029G	knitted union flag hot water bottle	
4	536365	2010-12-01 08:26:00	201012	12	3	8	84029E	red woolly hottie white heart.	

Lets display all columns once

In [95]:

```
df_new.columns
```

Out[95]:

```
Index(['invoice_num', 'invoice_date', 'year_month', 'month', 'day', 'hou
r',
       'stock_code', 'description', 'quantity', 'unit_price', 'amount_spe
nt',
       'cust_id', 'country'],
      dtype='object')
```

In [96]:

```
for col in df_new.columns:
    print(col)
```

```
invoice_num
invoice_date
year_month
month
day
hour
stock_code
description
quantity
unit_price
amount_spent
cust_id
country
```

Exploratory Data Analysis (EDA)

In [97]:

```
df_new.groupby(by = ['cust_id']).count()
```

Out[97]:

cust_id	invoice_num	invoice_date	year_month	month	day	hour	stock_code	descriptior
12346	1	1	1	1	1	1	1	1
12347	182	182	182	182	182	182	182	182
12348	31	31	31	31	31	31	31	31
12349	73	73	73	73	73	73	73	73
12350	17	17	17	17	17	17	17	17
...	...	...	...	...	...	...	...	..
18280	10	10	10	10	10	10	10	10
18281	7	7	7	7	7	7	7	7
18282	12	12	12	12	12	12	12	12
18283	756	756	756	756	756	756	756	756
18287	70	70	70	70	70	70	70	70

4339 rows × 12 columns

In [98]:

```
df_new.groupby(by = ['cust_id','country']).count()
```

Out[98]:

cust_id	country	invoice_num	invoice_date	year_month	month	day	hour	stock_code
12346	**United Kingdom**	1	1	1	1	1	1	1
12347	**Iceland**	182	182	182	182	182	182	182
12348	**Finland**	31	31	31	31	31	31	31
12349	**Italy**	73	73	73	73	73	73	73
12350	**Norway**	17	17	17	17	17	17	17
...	**...**	...	...	...	...	...	...	...
18280	**United Kingdom**	10	10	10	10	10	10	10
18281	**United Kingdom**	7	7	7	7	7	7	7
18282	**United Kingdom**	12	12	12	12	12	12	12
18283	**United Kingdom**	756	756	756	756	756	756	756
18287	**United Kingdom**	70	70	70	70	70	70	70

4347 rows × 11 columns

In [99]:

```
df_new.groupby(by = ['cust_id','country'])['invoice_num'].count()
```

Out[99]:

```
cust_id  country
12346    United Kingdom      1
12347    Iceland           182
12348    Finland            31
12349    Italy              73
12350    Norway             17
                          ...
18280    United Kingdom     10
18281    United Kingdom      7
18282    United Kingdom     12
18283    United Kingdom    756
18287    United Kingdom     70
Name: invoice_num, Length: 4347, dtype: int64
```

In [100…

```
df_new.groupby(by = ['cust_id','country'], as_index = False)['invoice_num
```

Out[100]:

	cust_id	country	invoice_num
0	12346	United Kingdom	1
1	12347	Iceland	182
2	12348	Finland	31
3	12349	Italy	73
4	12350	Norway	17
...	...	...	...
4342	18280	United Kingdom	10
4343	18281	United Kingdom	7
4344	18282	United Kingdom	12
4345	18283	United Kingdom	756
4346	18287	United Kingdom	70

4347 rows × 3 columns

In [101…

```
df_new.groupby(by=['cust_id','country'], as_index=False)['invoice_num'].c
```

Out[101]:

	cust_id	country	invoice_num
0	12346	United Kingdom	1
1	12347	Iceland	182
2	12348	Finland	31
3	12349	Italy	73
4	12350	Norway	17

Data Visaulization libraries

In [102…

```
import matplotlib.pyplot as plt
import seaborn as sns
```

In [103…

```
df_new.groupby(by=['cust_id','country'], as_index=False)['invoice_num'].c
```

Out[103]:

	cust_id	country	invoice_num
0	12346	United Kingdom	1
1	12347	Iceland	182
2	12348	Finland	31
3	12349	Italy	73
4	12350	Norway	17
...	...	...	...
4342	18280	United Kingdom	10
4343	18281	United Kingdom	7
4344	18282	United Kingdom	12
4345	18283	United Kingdom	756
4346	18287	United Kingdom	70

4347 rows × 3 columns

In [104…
```
orders = df_new.groupby(by=['cust_id','country'], as_index=False)['invoic
```

In [105…
```
orders
```

Out[105]:

	cust_id	country	invoice_num
0	12346	United Kingdom	1
1	12347	Iceland	182
2	12348	Finland	31
3	12349	Italy	73
4	12350	Norway	17
...	...	...	...
4342	18280	United Kingdom	10
4343	18281	United Kingdom	7
4344	18282	United Kingdom	12
4345	18283	United Kingdom	756
4346	18287	United Kingdom	70

4347 rows × 3 columns

Check TOP 5 most number of orders

In [106…
```
orders.sort_values(by = 'invoice_num', ascending = False).head()
```

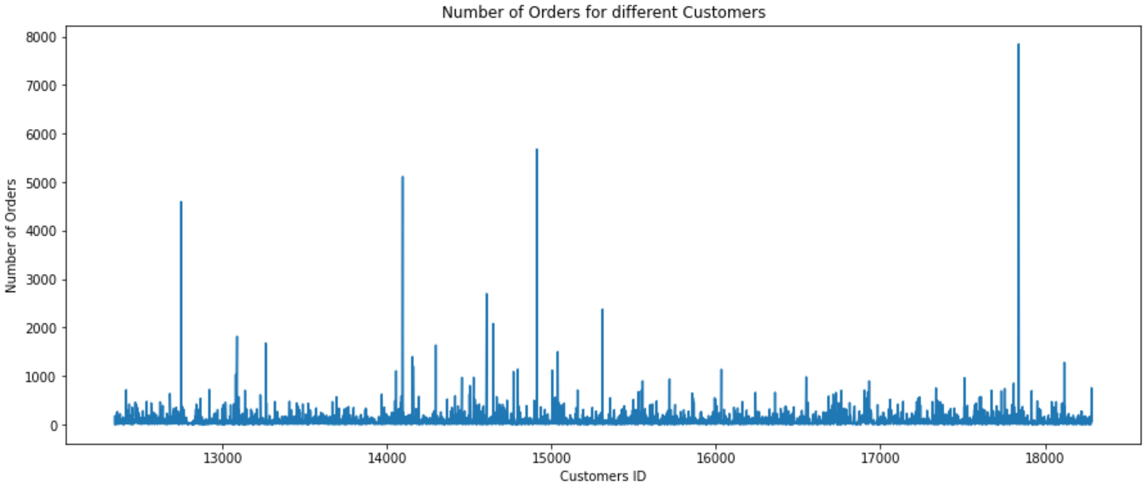
Out[106]:

	cust_id	country	invoice_num
4019	17841	United Kingdom	7847
1888	14911	EIRE	5677
1298	14096	United Kingdom	5111
334	12748	United Kingdom	4596
1670	14606	United Kingdom	2700

Visualizing - Number of Orders for different Customers

In [107…

```
orders = df_new.groupby(by=['cust_id','country'], as_index=False)['invoic

plt.subplots(figsize=(15,6))

plt.plot(orders.cust_id, orders.invoice_num)

plt.xlabel('Customers ID')
plt.ylabel('Number of Orders')
plt.title('Number of Orders for different Customers')

plt.show()
```



How much money spent by each customers?

In [108…

```
df_new.groupby(by = ['cust_id', 'country']).sum()
```

Out[108]:

		year_month	month	day	hour	quantity	unit_price	amount_spent
cust_id	**country**							
12346	**United Kingdom**	201101	1	2	10	74215	1.04	77183.60
12347	**Iceland**	36598483	1383	441	2219	2458	481.21	4310.00
12348	**Finland**	6232657	257	111	472	2341	178.71	1797.24
12349	**Italy**	14681103	803	73	657	631	605.10	1757.55
12350	**Norway**	3418734	34	51	272	197	65.30	334.40
...	**...**	...	...	...	...	...	...	...
18280	**United Kingdom**	2011030	30	10	90	45	47.65	180.60
18281	**United Kingdom**	1407742	42	49	70	54	39.36	80.82
18282	**United Kingdom**	2413316	116	60	146	103	62.39	178.05
18283	**United Kingdom**	152037103	5503	2489	10346	1397	1220.93	2094.88
18287	**United Kingdom**	14077555	555	332	697	1586	104.55	1837.28

4347 rows × 7 columns

In [109…

```
df_new.groupby(by = ['cust_id', 'country'])['amount_spent'].sum()
```

Out[109]:

```
cust_id  country
12346    United Kingdom    77183.60
12347    Iceland            4310.00
12348    Finland            1797.24
12349    Italy              1757.55
12350    Norway              334.40
                             ...
18280    United Kingdom      180.60
18281    United Kingdom       80.82
18282    United Kingdom      178.05
18283    United Kingdom     2094.88
18287    United Kingdom     1837.28
Name: amount_spent, Length: 4347, dtype: float64
```

In [110…

```
df_new.groupby(by = ['cust_id', 'country'], as_index = False)['amount_spe
```

Out[110]:

	cust_id	country	amount_spent
0	12346	United Kingdom	77183.60
1	12347	Iceland	4310.00
2	12348	Finland	1797.24
3	12349	Italy	1757.55
4	12350	Norway	334.40
...	...	...	...
4342	18280	United Kingdom	180.60
4343	18281	United Kingdom	80.82
4344	18282	United Kingdom	178.05
4345	18283	United Kingdom	2094.88
4346	18287	United Kingdom	1837.28

4347 rows × 3 columns

In [111…

```
money_spent = df_new.groupby(by = ['cust_id', 'country'], as_index = Fals
```

In [112…

```
money_spent
```

Out[112]:

	cust_id	country	amount_spent
0	12346	United Kingdom	77183.60
1	12347	Iceland	4310.00
2	12348	Finland	1797.24
3	12349	Italy	1757.55
4	12350	Norway	334.40
...	...	...	...
4342	18280	United Kingdom	180.60
4343	18281	United Kingdom	80.82
4344	18282	United Kingdom	178.05
4345	18283	United Kingdom	2094.88
4346	18287	United Kingdom	1837.28

4347 rows × 3 columns

Top FIVE customers who spend highest money

In [113…

```
money_spent.sort_values(by='amount_spent', ascending = False).head()
```

Out[113]:

	cust_id	country	amount_spent
1698	14646	Netherlands	280206.02
4210	18102	United Kingdom	259657.30
3737	17450	United Kingdom	194550.79
3017	16446	United Kingdom	168472.50
1888	14911	EIRE	143825.06

Top TEN customers who spend highest money

In [114…

```
money_spent.sort_values(by='amount_spent', ascending = False).head(10)
```

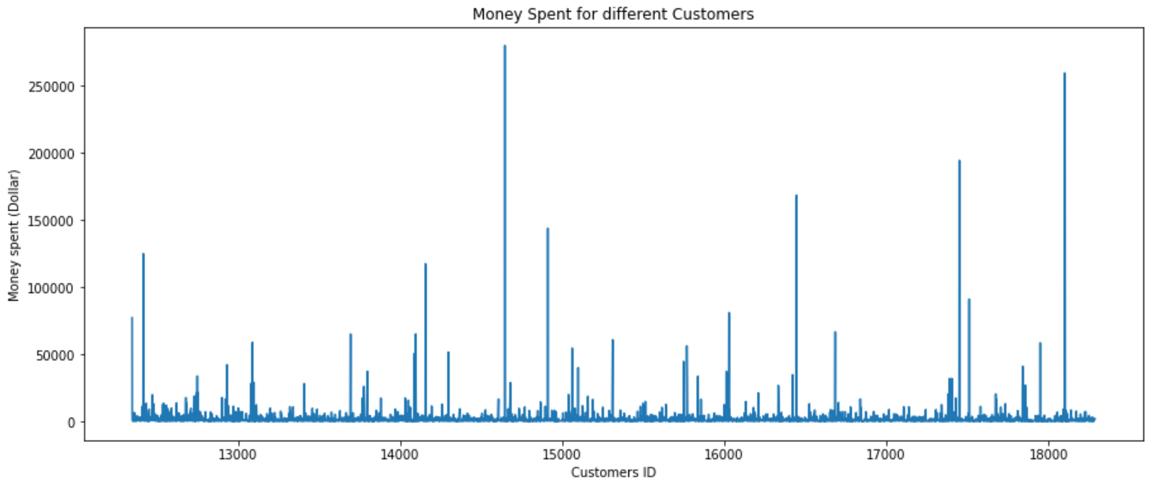
Out[114]:

	cust_id	country	amount_spent
1698	14646	Netherlands	280206.02
4210	18102	United Kingdom	259657.30
3737	17450	United Kingdom	194550.79
3017	16446	United Kingdom	168472.50
1888	14911	EIRE	143825.06
57	12415	Australia	124914.53
1342	14156	EIRE	117379.63
3780	17511	United Kingdom	91062.38
2711	16029	United Kingdom	81024.84
0	12346	United Kingdom	77183.60

Visualizing - Money spent for different customers

In [115…

```
money_spent = df_new.groupby(by=['cust_id','country'], as_index=False)['a

plt.subplots(figsize=(15,6))

plt.plot(money_spent.cust_id, money_spent.amount_spent)

plt.xlabel('Customers ID')
plt.ylabel('Money spent (Dollar)')
plt.title('Money Spent for different Customers')

plt.show()
```



In [116…

```
df_new.head()
```

Out[116]:

	invoice_num	invoice_date	year_month	month	day	hour	stock_code	description	qu
0	536365	2010-12-01 08:26:00	201012	12	3	8	85123A	white hanging heart t-light holder	
1	536365	2010-12-01 08:26:00	201012	12	3	8	71053	white metal lantern	
2	536365	2010-12-01 08:26:00	201012	12	3	8	84406B	cream cupid hearts coat hanger	
3	536365	2010-12-01 08:26:00	201012	12	3	8	84029G	knitted union flag hot water bottle	
4	536365	2010-12-01 08:26:00	201012	12	3	8	84029E	red woolly hottie white heart.	

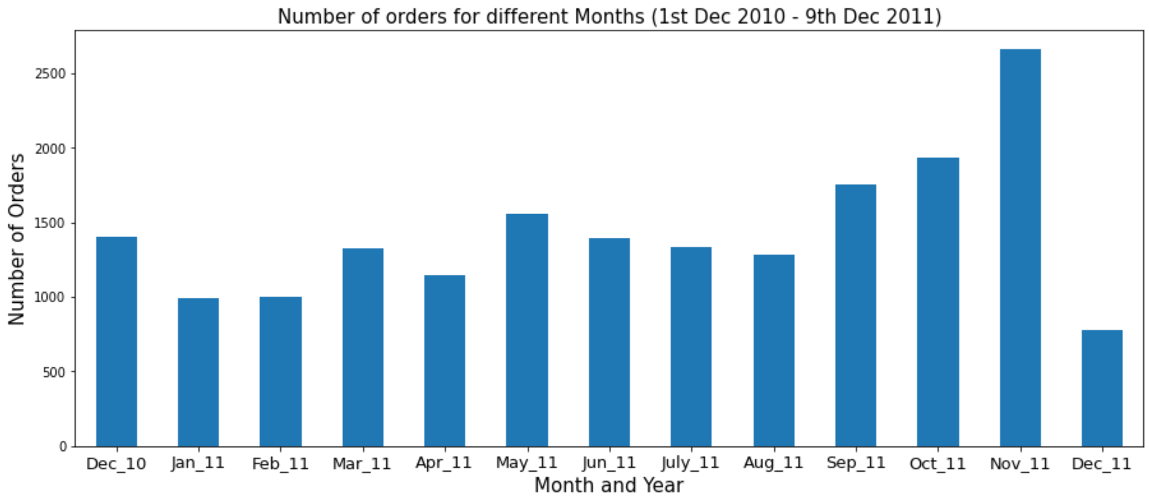
Number of order for different months

In [117…

```
color = sns.color_palette()
```

In [118…

```
ax = df_new.groupby('invoice_num')['year_month'].unique().value_counts().

ax.set_xlabel('Month and Year',fontsize=15)
ax.set_ylabel('Number of Orders',fontsize=15)
ax.set_title('Number of orders for different Months (1st Dec 2010 - 9th D

t = ('Dec_10','Jan_11','Feb_11','Mar_11','Apr_11','May_11','Jun_11','July

ax.set_xticklabels(t, rotation='horizontal', fontsize=13)

plt.show()
```



How many orders (per day)?

```
In [119…  df_new.groupby('invoice_num')
```

```
Out[119]:  <pandas.core.groupby.generic.DataFrameGroupBy object at 0x00000238B476AE
           20>
```

```
In [120…  df_new.groupby('invoice_num')['day']
```

```
Out[120]:  <pandas.core.groupby.generic.SeriesGroupBy object at 0x00000238B4808F70>
```

```
In [121…  df_new.groupby('invoice_num')['day'].unique()
```

```
Out[121]:  invoice_num
           536365    [3]
           536366    [3]
           536367    [3]
           536368    [3]
           536369    [3]
                    ...
           581583    [5]
           581584    [5]
           581585    [5]
           581586    [5]
           581587    [5]
           Name: day, Length: 18536, dtype: object
```

```
In [122…  df_new.groupby('invoice_num')['day'].unique().value_counts()
```

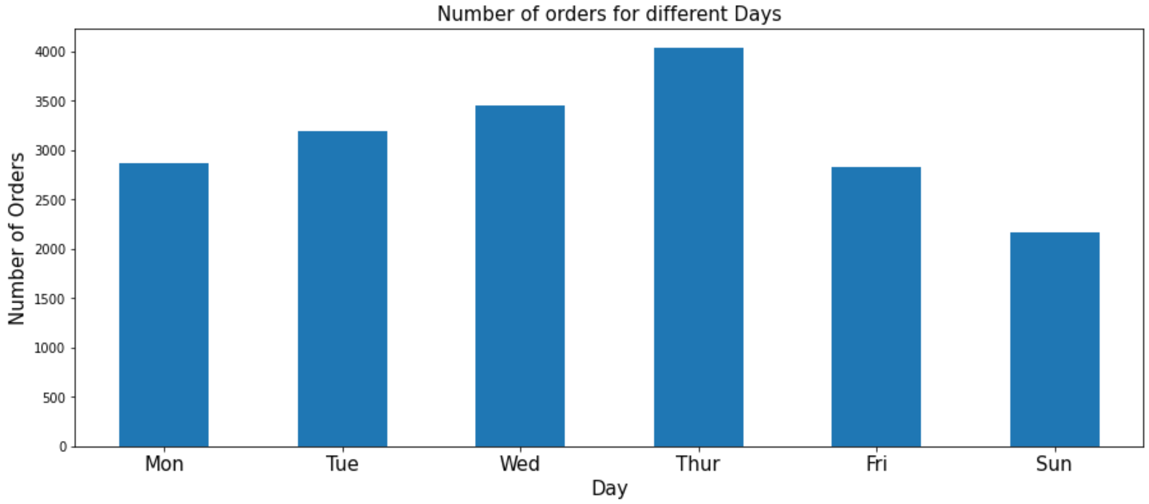
```
Out[122]:  [4]    4033
           [3]    3455
           [2]    3185
           [1]    2863
           [5]    2831
           [7]    2169
           Name: day, dtype: int64
```

```
In [123…  df_new.groupby('invoice_num')['day'].unique().value_counts().sort_index()
```

```
Out[123]:  [1]    2863
           [2]    3185
           [3]    3455
           [4]    4033
           [5]    2831
           [7]    2169
           Name: day, dtype: int64
```

Day wise sales count/business

```
In [124…  ax = df_new.groupby('invoice_num')['day'].unique().value_counts().sort_in

          ax.set_xlabel('Day',fontsize=15)
          ax.set_ylabel('Number of Orders',fontsize=15)
          ax.set_title('Number of orders for different Days',fontsize=15)
          d = ('Mon','Tue','Wed','Thur','Fri','Sun')
          ax.set_xticklabels(d, rotation='horizontal', fontsize=15)
          plt.show()
```

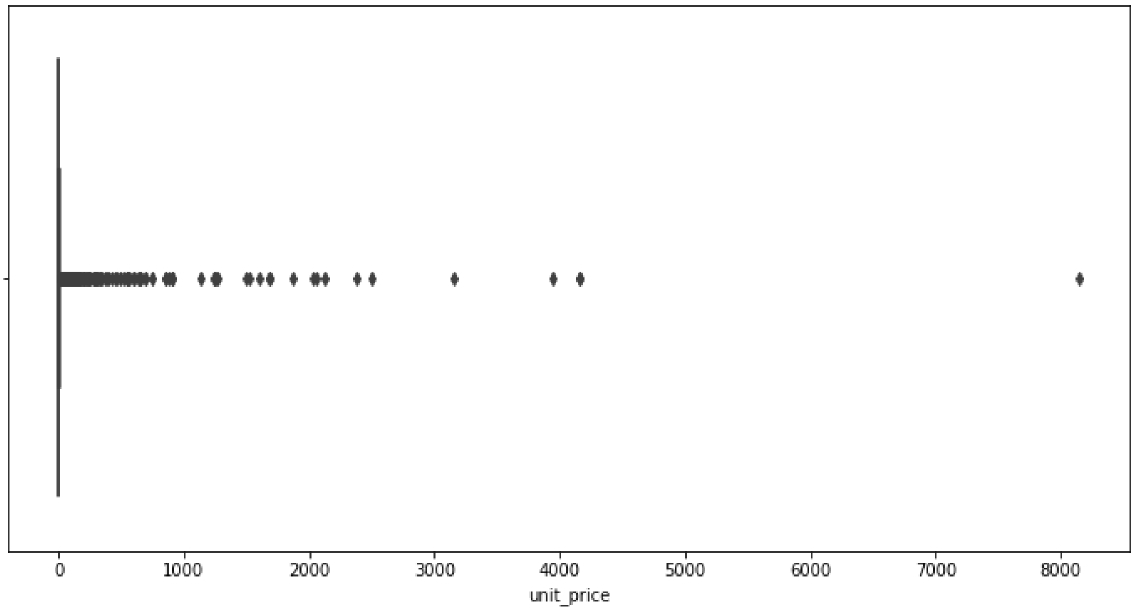


Discover patterns for Unit Price

```
In [125…  df_new.unit_price.describe()
```

```
Out[125]:  count    397924.000000
           mean          3.116174
           std          22.096788
           min           0.000000
           25%           1.250000
           50%           1.950000
           75%           3.750000
           max        8142.750000
           Name: unit_price, dtype: float64
```

```
In [126…  # check the distribution of unit price
          plt.subplots(figsize=(12,6))
          sns.boxplot(df_new.unit_price)
          plt.show()
```



In [127…

```
df_free = df_new[df_new.unit_price == 0]
```

In [128…

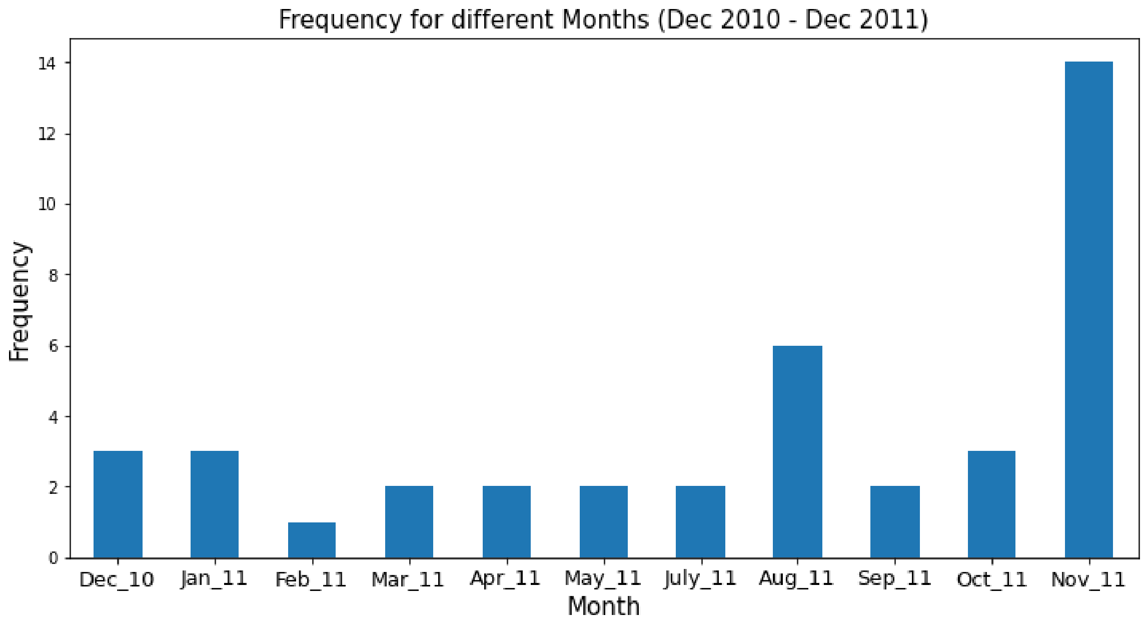
```
df_free.year_month.value_counts().sort_index()
```

Out[128]:

```
201012     3
201101     3
201102     1
201103     2
201104     2
201105     2
201107     2
201108     6
201109     2
201110     3
201111    14
Name: year_month, dtype: int64
```

In [129…

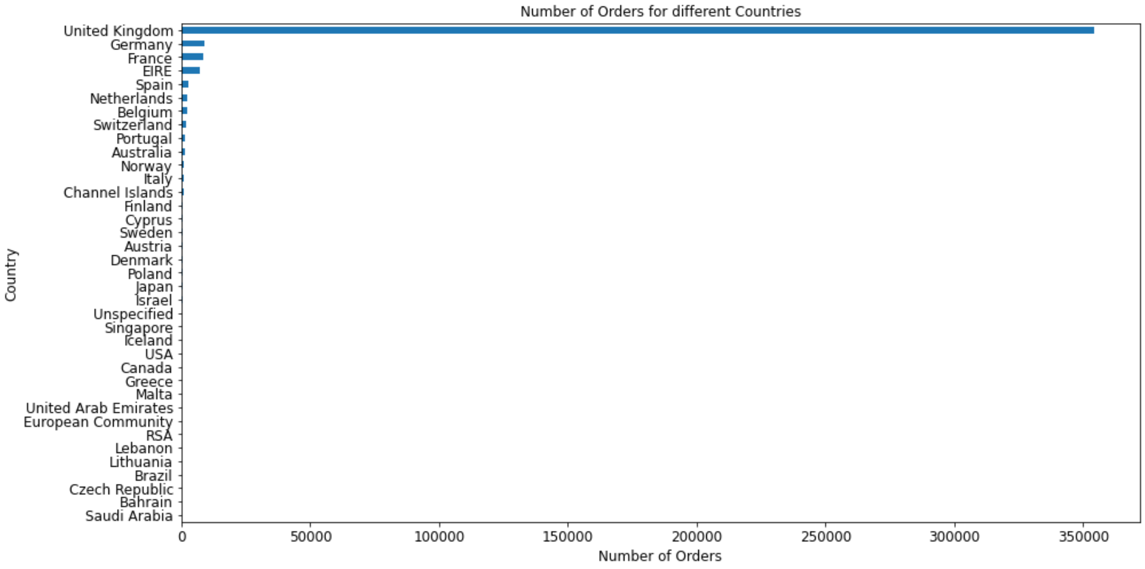
```
ax = df_free.year_month.value_counts().sort_index().plot(kind = 'bar',fig
ax.set_xlabel('Month',fontsize=15)
ax.set_ylabel('Frequency',fontsize=15)
ax.set_title('Frequency for different Months (Dec 2010 - Dec 2011)',fonts

m = ('Dec_10','Jan_11','Feb_11','Mar_11','Apr_11','May_11','July_11','Aug

ax.set_xticklabels(m, rotation='horizontal', fontsize=13)
plt.show()
```



How many orders for each country?

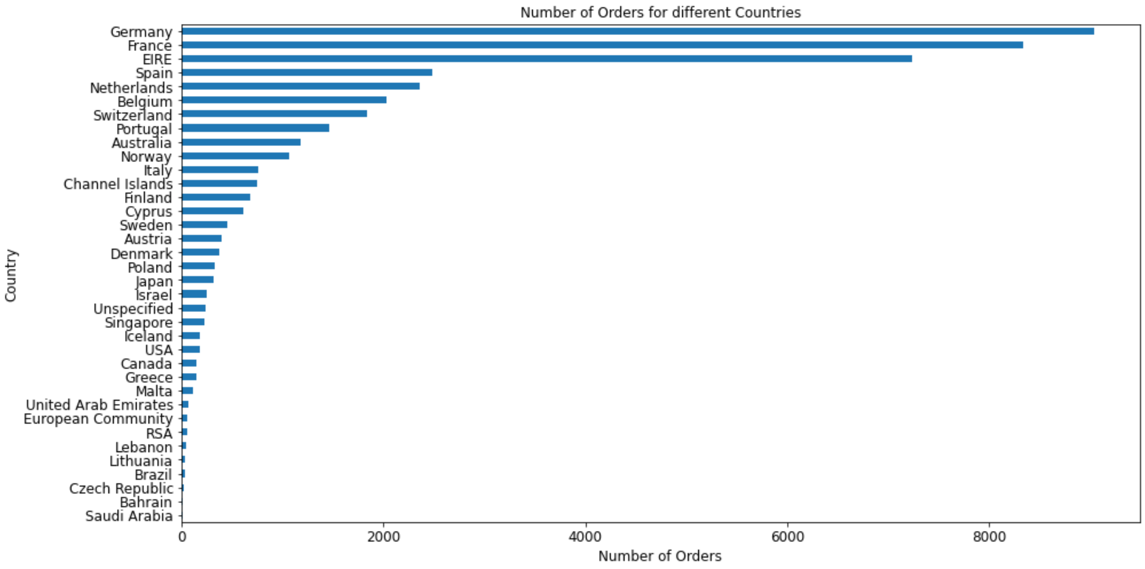
In [130…

```
group_country_orders = df_new.groupby('country')['invoice_num'].count().s
# del group_country_orders['United Kingdom']

# plot number of unique customers in each country (with UK)
plt.subplots(figsize=(15,8))
group_country_orders.plot(kind = 'barh', fontsize=12, color=color[0])
plt.xlabel('Number of Orders', fontsize=12)
plt.ylabel('Country', fontsize=12)
plt.title('Number of Orders for different Countries', fontsize=12)
plt.show()
```



In [131…

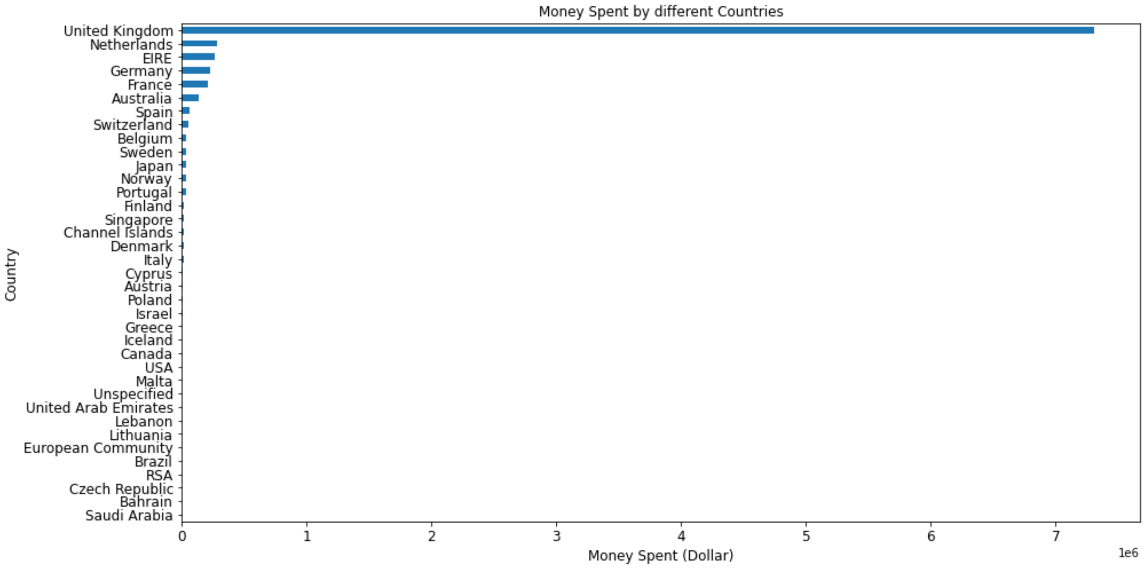
```
group_country_orders = df_new.groupby('country')['invoice_num'].count().s
del group_country_orders['United Kingdom']

# plot number of unique customers in each country (with UK)
plt.subplots(figsize=(15,8))
group_country_orders.plot(kind = 'barh', fontsize=12, color=color[0])
plt.xlabel('Number of Orders', fontsize=12)
plt.ylabel('Country', fontsize=12)
plt.title('Number of Orders for different Countries', fontsize=12)
plt.show()
```



How much money spent by each country?

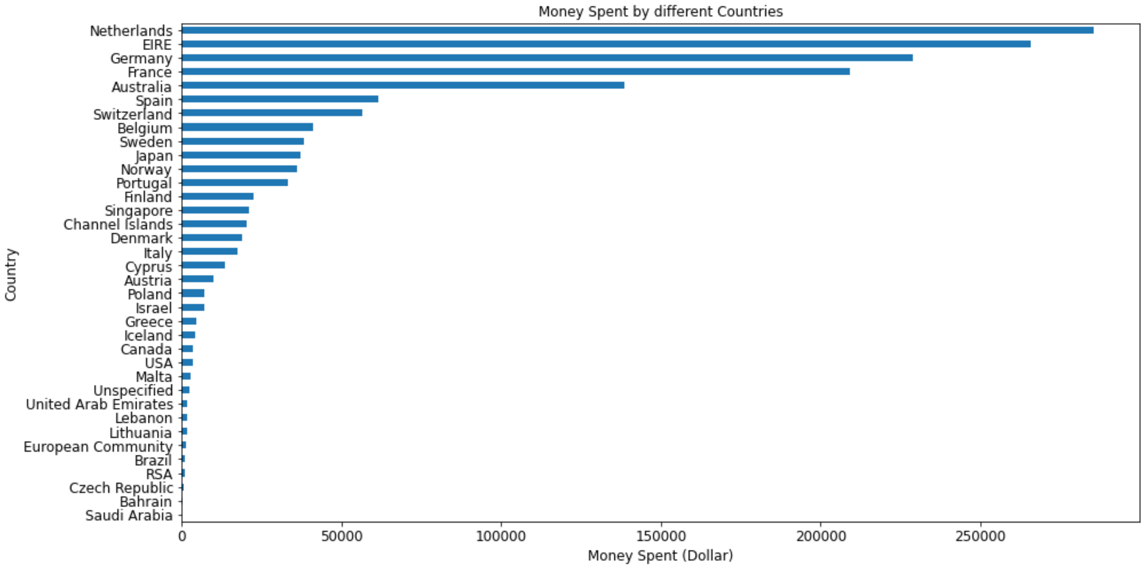
In [132…

```
group_country_amount_spent = df_new.groupby('country')['amount_spent'].su
# del group_country_orders['United Kingdom']

# plot total money spent by each country (with UK)
plt.subplots(figsize=(15,8))
group_country_amount_spent.plot(kind = 'barh', fontsize=12, color=color[0
plt.xlabel('Money Spent (Dollar)', fontsize=12)
plt.ylabel('Country', fontsize=12)
plt.title('Money Spent by different Countries', fontsize=12)
plt.show()
```



In [133…

```
group_country_amount_spent = df_new.groupby('country')['amount_spent'].su
del group_country_amount_spent['United Kingdom']

# plot total money spent by each country (without UK)
plt.subplots(figsize=(15,8))
group_country_amount_spent.plot(kind = 'barh', fontsize=12, color=color[0
plt.xlabel('Money Spent (Dollar)', fontsize=12)
plt.ylabel('Country', fontsize=12)
plt.title('Money Spent by different Countries', fontsize=12)
plt.show()
```



This is called Data Analysis :)

```
In [ ]:
```