Intro to Pandas and Simple Charting

February 2, 2018

1 Exploratort Data Analysis Using Pandas

1.0.1 Importing Necessary Libraries

```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt

In [2]: # The following line of code enables Jupyter notebook for
        # IPython to display matplotlib graphs

        %matplotlib inline
```

1.0.2 Reading the data from CSV file

```
In [3]: # read the data

        sales = pd.read_csv("sales_data.csv", parse_dates = ['date'])
        sales.head()
```

Out[3]:

	Unnamed: 0	account.number	name	sku	category	quantity	unit.price	ext.price	date
0	1	296809	Carroll PLC	QN-82852	Belt	13	44.48	578.24	2014-09-27 07:13:03
1	2	98022	Heidenreich-Bosco	MJ-21460	Shoes	19	53.62	1018.78	2014-07-29 02:10:44
2	3	563905	Kerluke, Reilly and Bechtelar	AS-93055	Shirt	12	24.16	289.92	2014-03-01 10:51:24
3	4	93356	Waters-Walker	AS-93055	Shirt	5	82.68	413.40	2013-11-17 20:41:11
4	5	659366	Waelchi-Fahey	AS-93055	Shirt	18	99.64	1793.52	2014-01-03 08:14:27

```
In [4]: sales.describe()
```

Out[4]:

	Unnamed: 0	account.number	quantity	unit.price	ext.price
count	1000.000000	1000.000000	1000.000000	1000.000000	1000.00000

```
mean     500.500000   535208.897000     10.328000     56.179630   579.84390
std      288.819436   277589.746014      5.687597     25.331939   435.30381
min        1.000000    93356.000000      1.000000     10.060000    10.38000
25%      250.750000   299771.000000      5.750000     35.995000   232.60500
50%      500.500000   563905.000000     10.000000     56.765000   471.72000
75%      750.250000   750461.000000     15.000000     76.802500   878.13750
max     1000.000000   995267.000000     20.000000     99.970000  1994.80000
```

We can learn that:

- The customers on average purchases 10 items per transaction
- The average cost of the transaction is $579

```
In [5]: sales['unit.price'].describe()
```

```
Out[5]: count    1000.000000
        mean       56.179630
        std        25.331939
        min        10.060000
        25%        35.995000
        50%        56.765000
        75%        76.802500
        max        99.970000
        Name: unit.price, dtype: float64
```

```
In [6]: sales.dtypes
```

```
Out[6]: Unnamed: 0                  int64
        account.number              int64
        name                       object
        sku                        object
        category                   object
        quantity                    int64
        unit.price                float64
        ext.price                 float64
        date                datetime64[ns]
        dtype: object
```

1.0.3 Plotting Some Data

```
In [7]: customers = sales[['name', 'ext.price', 'date']]
```

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

```
Out[8]:                          name  ext.price                date
        0                  Carroll PLC     578.24 2014-09-27 07:13:03
        1            Heidenreich-Bosco    1018.78 2014-07-29 02:10:44
        2  Kerluke, Reilly and Bechtelar     289.92 2014-03-01 10:51:24
        3                Waters-Walker     413.40 2013-11-17 20:41:11
        4                Waelchi-Fahey    1793.52 2014-01-03 08:14:27
```

```
In [9]: customers.shape

Out[9]: (1000, 3)
```

1.0.4 How many transactions each customer had?

```
In [10]: # Let's see how many transactions each customer had..
         # In R we used group_by, and here we can do the same

         # first we do the grouping
         customer_group = customers.groupby('name')

         # find the number of enteries in each group
         customer_group.size()

Out[10]: name
         Berge LLC                       52
         Carroll PLC                     57
         Cole-Eichmann                   51
         Davis, Kshlerin and Reilly      41
         Ernser, Cruickshank and Lind    47
         Gorczany-Hahn                   42
         Hamill-Hackett                  44
         Hegmann and Sons                58
         Heidenreich-Bosco               40
         Huel-Haag                       43
         Kerluke, Reilly and Bechtelar   52
         Kihn, McClure and Denesik       58
         Kilback-Gerlach                 45
         Koelpin PLC                     53
         Kunze Inc                       54
         Kuphal, Zieme and Kub           52
         Senger, Upton and Breitenberg   59
         Volkman, Goyette and Lemke      48
         Waelchi-Fahey                   54
         Waters-Walker                   50
         dtype: int64
```

1.0.5 How much did each customer pay in total? Arrange the dataframe in increasing order.

```
In [11]: sales_total = customer_group.sum(columns = 'ext.price')

In [12]: sales_total.head()

Out[12]:                              ext.price
         name
         Berge LLC                     30064.87
         Carroll PLC                   35934.31
         Cole-Eichmann                 30435.42
```

```
Davis, Kshlerin and Reilly     19054.76
Ernser, Cruickshank and Lind   28089.02
```

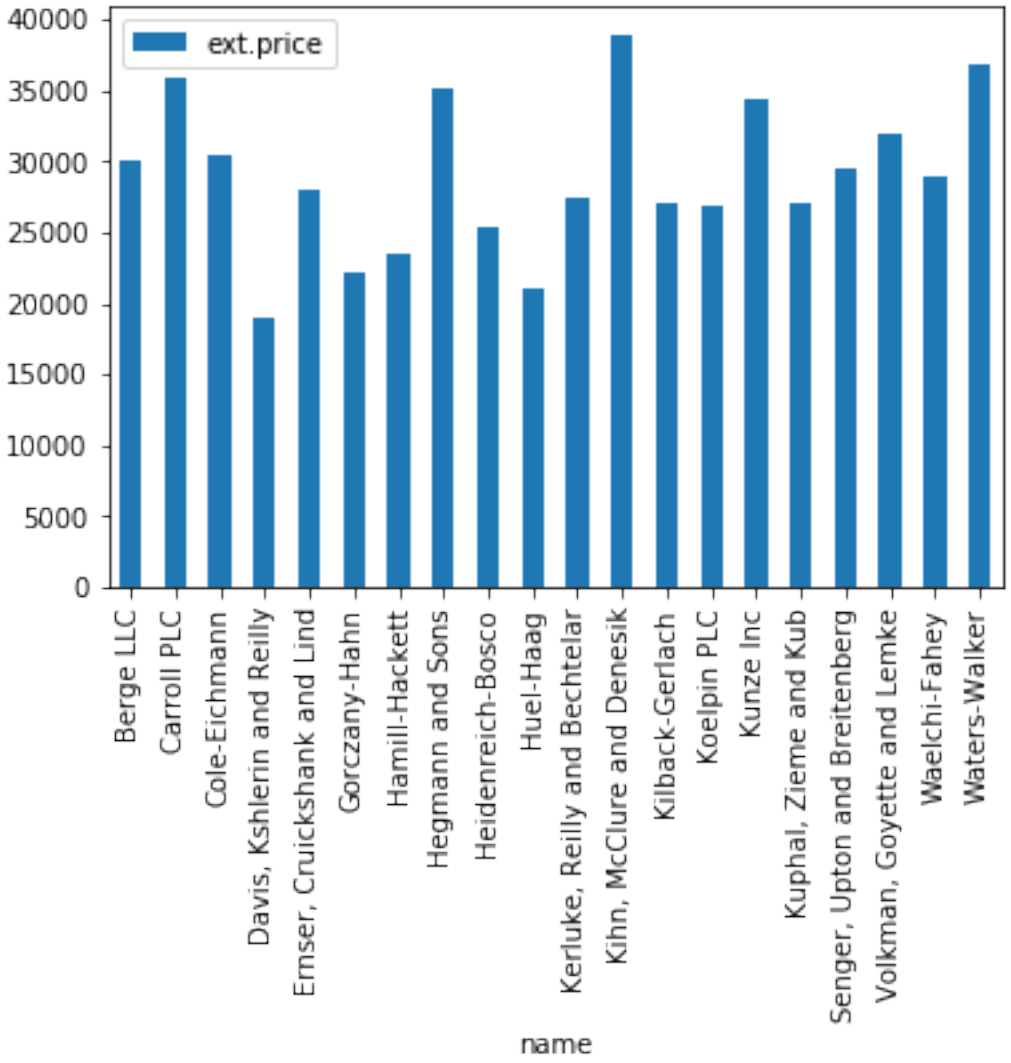
```
In [13]: # arrange
         sales_total.sort_values(by = 'ext.price').head()
```

Out[13]:

name	ext.price
Davis, Kshlerin and Reilly	19054.76
Huel-Haag	21087.88
Gorczany-Hahn	22207.90
Hamill-Hackett	23433.78
Heidenreich-Bosco	25428.29

1.0.6 Create a bar chart to show the distribution of total sales for all customers.

```
In [14]: sales_plot = sales_total.plot(kind = 'bar')
```



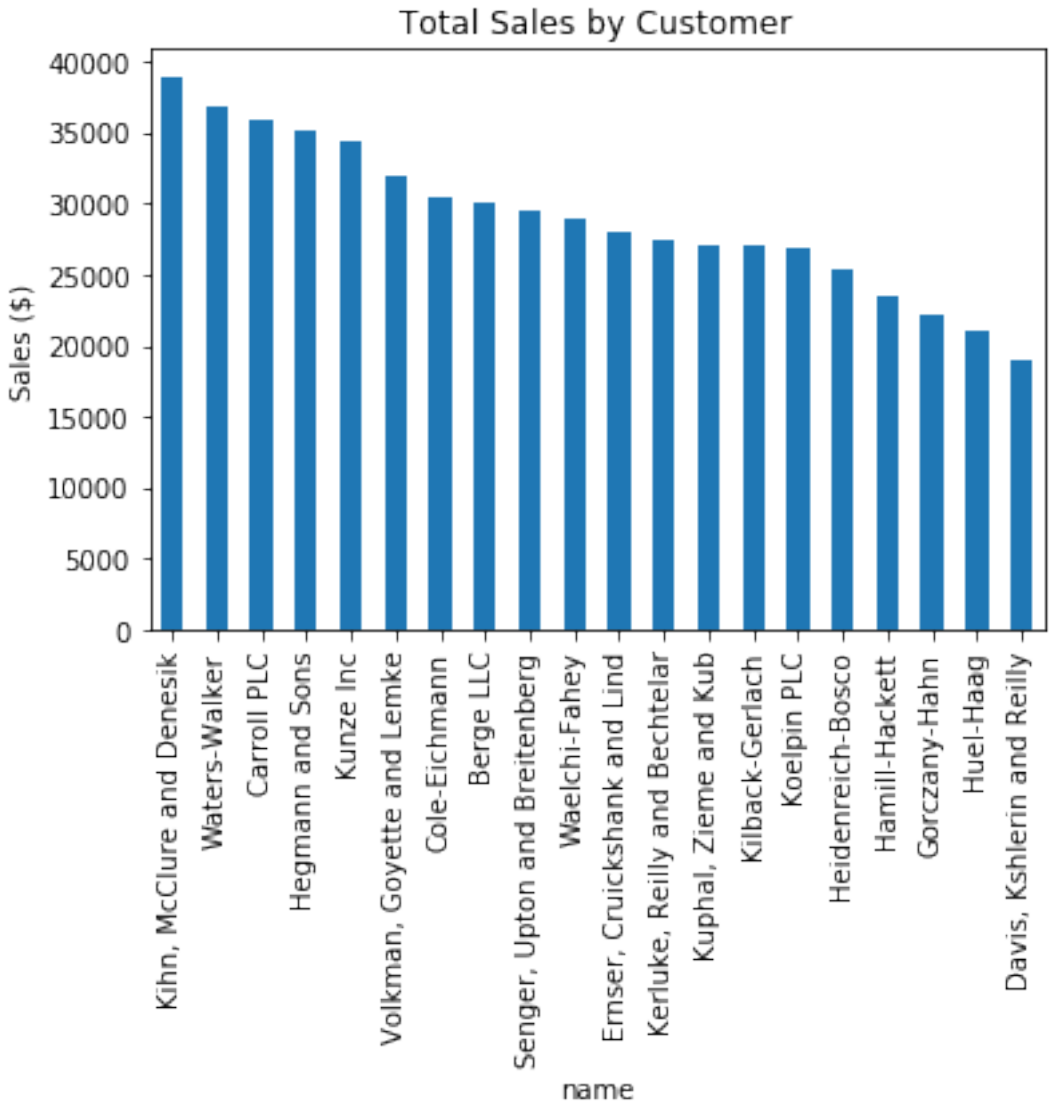
We can improve the above chart:

- sort the data
- remove legend
- add title
- label axis

```
In [15]: sales_plot = sales_total.sort_values(by = 'ext.price', ascending = False).\
         plot(kind='bar',legend=None,title="Total Sales by Customer")

         sales_plot.set_ylabel("Sales ($)")
```

```
Out[15]: Text(0,0.5,'Sales ($)')
```



1.0.7 Sales break by category

In [16]:
```
customers = sales[['name', 'category','ext.price']]
customers.head()
```

Out[16]:

	name	category	ext.price
0	Carroll PLC	Belt	578.24
1	Heidenreich-Bosco	Shoes	1018.78
2	Kerluke, Reilly and Bechtelar	Shirt	289.92
3	Waters-Walker	Shirt	413.40
4	Waelchi-Fahey	Shirt	1793.52

In [17]:
```
category_group = customers.groupby(by = ['name', 'category']).sum(columns = "ext.price
category_group.head()
```

Out[17]:

		ext.price
name	category	
Berge LLC	Belt	6033.53
	Shirt	9670.24
	Shoes	14361.10
Carroll PLC	Belt	9359.26
	Shirt	13717.61

In [18]:
```
# In order to be able to visualize the above data, we need to unstack it
category_group.unstack().head()
```

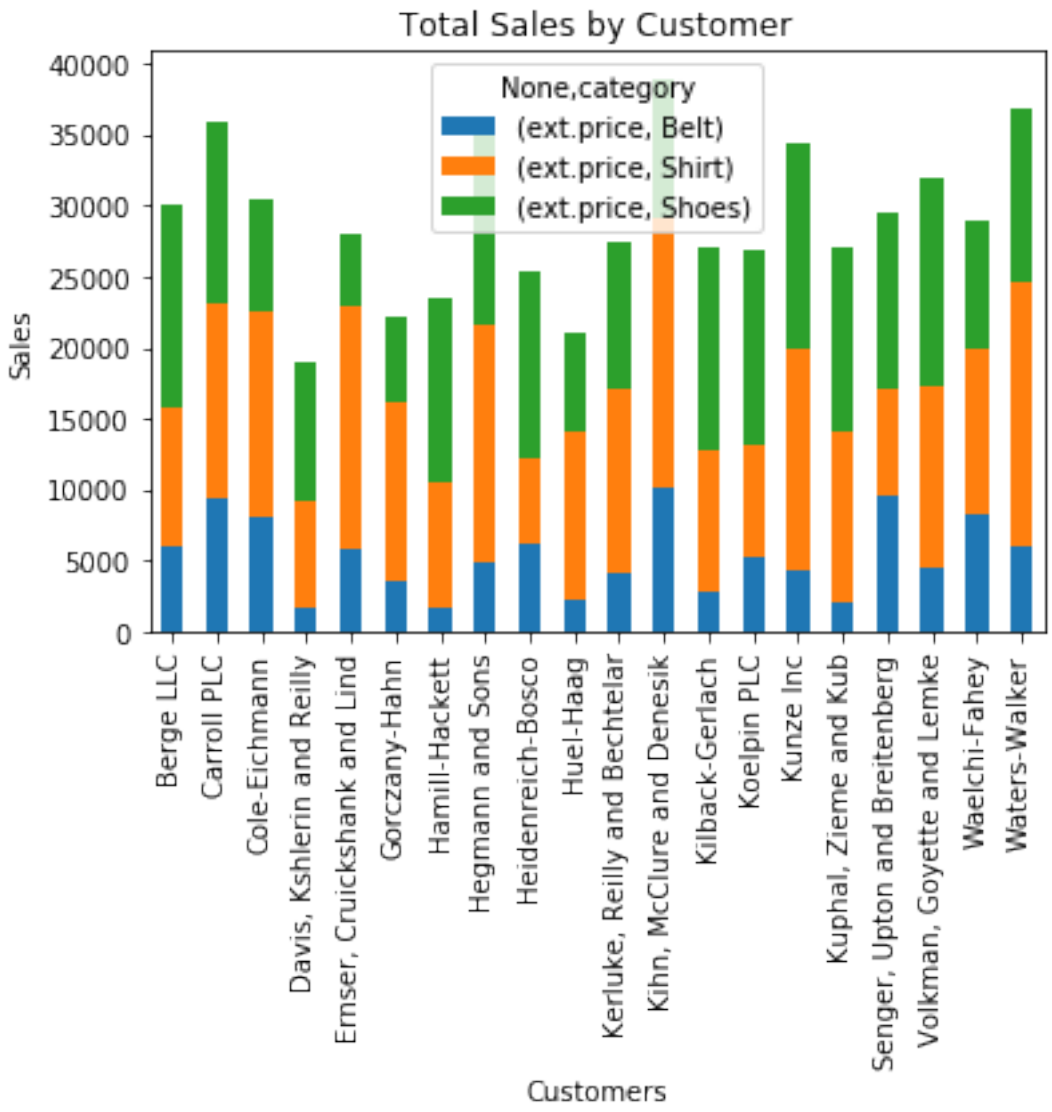
Out[18]:

	ext.price		
category	Belt	Shirt	Shoes
name			
Berge LLC	6033.53	9670.24	14361.10
Carroll PLC	9359.26	13717.61	12857.44
Cole-Eichmann	8112.70	14528.01	7794.71
Davis, Kshlerin and Reilly	1604.13	7533.03	9917.60
Ernser, Cruickshank and Lind	5894.38	16944.19	5250.45

In [19]:
```
sales_plot = category_group.unstack().plot(kind = 'bar', stacked = True, \
                                    title = "Total Sales by Customer")

sales_plot.set_xlabel("Customers")
sales_plot.set_ylabel("Sales")
```

Out[19]:
```
Text(0,0.5,'Sales')
```

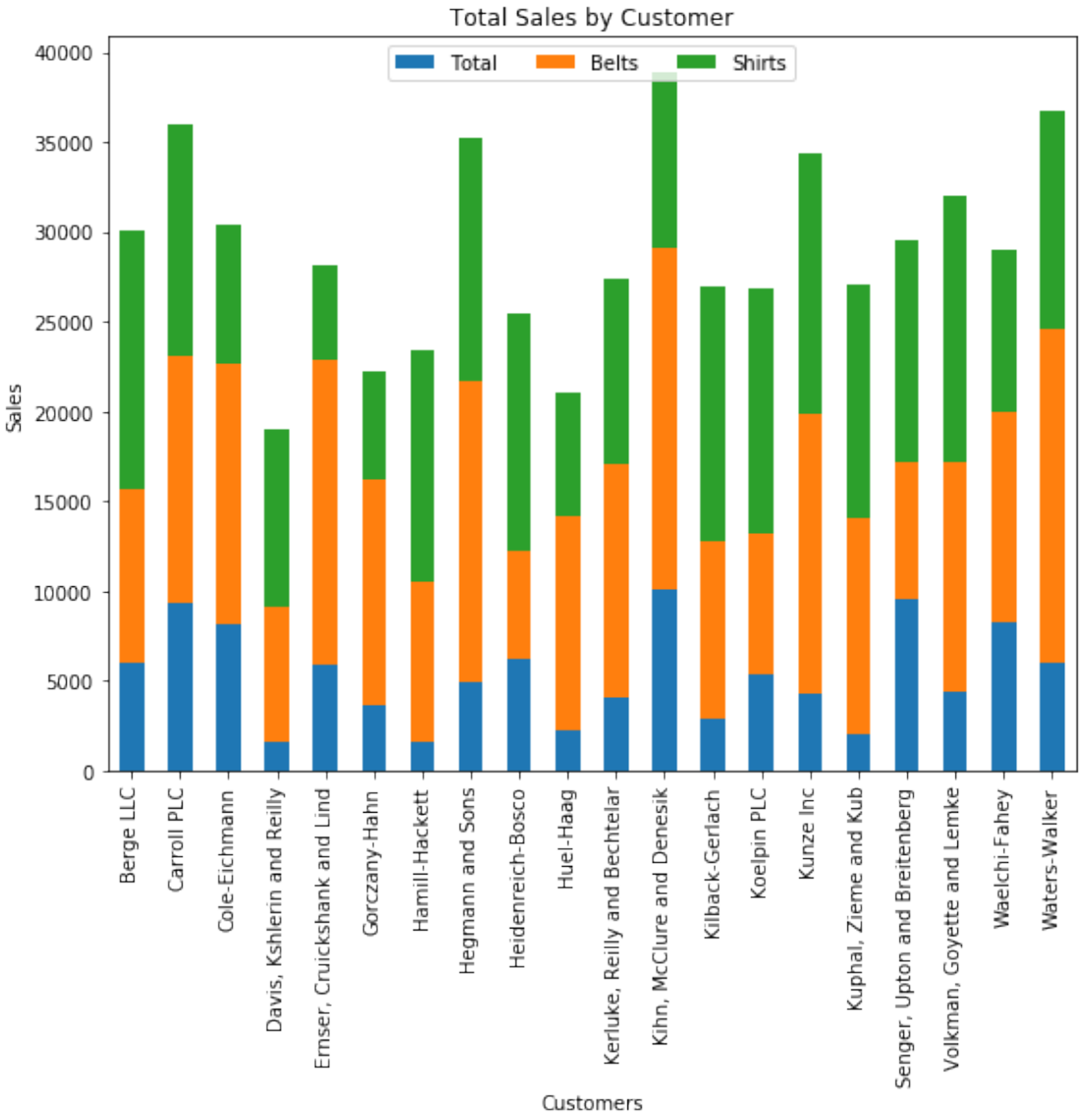



```
In [20]: sales_plot = category_group.unstack().plot(kind = 'bar', stacked = True, \
                                        title = "Total Sales by Customer", figsize=(9, 7))

         sales_plot.set_xlabel("Customers")
         sales_plot.set_ylabel("Sales")

         sales_plot.legend(["Total", "Belts", "Shirts", "Shoes"], loc = 9, ncol = 4)

Out[20]: <matplotlib.legend.Legend at 0x115bfff98>
```



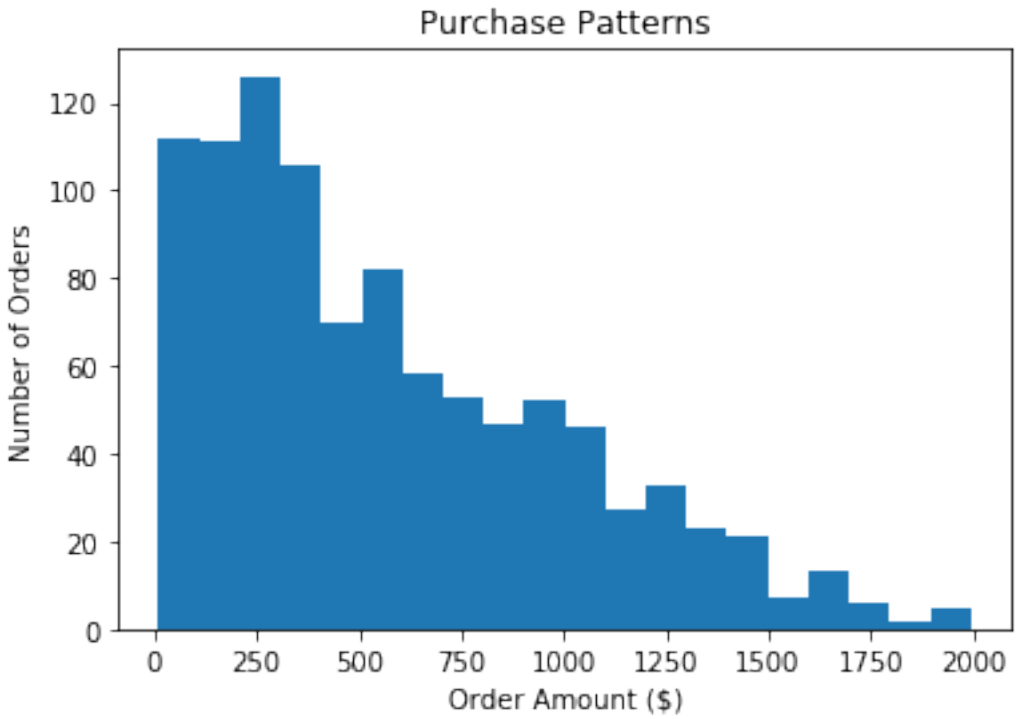
1.0.8 Create a histogram to understand the distribution of purchasing patterns

```
In [21]: purchase_patterns = sales[['ext.price', 'date']]
         purchase_patterns.head()
```

```
Out[21]:    ext.price                 date
         0     578.24 2014-09-27 07:13:03
         1    1018.78 2014-07-29 02:10:44
         2     289.92 2014-03-01 10:51:24
         3     413.40 2013-11-17 20:41:11
         4    1793.52 2014-01-03 08:14:27
```

```
In [22]: purchase_plot = purchase_patterns['ext.price'].plot(kind = "hist", bins = 20)
         purchase_plot.set_title("Purchase Patterns")
         purchase_plot.set_xlabel("Order Amount ($)")
         purchase_plot.set_ylabel("Number of Orders")
```

```
Out[22]: Text(0,0.5,'Number of Orders')
```



1.0.9 Do we have certain months that are busier than others?

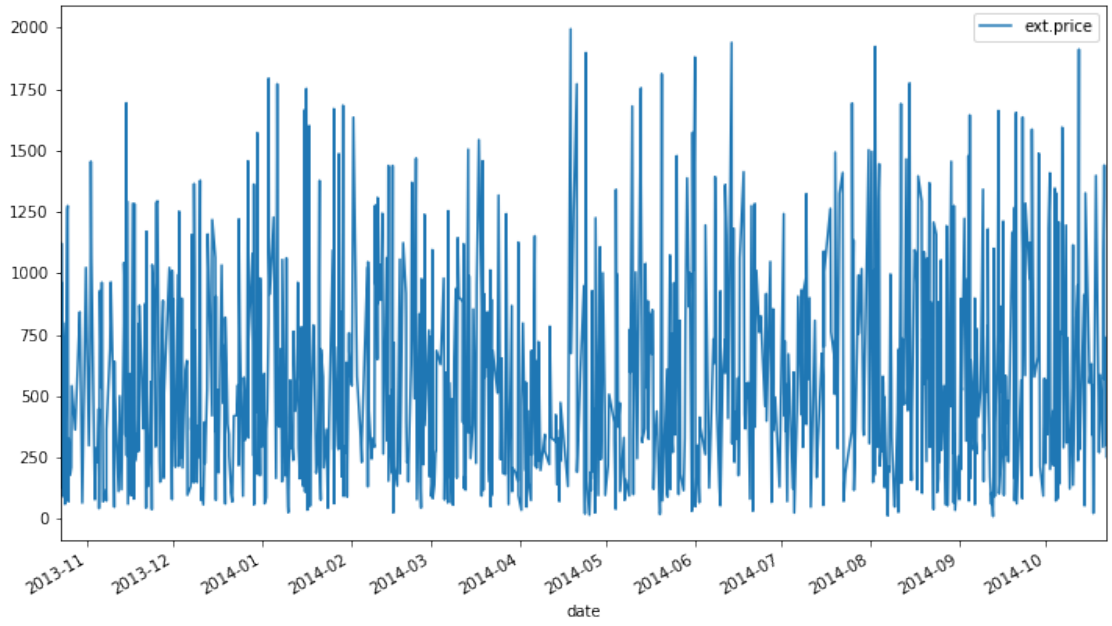
If we want to analyze the data by date, we need to set the date column as the index using `set_index()` command.

```
In [23]: purchase_patterns = purchase_patterns.set_index("date")
         purchase_patterns.head()
```

```
Out[23]:                      ext.price
         date
         2014-09-27 07:13:03     578.24
         2014-07-29 02:10:44    1018.78
         2014-03-01 10:51:24     289.92
         2013-11-17 20:41:11     413.40
         2014-01-03 08:14:27    1793.52
```

```
In [24]: purchase_patterns.plot(figsize=(12, 7))
```

```
Out[24]: <matplotlib.axes._subplots.AxesSubplot at 0x1161489e8>
```



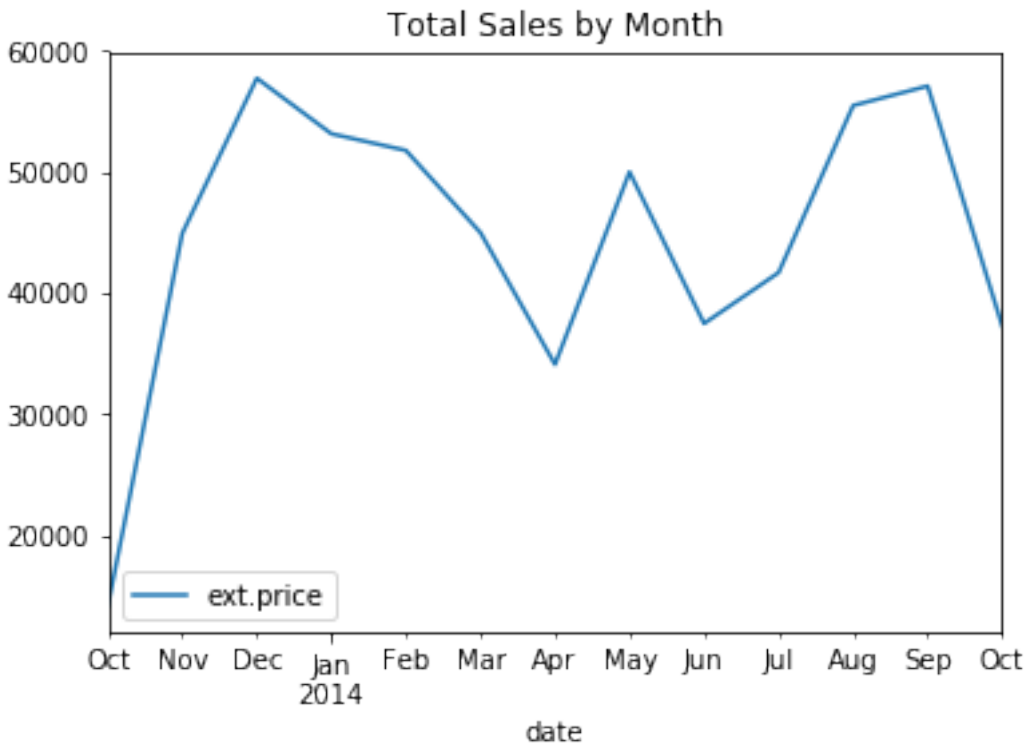
One of the cool things that pandas allows us to do is to "resample" the data. If we want to look at the data by month, we can resample, and sum it all up. In the following code, we will use `M` as the period for resampling which means the data should be resampled on a month boundary.

```
In [25]: monthly_pattern = purchase_patterns.resample("M", how = sum)

/Users/abbasssharif/anaconda3/lib/python3.6/site-packages/ipykernel_launcher.py:1: FutureWarni
the new syntax is .resample(...)..apply(<func>)
  """Entry point for launching an IPython kernel.
```

```
In [26]: monthly_pattern.plot(title = "Total Sales by Month")

Out[26]: <matplotlib.axes._subplots.AxesSubplot at 0x1163f7748>
```


Total Sales by Month
60000
50000
40000
30000
20000
ext.price
Oct
Nov
Dec
Jan
2014
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
date