CONTEXT
The severity and occurrences of the Forest Fires increasing year on year. So, understanding the frequency of the forest fires and finding other patterns using exploratory data analysis can help in taking proactive actions preventing them.

In this section we will look at the Forest Fire Data which has been made available by Brazilian Forest Departments. This dataset is available at the following location: https://dados.gov.br/dataset/sistema-nacional-de-informacoes-florestais-snif/resource/949310f1-05bc-4f56-a63f-aef67aac6164 (https://dados.gov.br/dataset/sistema-nacional-de-informacoes-florestais-snif/resource/949310f1-05bc-4f56-a63f-aef67aac6164)

For this execise the data has been pre-formatted and is available as a csv file in the folder named as **dataset**
Make sure that

- The dataset folder and Python Notebook are at the same level

BRIEF ABOUT DATASET
There are following columns available in the dataset:

- Year - year the observation belong to
- State - state in which the fire has been reported
- Month - month of the year, the fire was reported
- Number of Fires -number of fires reported
- Date Reported - date when the fire was reported

In [1]:
```
## Import pyplot from matplotlib
import matplotlib.pyplot as plt

## Define a Plot Method to be used in the notebook to plot the data
def plot_data(df_fires):
    #Creating a Bar Graph
    #Plot X Values and Y Values
    plt.figure(figsize=(25,15))
    plt.bar(df_fires['Month'], df_fires['Number of Fires'], color = (0.5,0.

    #Add Actual Title and Title for Subheadings
    plt.suptitle('Amazon Forest Fires Over the Months', fontsize=20)
    plt.title('Using Data from Years 1998 - 2017', fontsize=20)
    plt.xlabel('Month', fontsize=20)
    plt.ylabel('Number of Forest Fires', fontsize=20)

#plt.text(x-coordinate, y-coordinate, valueOfText, alignmnet)
#this adds text at the top of each bar indicating its value
    for i, num in enumerate(df_fires['Number of Fires']):
        plt.text(
            i,
            num+2500,
            num,
            ha='center',
            verticalalignment='top',
            fontsize=20)

    plt.setp(plt.gca().get_xticklabels(),
         rotation=45,
         horizontalalignment='right',
         fontsize=20)

    plt.setp(plt.gca().get_yticklabels(), fontsize=20)
```

TO DO - Activity 1 - Import Packages

In the code cell below import the Pandas and NumPy as **pd** and **np** respectively

In [2]:
```
# Solution for Activity 1
import pandas as pd
import numpy as np
```

As a next step we will import the csv data into the Pandas DataFrame.

NOTE: We will cover how to do Date Ingestion into Pandas in our next module, so for this exercise the code has been provided for you in the cell below and you simply need to execute it.

In [3]:
```
#Read Data from the Datasource
data = pd.read_csv('./dataset/module3/brazilianfire.csv')
data['Number of Fires'] = data['Number of Fires'].astype(int)
```

TO DO - Activity 2 - Sample the Data in the Pandas

DataFrame

In [4]:
```
# Solution for Activity 2
#Sampling data in the dataframe, we will look at top 10 rows
data.head(10)
```

Out[4]:

	Year	State	Month	Number of Fires	Date Reported
0	1998	Acre	January	0	1/01/1998
1	1999	Acre	January	0	1/01/1999
2	2000	Acre	January	0	1/01/2000
3	2001	Acre	January	0	1/01/2001
4	2002	Acre	January	0	1/01/2002
5	2003	Acre	January	10	1/01/2003
6	2004	Acre	January	0	1/01/2004
7	2005	Acre	January	12	1/01/2005
8	2006	Acre	January	4	1/01/2006
9	2007	Acre	January	0	1/01/2007

TO DO - Activity 3:

Find how many rows and columns are there in the dataframe. There are multiple ways this information can be extracted. For e.g. you can use the shape attribute of the dataframe.

In [5]:
```
##Solution to Activity 3
## What is the shape of the data i.e. how many rows and how many columns ex
data.shape
```

Out[5]:
```
(6454, 5)
```

So how many rows and columns the dataframe have?

Number of Rows = 6454
Number of Columns = 5

TO DO - Activity 4:

Provide the summary statistics for the whole data set i.e. for every columns of the DataFrame. For this you can use the Data Frame method **.describe()**

- Note though by default summary statistics are only provided for the numeric columns.
- You may have to add **include='all'** parameter to the method to include statistics for non numeric columns

In [6]:
```
## Solution for Activity 4
#Provide the Summary Statistics for the Data
data.describe()
```

Out[6]:

	Year	Number of Fires
count	6454.000000	6454.000000
mean	2007.461729	108.235358
std	5.746654	190.843947
min	1998.000000	0.000000
25%	2002.000000	3.000000
50%	2007.000000	24.000000
75%	2012.000000	113.000000
max	2017.000000	998.000000

As we can see only the numeric columns are included by default in the summary statistics. So we will pass the parameter include='all' to the method.

In [7]:
```
data.describe(include='all')
```

Out[7]:

	Year	State	Month	Number of Fires	Date Reported
count	6454.000000	6454	6454	6454.000000	6454
unique	NaN	27	12	NaN	20
top	NaN	Alagoas	January	NaN	1/01/2001
freq	NaN	240	541	NaN	324
mean	2007.461729	NaN	NaN	108.235358	NaN
std	5.746654	NaN	NaN	190.843947	NaN
min	1998.000000	NaN	NaN	0.000000	NaN
25%	2002.000000	NaN	NaN	3.000000	NaN
50%	2007.000000	NaN	NaN	24.000000	NaN
75%	2012.000000	NaN	NaN	113.000000	NaN
max	2017.000000	NaN	NaN	998.000000	NaN

As you can see for the non-numeric columns i.e. State, Month and Date Reported only following measurements have been calculated:

- Count or Total Number of Records
- Total Number of Unique Entries.
- Quantitative Statistics for these columns have null values- NaN

In [8]:
```
##Check for any missing values
data.isna().sum()
```

Out[8]:
```
Year              0
State             0
Month             0
Number of Fires    0
Date Reported      0
dtype: int64
```

Data Aggregation and Data Groupings

In this segement we will perform some data aggregation activities.
NOTE: We will cover the Data Wrangling activities using Pandas and NumPy in detail in the subsequent module. So in this module code snippet has been provided for you. You simply need to execute the code cell

In this section we will now calculate the total number of fires on a month on month basis for the entire period.

In [9]:
```
#Grouping the Data on Months Column, and performing the summation on number
ffire_per_month = data.groupby('Month')['Number of Fires'].sum()
print(ffire_per_month)
```

```
Month
April        28188
August       87970
December     57513
February     30848
January      47746
July         92302
June         56003
March        30717
May          34729
November     85471
October      88600
September    58464
Name: Number of Fires, dtype: int32
```

As you can see the data is not arranged in the order of months, by default the Months has been considered as the row index and lexicographically arranged.

To rearrange this data we will have perform the reindexing operation on the Pandas Series.

TO DO - Activity 5

Rearrange the data in the Pandas Series **ffire_per_month**, so that data arranged in the actual order of months i.e. January -> Feb -> March and so on and so forth.

1. Create the order list of months
2. Using reindex method reindex the Series, remember to pass the order list of months as the parameter to the method
3. Store the rearranged the data into the variable **ffire_pm_rearranged**

Hint: Remember in case of Pandas Series we can explicitly pass the order list of index to the reindex method and the data will be arranged accordingly.

In [10]:
```
## Solution for Activity 5
months_unique= list(data.Month.unique())
months_unique
```

Out[10]:
```
['January',
 'February',
 'March',
 'April',
 'May',
 'June',
 'July',
 'August',
 'September',
 'October',
 'November',
 'December']
```

In [11]:
```
ffire_pm_rearranged = ffire_per_month.reindex(months_unique, axis=0)
ffire_pm_rearranged
```

Out[11]:
```
Month
January      47746
February     30848
March        30717
April        28188
May          34729
June         56003
July         92302
August       87970
September    58464
October      88600
November     85471
December     57513
Name: Number of Fires, dtype: int32
```

We will now convert the Pandas Series into DataFrame with two columns Months and Number of Fires, and with defaul index for row labels. Once data has been converted into Pandas DataFrame we will plot the data using the pre-defined method available to you.

Below code converts the Pandas Series into a DataFrame and reindex the row labels

In [12]:
```
df_ffire_pm = ffire_pm_rearranged.to_frame()
df_ffire_pm.reset_index(level=0, inplace=True)
df_ffire_pm
```

Out[12]:

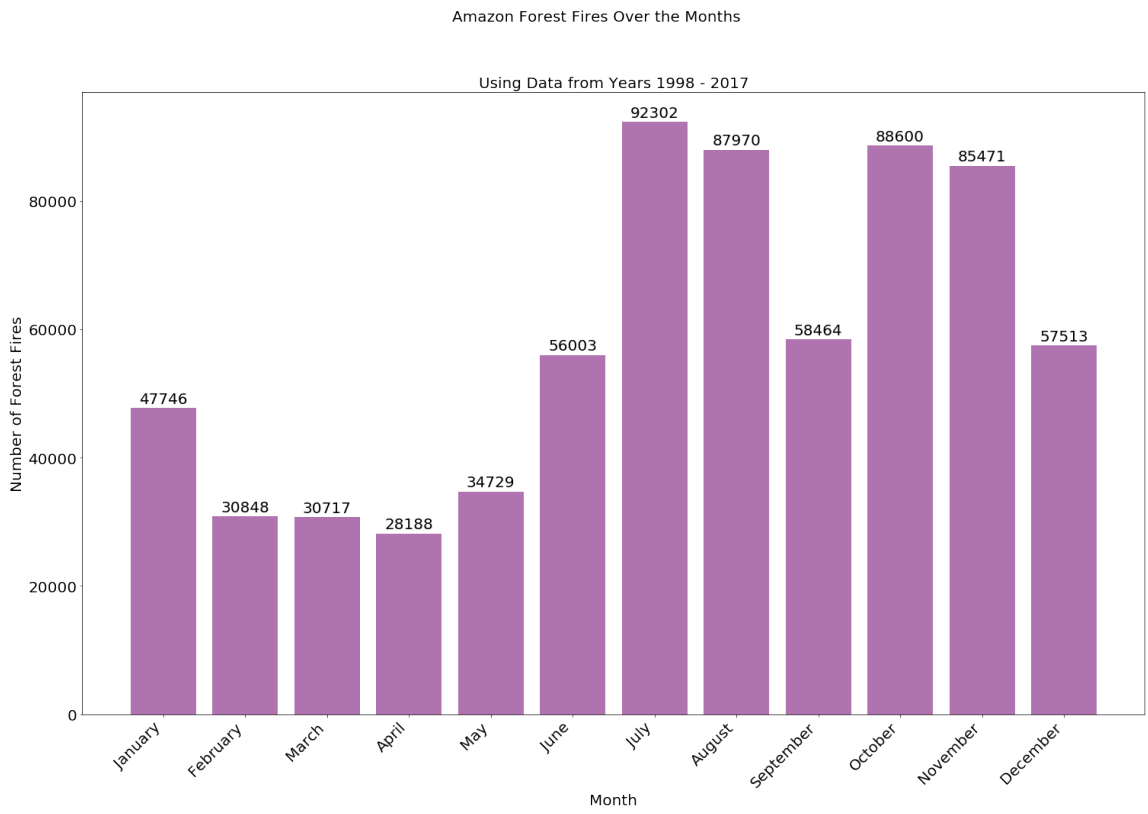
	Month	Number of Fires
0	January	47746
1	February	30848
2	March	30717
3	April	28188
4	May	34729
5	June	56003
6	July	92302
7	August	87970
8	September	58464
9	October	88600
10	November	85471
11	December	57513

TO DO Activity 6 - Call the Plot Function and Pass the DataFrame as Parameter

There is a function that has been defined initially in this notebook. You will now call that function and pass the dataframe **df_ffire_pm** which you have created in the previous steps.

1. Call function **plot_data()** and pass the DataFrame **df_ffire_pm** as the parameter of this function

In [13]:
```
## Solution for Activity 6
plot_data(df_ffire_pm)
```



As we can see most number of fires have occured in the month of July, August, October and November.

NOTE: This exercise has covered some very basic data exploration activities on the dataset. There are lot more analysis that can be performed on this data set

In our upcoming modules we will go into the details of Data Ingestion, Data Wrangling and Exploratory Data Analysis activities using python