MODULE: DATA ANALYTICS

ASSIGNMENT 2

TOPIC: DATA EXPLORATION and Visualization

For the given *Earthquake* Dataset

1. Clean and perform steps of Wrangling.

```
import pandas as pd


df = pd.read_csv('/content/earthquake.csv')
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 23412 entries, 0 to 23411
Data columns (total 21 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   Date                        23412 non-null  object 
 1   Time                        23412 non-null  object 
 2   Latitude                    23412 non-null  float64
 3   Longitude                   23412 non-null  float64
 4   Type                        23412 non-null  object 
 5   Depth                       23412 non-null  float64
 6   Depth Error                 4461 non-null   float64
 7   Depth Seismic Stations      7097 non-null   float64
 8   Magnitude                   23412 non-null  float64
 9   Magnitude Type              23409 non-null  object 
 10  Magnitude Error             327 non-null    float64
 11  Magnitude Seismic Stations  2564 non-null   float64
 12  Azimuthal Gap               7299 non-null   float64
 13  Horizontal Distance         1604 non-null   float64
```

```
 14  Horizontal Error           1156 non-null   float64
 15  Root Mean Square           17352 non-null  float64
 16  ID                         23412 non-null  object
 17  Source                     23412 non-null  object
 18  Location Source            23412 non-null  object
 19  Magnitude Source           23412 non-null  object
 20  Status                     23412 non-null  object
dtypes: float64(12), object(9)
memory usage: 3.8+ MB
```

Since in Columns : Depth Error, Depth Seismic Stations, Magnitude Error, Magnitude Seismic Stations, Azimuthal Gap, Horizontal Distance, and Horizontal Error has mostly the null values. Dropping these columns from dataframe is sensible thing to do.

```
df1 = df.drop(columns=['Depth Error', 'Depth Seismic Stations', 'Magnitude Error', 'Magnitude Seismic Stations', 'Azimuthal Gap', 'Ho
df1.head(2)
```

	Date	Time	Latitude	Longitude	Type	Depth	Magnitude	Magnitude Type	Root Mean Square
0	02/01/1965	13:44:18	19.246	145.616	Earthquake	131.6	6.0	MW	NaN
1	04/01/1965	11:29:49	1.863	127.352	Earthquake	80.0	5.8	MW	NaN

```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 23412 entries, 0 to 23411
Data columns (total 14 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   Date              23412 non-null  object
 1   Time              23412 non-null  object
 2   Latitude          23412 non-null  float64
```

```
 3   Longitude         23412 non-null  float64
 4   Type              23412 non-null  object
 5   Depth             23412 non-null  float64
 6   Magnitude         23412 non-null  float64
 7   Magnitude Type    23409 non-null  object
 8   Root Mean Square  17352 non-null  float64
 9   ID                23412 non-null  object
 10  Source            23412 non-null  object
 11  Location Source   23412 non-null  object
 12  Magnitude Source  23412 non-null  object
 13  Status            23412 non-null  object
dtypes: float64(5), object(9)
memory usage: 2.5+ MB
```

For columns Magnitude Type, and Root Mean Square has some null values.

Imputation: 'Magnitude Type' has object as dtype so frequent value is better method for imputing for null values. OTOH RMS is continuous and dtype float using mean is better method.

```
df1[df1['Magnitude Type'].isnull()]
```

	Date	Time	Latitude	Longitude	Type	Depth	Magnitude	Magnitude Type	Roo Mea Squa
6703	08/24/1983	13:36:00	40.3732	-124.9227	Earthquake	11.93	5.70	NaN	Na
7294	11/23/1984	18:08:00	37.4600	-118.5900	Earthquake	9.00	5.82	NaN	Na
7919	03/31/1986	11:55:00	37.4788	-121.6858	Earthquake	9.17	5.60	NaN	Na

```
freqMT = df1['Magnitude Type'].value_counts().idxmax()
freqMT
```

```
'MW'
```

```
avgrms = df1['Root Mean Square'].sum()/ df1['Root Mean Square'].notnull().sum()
avgrms
```

```
1.022783990318119
```

```
import numpy as np
df1['Magnitude Type'].replace(np.nan, freqMT, inplace=True)
df1['Root Mean Square'].replace(np.nan, avgrms, inplace=True)
df1.head(10)
```

	Date	Time	Latitude	Longitude	Type	Depth	Magnitude	Magnitude Type	Root Mean Square
0	02/01/1965	13:44:18	19.246	145.616	Earthquake	131.6	6.0	MW	1.022784
1	04/01/1965	11:29:49	1.863	127.352	Earthquake	80.0	5.8	MW	1.022784
2	05/01/1965	18:05:58	-20.579	-173.972	Earthquake	20.0	6.2	MW	1.022784
3	08/01/1965	18:49:43	-59.076	-23.557	Earthquake	15.0	5.8	MW	1.022784
4	09/01/1965	13:32:50	11.938	126.427	Earthquake	15.0	5.8	MW	1.022784
5	10/01/1965	13:36:32	-13.405	166.629	Earthquake	35.0	6.7	MW	1.022784
6	12/01/1965	13:32:25	27.357	87.867	Earthquake	20.0	5.9	MW	1.022784
7	01/15/1965	23:17:42	-13.309	166.212	Earthquake	35.0	6.0	MW	1.022784
8	01/16/1965	11:32:37	-56.452	-27.043	Earthquake	95.0	6.0	MW	1.022784
9	01/17/1965	10:43:17	-24.563	178.487	Earthquake	565.0	5.8	MW	1.022784

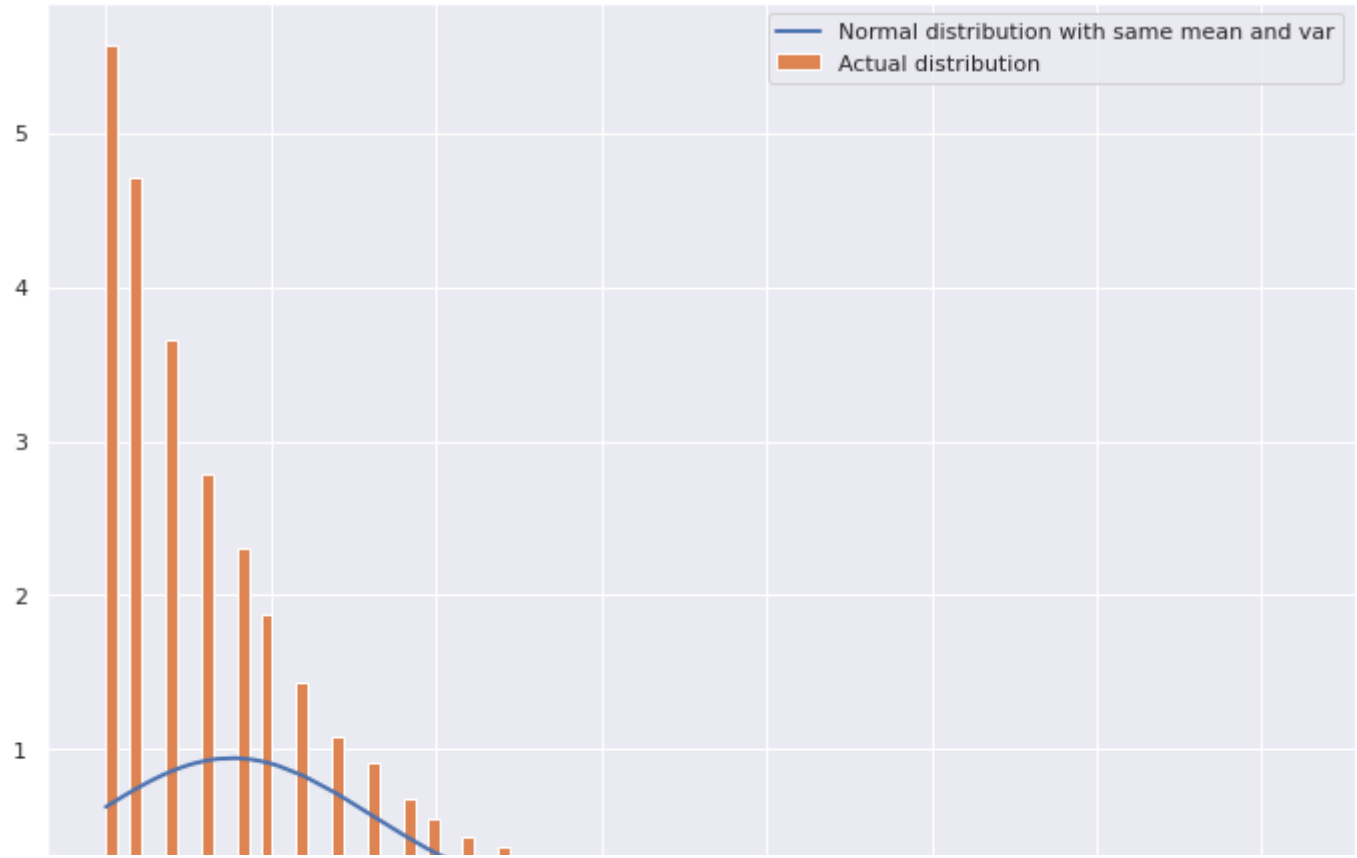
```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 23412 entries, 0 to 23411
Data columns (total 14 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   Date              23412 non-null  object 
 1   Time              23412 non-null  object 
 2   Latitude          23412 non-null  float64
 3   Longitude         23412 non-null  float64
 4   Type              23412 non-null  object 
 5   Depth             23412 non-null  float64
 6   Magnitude         23412 non-null  float64
 7   Magnitude Type    23412 non-null  object 
 8   Root Mean Square  23412 non-null  float64
 9   ID                23412 non-null  object 
 10  Source            23412 non-null  object 
 11  Location Source   23412 non-null  object 
 12  Magnitude Source  23412 non-null  object 
 13  Status            23412 non-null  object 
dtypes: float64(5), object(9)
memory usage: 2.5+ MB
```

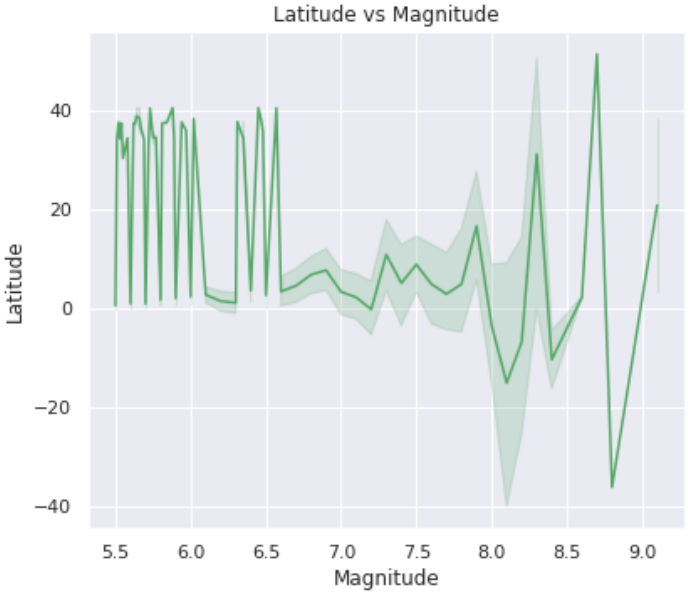
2. Depict the shape w.r.t skewness in magnitude and visualize its correlation with various attributes of data.

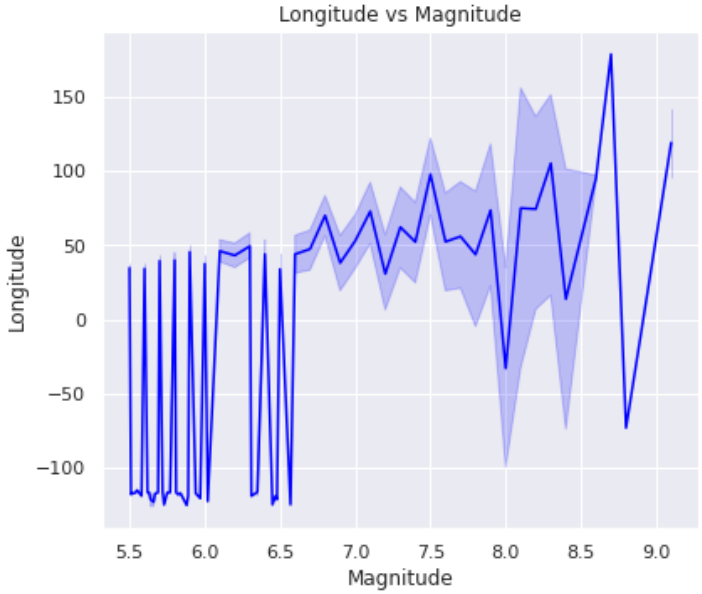
```
import matplotlib.pyplot as plt
import scipy.stats as stats


#convert pandas DataFrame object to numpy array and sort
h = np.asarray(df1['Magnitude'])
```

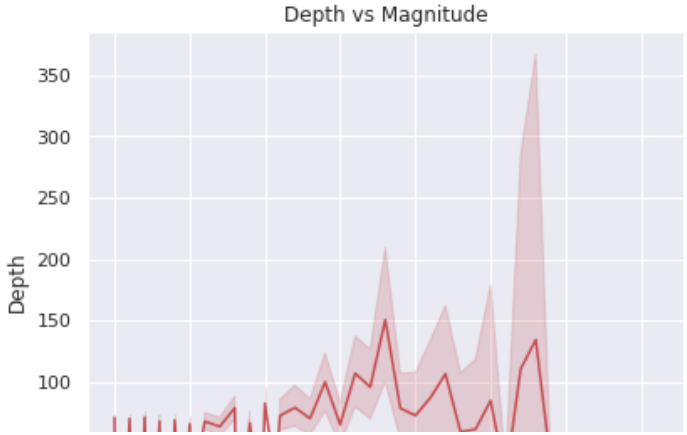
```
h = sorted(h)

#use the scipy stats module to fit a normal distirbution with same mean and standard deviation
fit = stats.norm.pdf(h, np.mean(h), np.std(h))

#plot both series on the histogram
plt.plot(h,fit,'-',linewidth = 2,label="Normal distribution with same mean and var")
plt.hist(h,density=True,bins = 100,label="Actual distribution")
plt.legend()
plt.show()
```

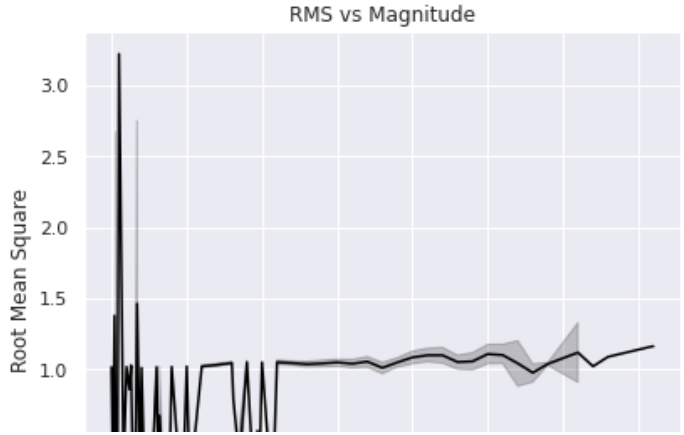


```
import seaborn as sns



cpl = ['Latitude','Longitude','Depth','Magnitude','Root Mean Square']

fig = plt.figure(figsize=(14,12))

# #  subplot #1
plt.subplot(221)
plt.title('Latitude vs Magnitude')
sns.lineplot(data = df1,y='Latitude',x='Magnitude',color='g')

#  subplot #2
plt.subplot(2,2,2)
plt.title('Longitude vs Magnitude')
sns.lineplot(data = df1,y='Longitude',x='Magnitude',color='blue')

#  subplot #3
plt.subplot(223)
plt.title('Depth vs Magnitude')
sns.lineplot(data = df1, y=df1['Depth'],x=df1['Magnitude'],color='r')

#  subplot #4
plt.subplot(2,2,4)
plt.title('RMS vs Magnitude')
sns.lineplot(data = df1, y=df1['Root Mean Square'],x=df1['Magnitude'],color='black')


plt.show()
```


Latitude vs Magnitude
Latitude
Magnitude
40
20
0
−20
−40
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0


Longitude vs Magnitude
Longitude
Magnitude
150
100
50
0
−50
−100
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0

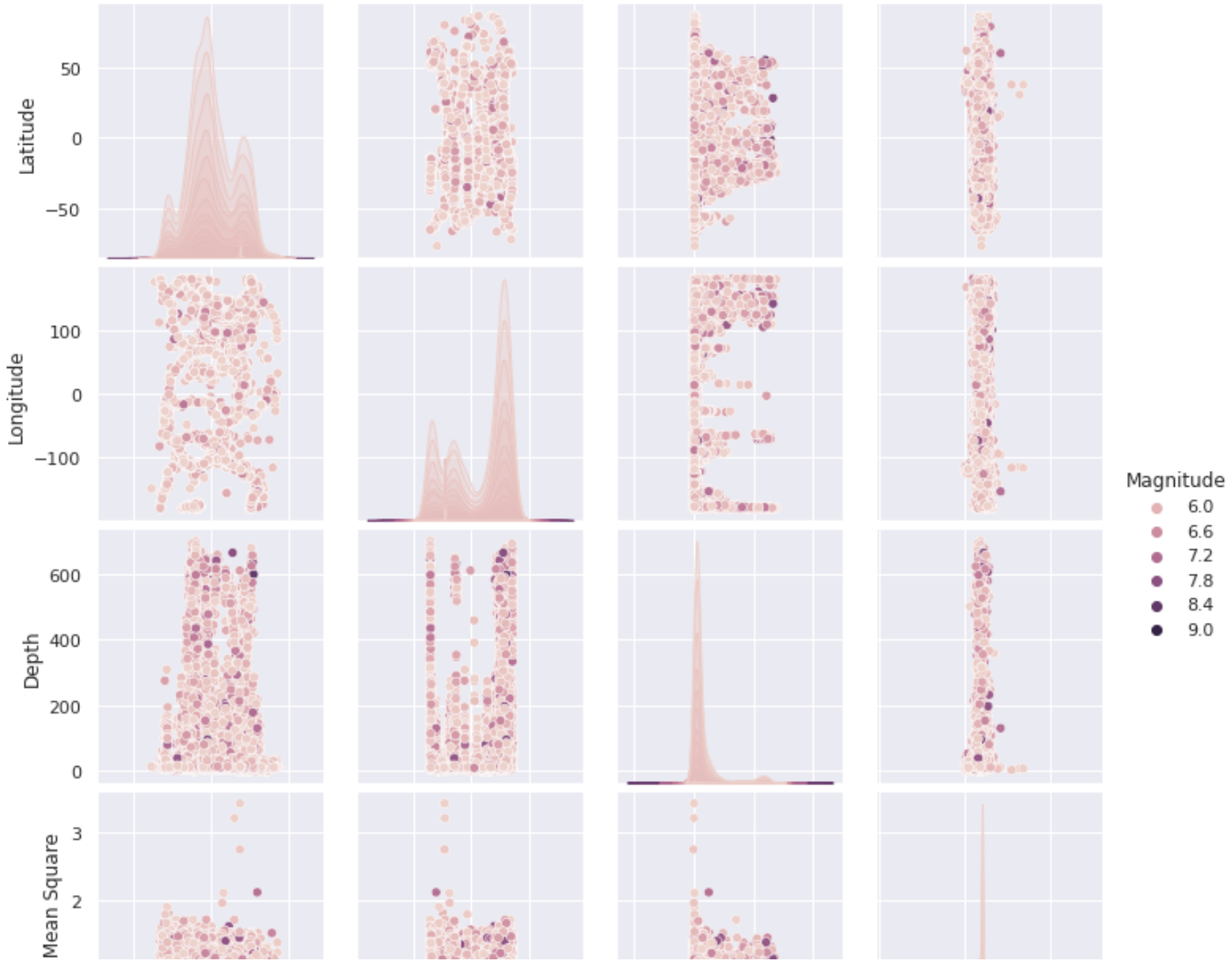

Depth vs Magnitude
Depth
350
300
250
200
150
100


RMS vs Magnitude
Root Mean Square
3.0
2.5
2.0
1.5
1.0

3. Explore the correlation statistics.

```
sns.pairplot(df1, hue='Magnitude')
```

```
<seaborn.axisgrid.PairGrid at 0x7f7087502590>
```



4. At which point of hour the most of the earthquakes and visualize the same using line plot w.r.t hour attribute.

```
df1 = df1.drop(df.index[df['Time'] == '1975-02-23T02:58:41.000Z'])
df1 = df1.drop(df.index[df['Time'] == '1985-04-28T02:53:41.530Z'])
df1 = df1.drop(df.index[df['Time'] == '2011-03-13T02:23:34.520Z'])
df1['Time']=(pd.to_datetime(df1['Time'].str.strip(), format='%H:%M:%S'))
df1['Hour']= df1['Time'].dt.hour


hour_counts = df1.groupby('Hour').apply(lambda x: x['Hour'].values)
hour_counts = pd.DataFrame(hour_counts)


df1.groupby('Hour').size()
```

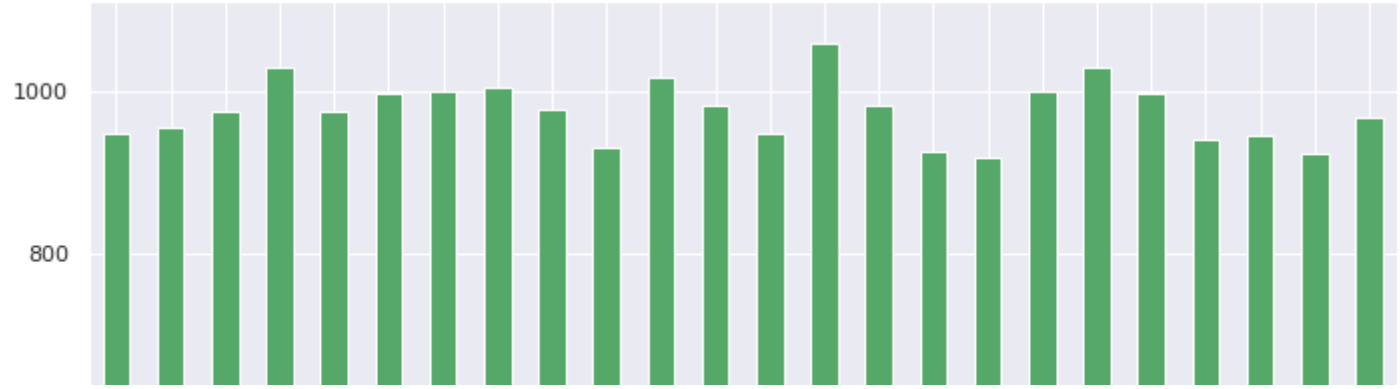
```
Hour
0      948
1      954
2      974
3     1029
4      975
5      996
6      998
7     1005
8      978
9      930
10    1017
```

```
11     981
12     946
13    1058
14     981
15     926
16     917
17     998
18    1029
19     996
20     939
21     945
22     923
23     966
dtype: int64
```

13th Hour has most number of EarthQuakes!

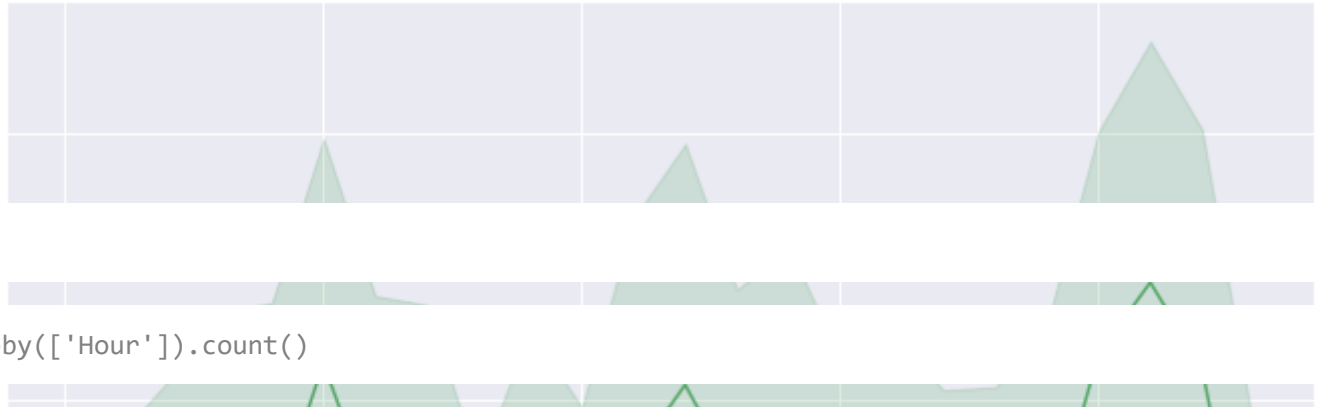
```
df1.groupby('Hour').size().plot(kind='bar',color='g')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7086fcac10>
```




```
#WRT Depth
sns.set(rc={'figure.figsize':(11.7,8.27)})
sns.lineplot(x='Hour',y='Depth',data=df1, color='g')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7084cbf050>
```




```
# df1.groupby(['Hour']).count()
```

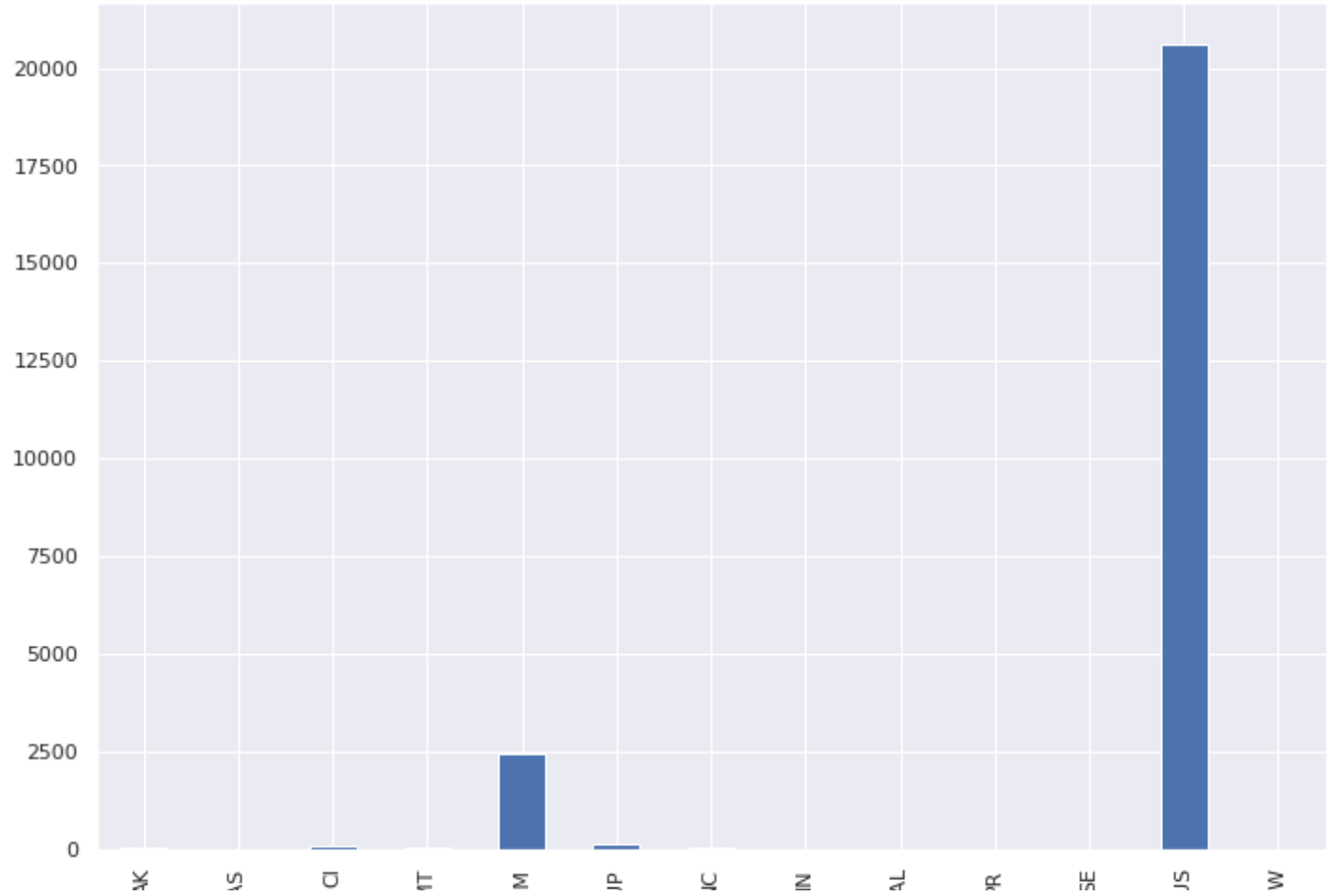
```
df1.head(2)
```

	Date	Time	Latitude	Longitude	Type	Depth	Magnitude	Magnitude Type	Root Mean Square
0	02/01/1965	1900-01-01 13:44:18	19.246	145.616	Earthquake	131.6	6.0	MW	1.022784
1	04/01/1965	1900-01-01 11:29:49	1.863	127.352	Earthquake	80.0	5.8	MW	1.022784

5. Visualize the count w.r.t Source, Type and Magnitude Source.

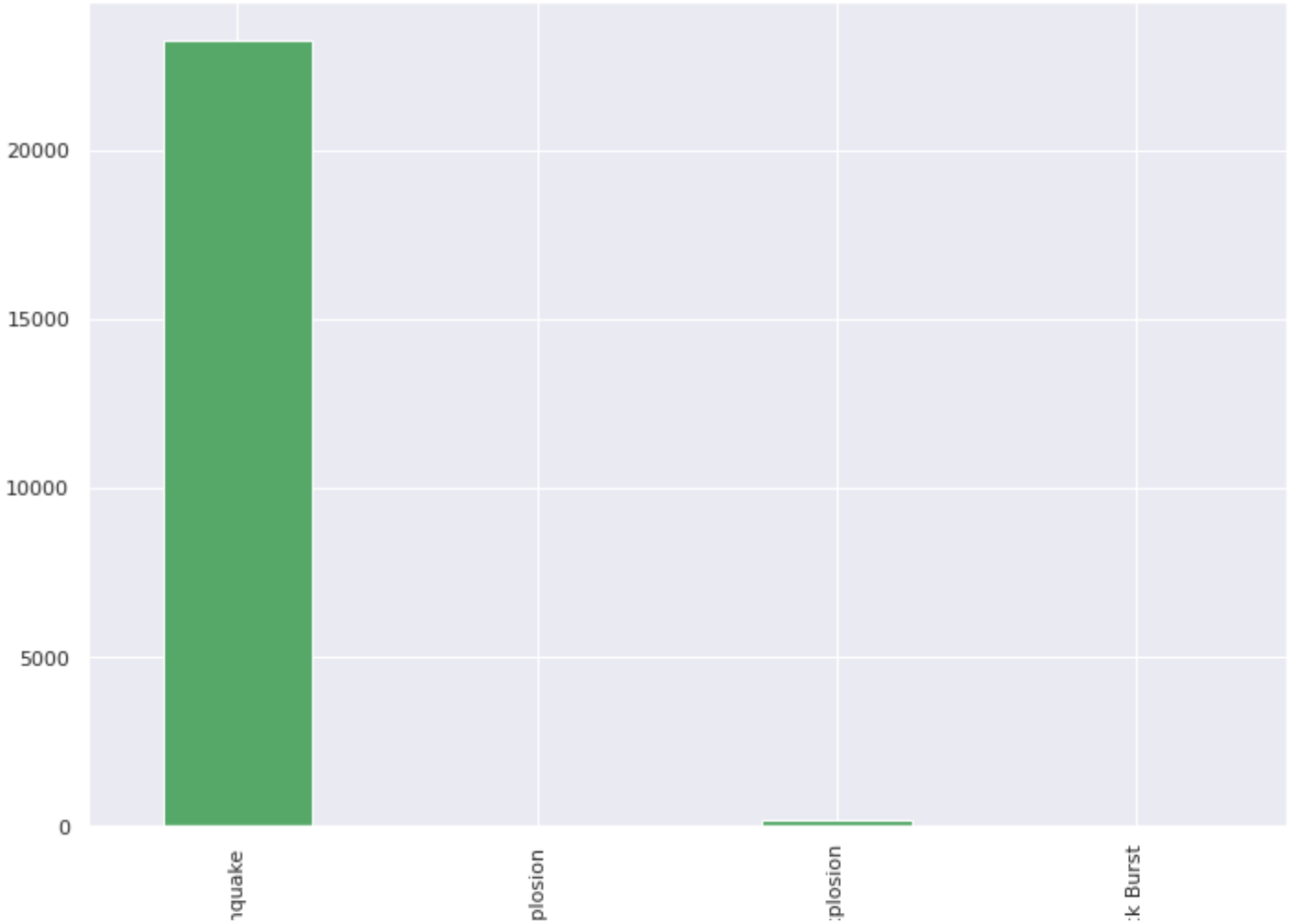
```
df1.groupby('Source').size().plot(kind='bar',color='b')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7082a00450>
```




```
df1.groupby('Type').size().plot(kind='bar',color='g')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7085f99c10>
```




```
df1.groupby('Magnitude').size().plot(kind='bar',color='r')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7085bb5310>
```