Mayank Singh

21, Nov, 2022

HP Election - 2022

Agenda - Understanding and Performing Bivariate and Multivariate Analysis

Bivariate Analysis

- Bivariate analysis can be defined as the analysis of bivariate data. It is one of the simplest forms of statistical analysis, which is used to find out if there is a relationship between two sets of values. Usually, it involves the variables X and Y

Multivariate Analysis

- Multivariate analysis involves analyzing multiple variables (more than two) to identify any possible association among them. Key takeaways Multivariate analysis offers a more complete examination of the data by looking at all possible factors.

Importing Liabraries

In [1]:

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

Reading Data Set

In [2]:

```
## Ignoring the encoding errors in my case, using "encoding_erros = 'ignore' para
df = pd.read_csv('Himachal_Pradesh_Political_party_candidates.csv', encoding_erro
```

In [3]:
```
df.head(2)
```

Out[3]:

	Sno	Candidate	Constituency	Party	Criminal Case	Education	Total Assets	Liabilitie
0	1	Abhay Kumar Ashok	DHARAMSHALA	IND	0	Post Graduate	Rs97,40,093\r\n~ 97Lacs+	Rs0\r\n
1	2	Abhinay Bhardwaj	HAMIRPUR	Rashtriya Devbhumi Party	0	Graduate	Rs5,42,477\r\n~ 5Lacs+	Rs2,50,000\r\n 2Lacs

Performing some Data Cleaning and Transformation task as per requirement

In [4]:
```
# Converting two major columns of Data set from String/object to int
# 1. Total assests value
# 2. Liabilities value
```

In [5]:
```
# .str.replace() is used to remove unwanted characters from the coulmn values so
# the object to int
df['Total Assets'] = df['Total Assets'].str.replace('Rs',"")
df['Total Assets'] = df['Total Assets'].str.replace('\r\n~',"")
df['Total Assets'] = df['Total Assets'].str.replace(',',"")
df['Total Assets']= df['Total Assets'].str.split().str[0]
df['Total Assets'] = df['Total Assets'].str.strip()
df['Total Assets'] = df['Total Assets'].astype(int) # converting object to int
```

In [6]:
```
# .str.replace() is used to remove unwanted characters from the coulmn values so
# the object to int
df['Liabilities'] = df['Liabilities'].str.replace('Rs',"")
df['Liabilities'] = df['Liabilities'].str.replace('\r\n~',"")
df['Liabilities'] = df['Liabilities'].str.replace(',',"")
df['Liabilities']= df['Liabilities'].str.split().str[0]
df['Liabilities'] = df['Liabilities'].str.strip()
df['Liabilities'] = df['Liabilities'].astype(int) # converting object to int
```

In [7]:
```
df.drop('Sno', axis = 1,inplace = True)
```

In [8]:

```
df.sample(5)
```

Out[8]:

	Candidate	Constituency	Party	Criminal Case	Education	Total Assets	Liabilities
400	Vinod Kumar	NACHAN (SC)	BJP	0	12th Pass	21409897	2744431
190	Manoj Kumar	JHANDUTA (SC)	Rashtriya Devbhumi Party	0	Graduate	1490853	0
307	Ravinder Pal Singh Mann	HAROLI	AAP	0	Graduate Professional	4966314	0
309	Ravinder Singh	JAWALAMUKHI	BJP	1	Graduate	34535958	1415567
81	Desh Raj	NADAUN	BSP	0	10th Pass	2353512	0

In [9]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 412 entries, 0 to 411
Data columns (total 7 columns):
 #   Column          Non-Null Count  Dtype 
---  ------          --------------  ----- 
 0   Candidate       412 non-null    object
 1   Constituency    412 non-null    object
 2   Party           412 non-null    object
 3   Criminal Case   412 non-null    int64 
 4   Education       412 non-null    object
 5   Total Assets    412 non-null    int32 
 6   Liabilities     412 non-null    int32 
dtypes: int32(2), int64(1), object(4)
memory usage: 19.4+ KB
```

Starting EDA

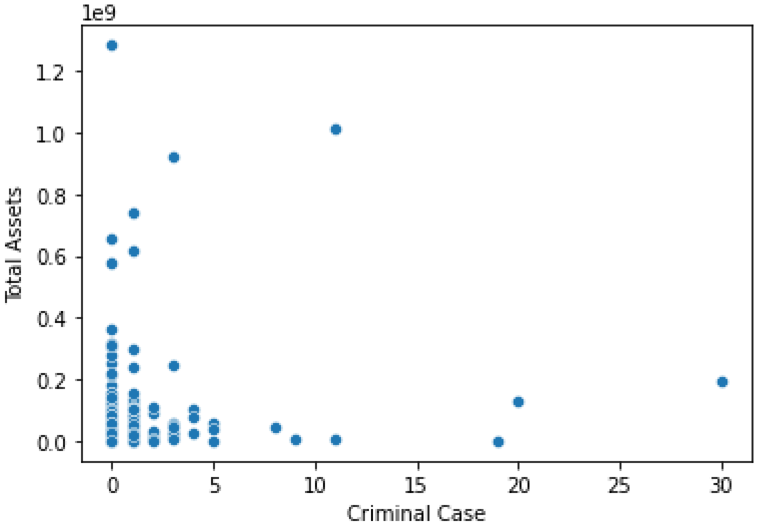
1. Scatter Plot (Numerical - Numerical)

Bivariate Analysis - We are trying to find a relationship between criminal cases and total assets i.e. as no. of crminal cases are incresing, is amount of total assets owned increasing. -- Result - no such relationship.

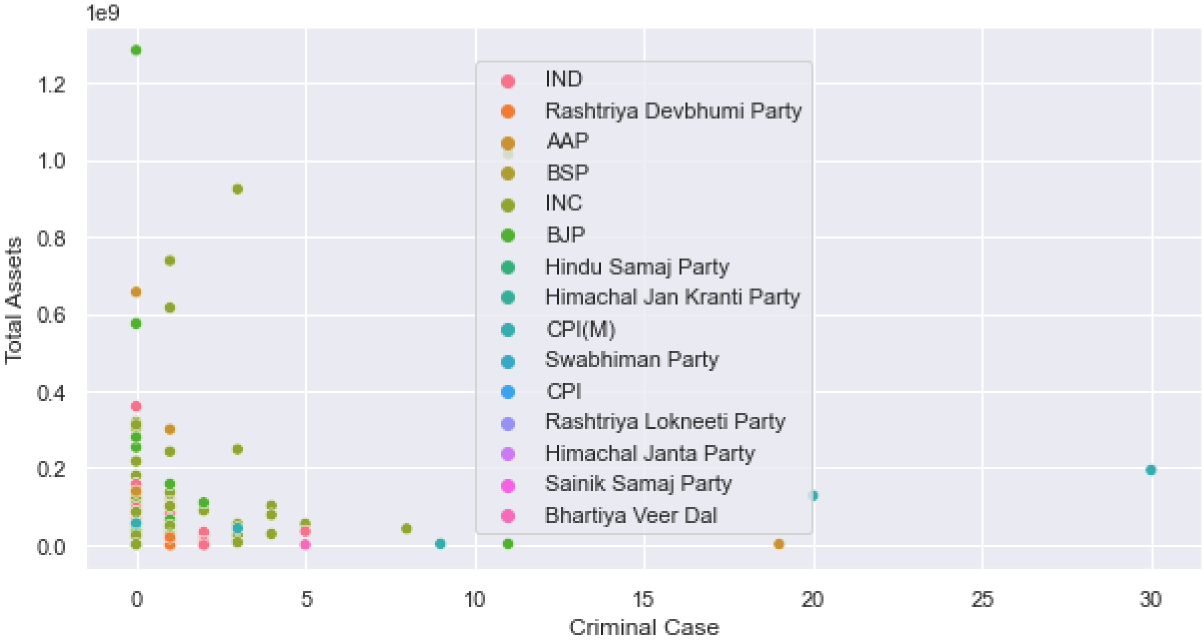
Multivariate analysis - we are infusing the party to identify that candidate belongs to which party.

```
In [10]: # Bivariate Analysis:
         sns.scatterplot(x = df['Criminal Case'],y = df['Total Assets'])
```

```
Out[10]: <AxesSubplot:xlabel='Criminal Case', ylabel='Total Assets'>
```



```
In [19]: # Multivariate Analysis:
         sns.scatterplot(x = df['Criminal Case'],y = df['Total Assets'], hue = df['Party']
         plt.legend(loc='center')
         sns.set(rc={"figure.figsize":(10, 5)})
```



2. Bar Plot (Numerical - Categorical)

A barplot is basically used to aggregate the categorical data according to some methods and by

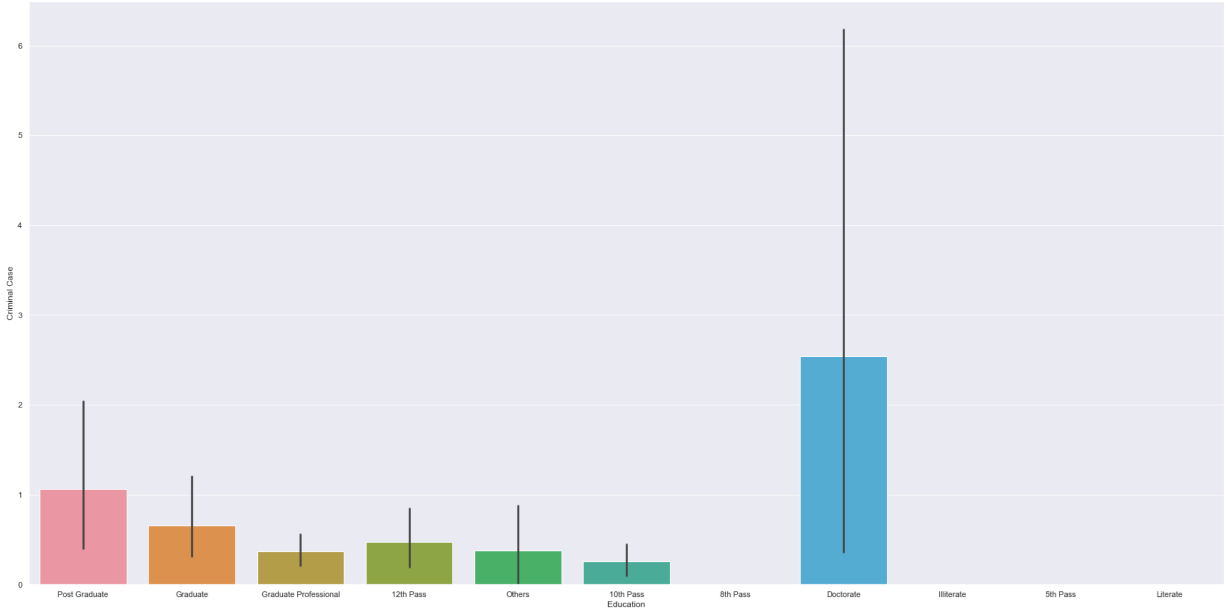
A barplot is basically used to aggregate the categorical data according to some methods and by default it’s the mean. It can also be understood as a visualization of the group by action. To use this plot we choose a categorical column for the x-axis and a numerical column for the y-axis, and we see that it creates a plot taking a mean per categorical column.

Bivariate Analysis - We are trying to find a relationship between criminal cases and Education. The Barplot says on an average Docrate candidates have high records of criminal cases. Ironically, the more qualified you are, it is possible you will commit more crime.

Multivariate analysis - we are infusing the party to identify that candidate belongs to which party. And the plot depicts that CPI(M) tops it in Doctrate category.

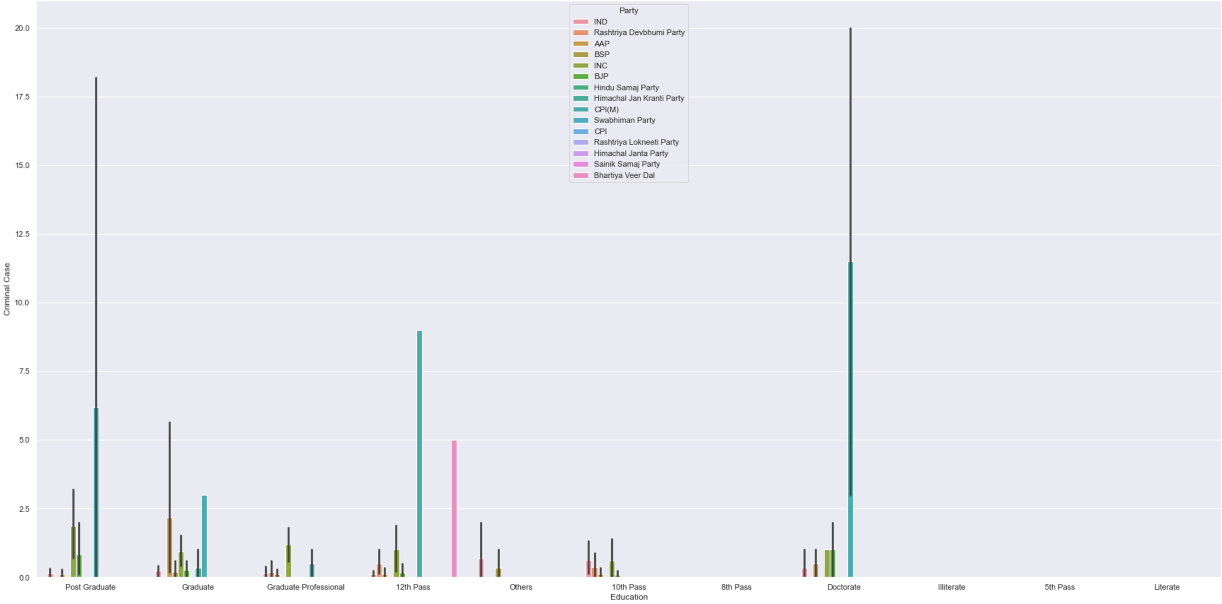
In [18]:

```
#Bivariate Analysis
sns.barplot(x = df['Education'], y = df['Criminal Case'])
sns.set(rc={"figure.figsize":(10, 5)})
```



In [17]:

```
# Multivariate Analysis
sns.barplot(x = df['Education'], y = df['Criminal Case'], hue = df['Party'])
sns.set(rc={"figure.figsize":(30, 15)})
```



3. Box Plot (Numerical - Categorical)

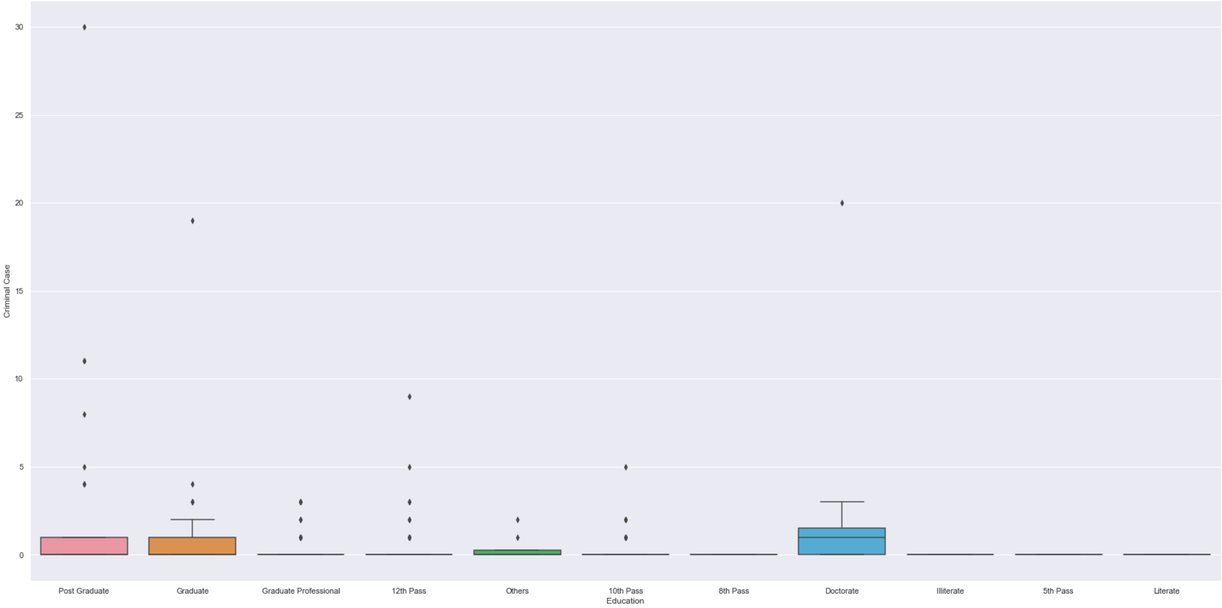
The seaborn boxplot is a very basic plot Boxplots are used to visualize distributions. Thats very useful when you want to compare data between two groups. Sometimes a boxplot is named a box-and-whisker plot. Any box shows the quartiles of the dataset while the whiskers extend to show the rest of the distribution.

In [14]:

```python
# Bivariate Analysis
sns.boxplot(x = df['Education'], y = df['Criminal Case'])
```

Out[14]:

```
<AxesSubplot:xlabel='Education', ylabel='Criminal Case'>
```

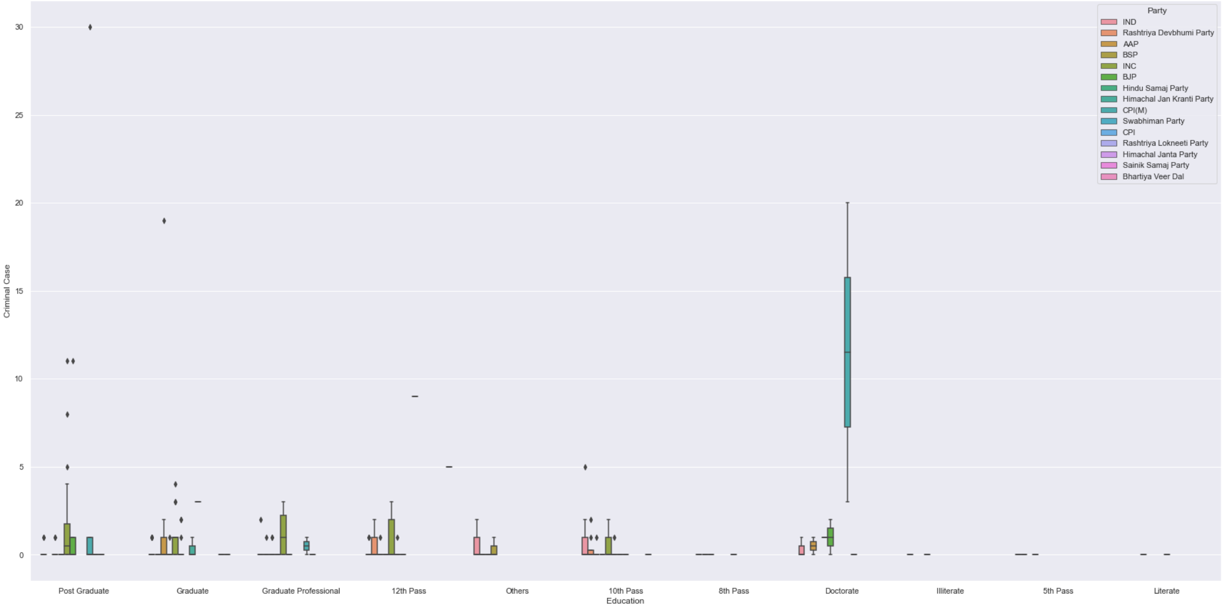


In [15]:

```python
# Multivariate Analysis
sns.boxplot(x = df['Education'], y = df['Criminal Case'], hue = df['Party'])
```

Out[15]:

```
<AxesSubplot:xlabel='Education', ylabel='Criminal Case'>
```



4. Distplot (Numerical - Categorical)

In [ ]:

```python
## Since we do not have any categorical column available in form of float/int dat
## we can not plot distplot to do Bivariate/Mutivariate anlaysis.
## Still to understand how to plot and its look we have plotted as distplot with
```

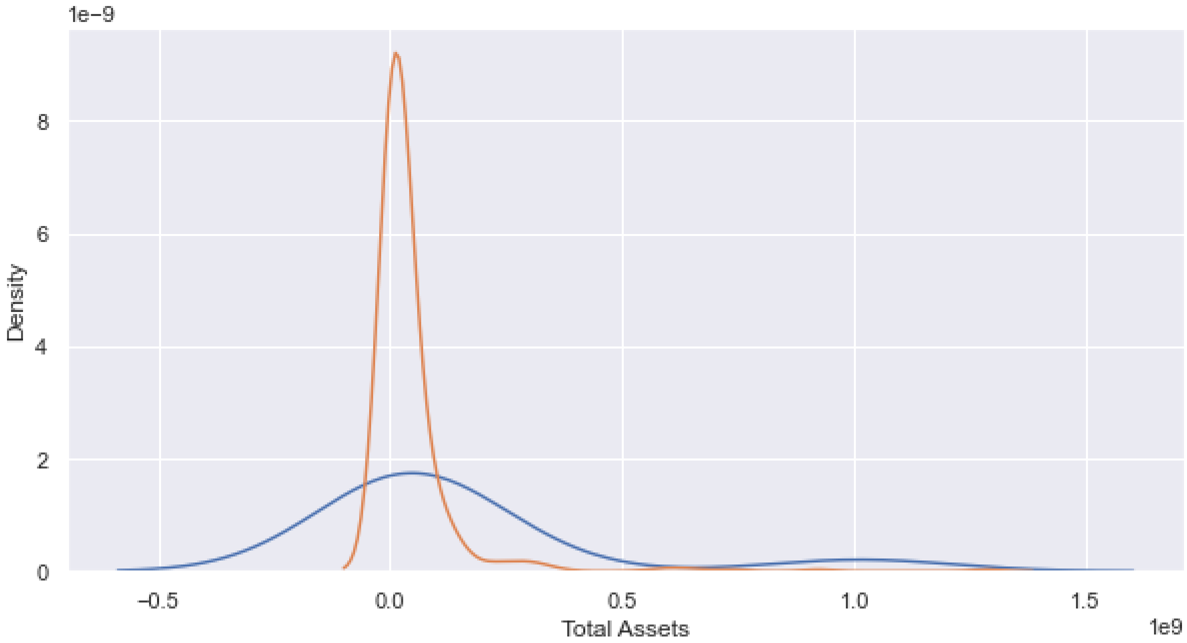
In [28]:

```
sns.distplot(df[df['Criminal Case']>=5]['Total Assets'], hist = False)
sns.distplot(df[df['Criminal Case']<=5]['Total Assets'], hist = False)
```

```
C:\Users\mayank.singh27\AppData\Local\Temp\ipykernel_44348\918789814.py:1: User
Warning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density pl
ots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751 (https://gist.
github.com/mwaskom/de44147ed2974457ad6372750bbe5751)

  sns.distplot(df[df['Criminal Case']>=5]['Total Assets'], hist = False)
C:\Users\mayank.singh27\AppData\Local\Temp\ipykernel_44348\918789814.py:2: User
Warning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density pl
ots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751 (https://gist.
github.com/mwaskom/de44147ed2974457ad6372750bbe5751)

  sns.distplot(df[df['Criminal Case']<=5]['Total Assets'], hist = False)
```

Out[28]:

```
<AxesSubplot:xlabel='Total Assets', ylabel='Density'>
```



5. Heatmap (Categorical - Categorical)

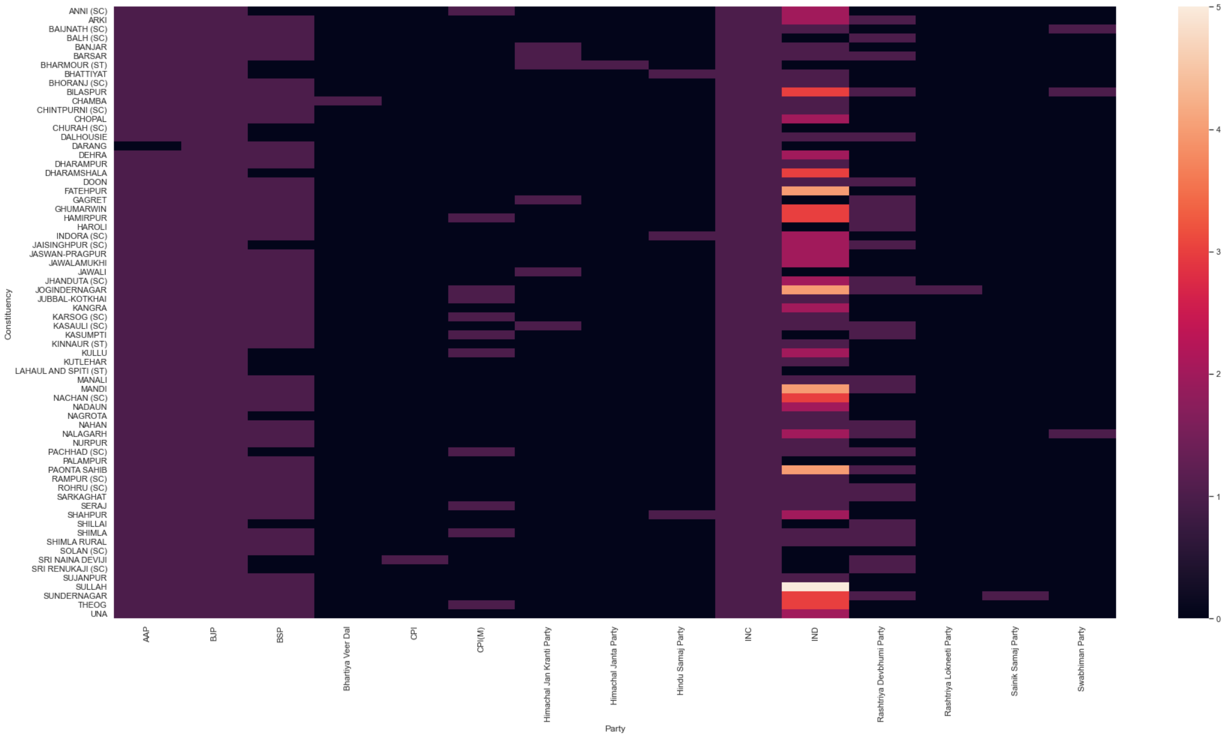
Heat Map helps to analyse two categorical columns with the help of colours. And what the colour is depicting can be understood with the help of colour bar on the right of graph. generally light colours indicate higher numbers.

```
In [29]: df.head(2)
```

Out[29]:

	Candidate	Constituency	Party	Criminal Case	Education	Total Assets	Liabilities
0	Abhay Kumar Ashok	DHARAMSHALA	IND	0	Post Graduate	9740093	0
1	Abhinay Bhardwaj	HAMIRPUR	Rashtriya Devbhumi Party	0	Graduate	542477	250000

```
In [33]: sns.heatmap(pd.crosstab(df['Constituency'], df['Party']))
         sns.set(rc={"figure.figsize":(30, 15)})
```



From the above heatmap and given beolw figures, we can findout which constituency has more no. of canddates from a party. Lighter colour shows more no. of candidates of a prty. For eg. from the SULLAH constituency IND has 5 members. Validate it from Heatmap as well as from below table

In [35]:
```python
pd.crosstab(df['Constituency'], df['Party'])
```

Out[35]:

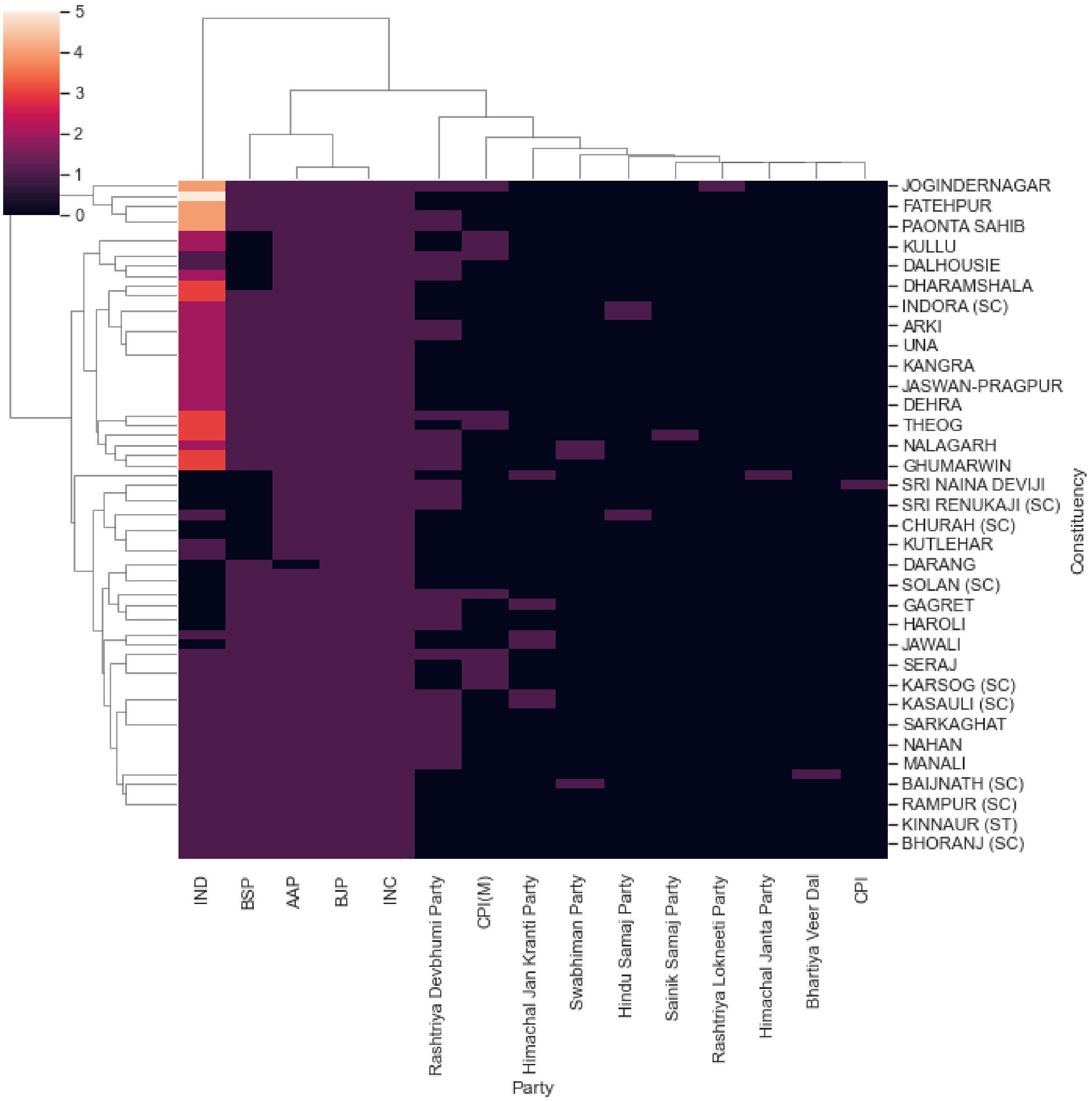
Party	AAP	BJP	BSP	Bhartiya Veer Dal	CPI	CPI(M)	Himachal Jan Kranti Party	Himachal Janta Party	Hindu Samaj Party	INC	IND
Constituency											
ANNI (SC)	1	1	0	0	0	1	0	0	0	1	2
ARKI	1	1	1	0	0	0	0	0	0	1	2
BAIJNATH (SC)	1	1	1	0	0	0	0	0	0	1	1
BALH (SC)	1	1	1	0	0	0	0	0	0	1	0
BANJAR	1	1	1	0	0	0	1	0	0	1	1
...	...	...	...	...	...	...	...	...	...	...	...
SUJANPUR	1	1	1	0	0	0	0	0	0	1	1
SULLAH	1	1	1	0	0	0	0	0	0	1	5
SUNDERNAGAR	1	1	1	0	0	0	0	0	0	1	3
THEOG	1	1	1	0	0	1	0	0	0	1	3
UNA	1	1	1	0	0	0	0	0	0	1	2

68 rows × 15 columns

6. Clustermap (Categorical - Categorical)

Plot a matrix dataset as a hierarchically-clustered heatmap. It is simillar to heatmap with a difference of presence of Dandograms that depicts the relationship bewteen different categories

```
In [36]: sns.clustermap(pd.crosstab(df['Constituency'], df['Party']))
         sns.set(rc={"figure.figsize":(30, 15)})
```

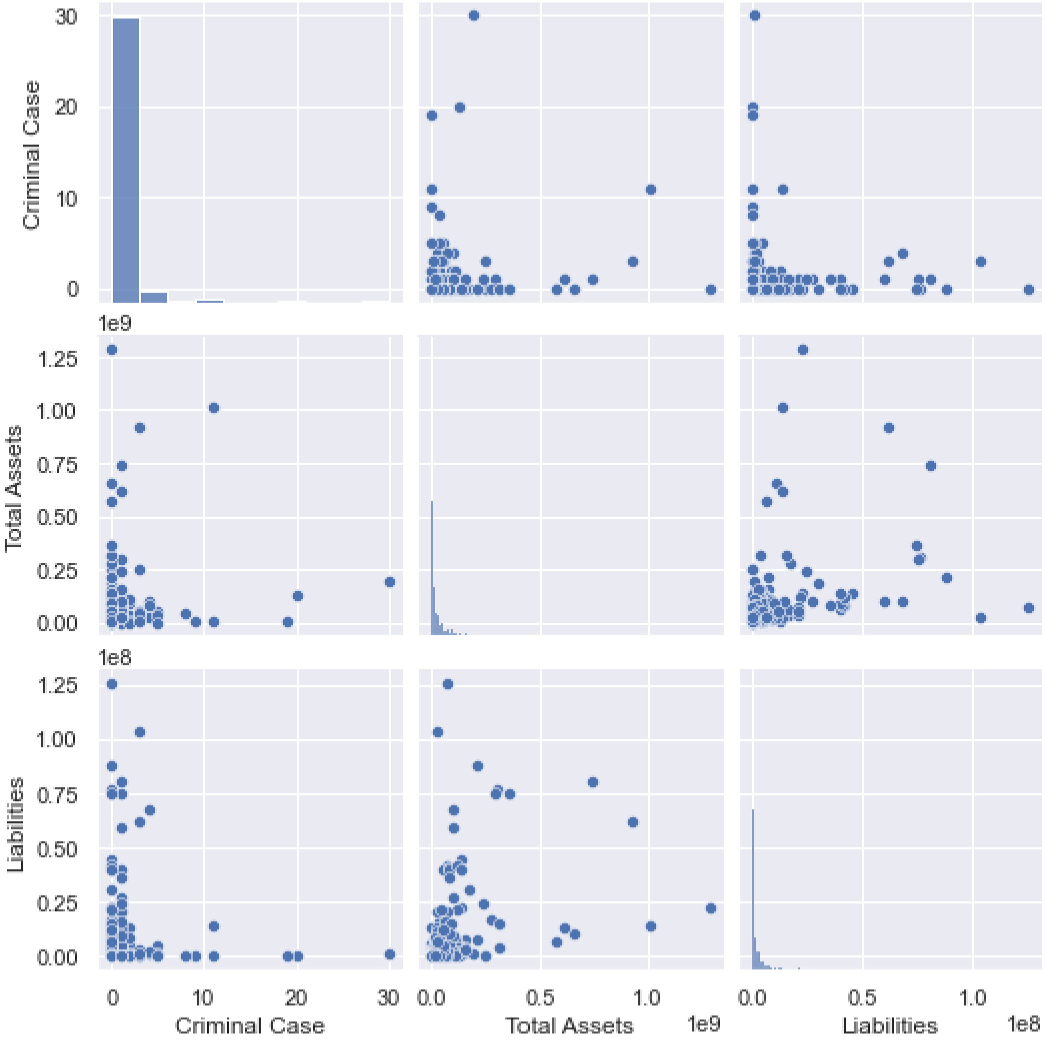


6. Pairplot

When we want to plot multiple scatter plot between Numerical columns of our data set, use pair plot. It provides all graphs showing relationship betwwen all numerical columns with each other

In [37]:
```
# Bivariate Analysis
sns.pairplot(df)
```

Out[37]:
```
<seaborn.axisgrid.PairGrid at 0x1550e7fc9d0>
```

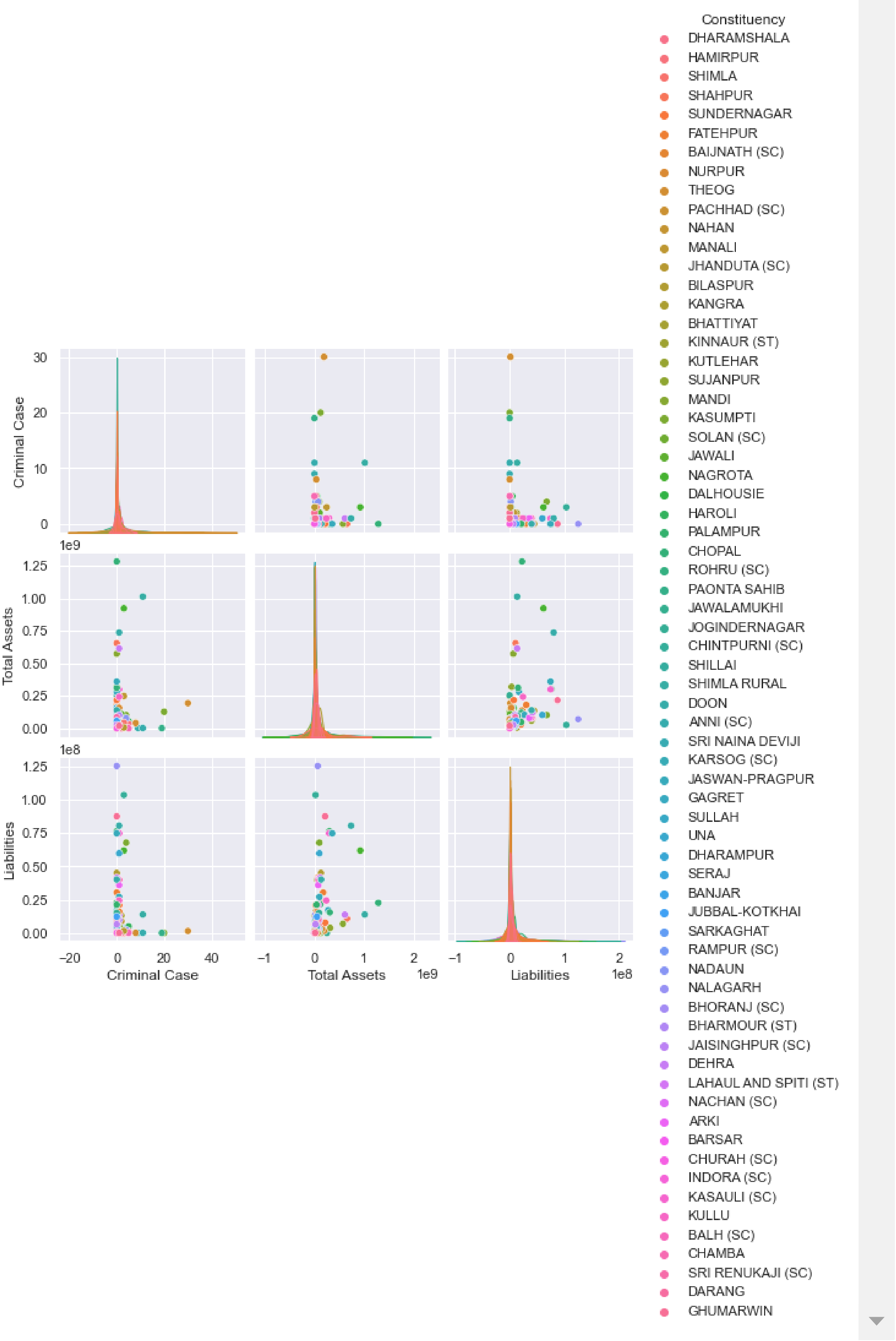


In [41]:

```
# Mutivariate Analysis
sns.pairplot(df, hue = 'Constituency')
```

Out[41]:

```
<seaborn.axisgrid.PairGrid at 0x15512b8e200>
```



8. Lineplot (Numerical - Numerical)

Line plot should be plotted in case there is a column of time based - month, date, year/s etc. to understand the relationship across a timeline.

Since we do not have time value in our data set we are not plotting it.