In [129…

```
#import important libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from scipy.stats import poisson
import seaborn as sns
from colorama import Fore, Back, Style
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.model_selection import KFold
from sklearn.model_selection import cross_val_score
from sklearn import preprocessing
from sklearn import metrics

import plotly.graph_objects as go
import plotly.express as px
from plotly.subplots import make_subplots
from plotly.offline import init_notebook_mode
init_notebook_mode(connected=True)
import warnings
warnings.filterwarnings("ignore")
```

Here are the different variables used in this term project

- Schizophrenia disorder
- Depressive disorder
- Anxiety disorder
- Bipolar disorder
- Eating disorder
- Major depression
- Eating Disorder
- Nearly Every Day
- More than half of the day
- several days

In [132…

```
# Read data

Data1 = pd.read_csv("Datasets/1- mental-illnesses-prevalence.csv")
Data2 = pd.read_csv("Datasets/4- adult-population-covered-in-primary-data-or
Data3 = pd.read_csv("Datasets/6- depressive-symptoms-across-us-population.cs
Data4 = pd.read_csv("Datasets/7- number-of-countries-with-primary-data-on-pr
```

In [134…

```
# Get data into dataframes for further analysis

df1 = pd.DataFrame(Data1)
df2 = pd.DataFrame(Data2)
df3 = pd.DataFrame(Data3)
df4 = pd.DataFrame(Data4)
```

Showing the descriptive characteristics details inside the dataframe for variables

- Mean
- Min
- Max

In [137…

```
df1.drop(columns=['Year']).describe().loc[['mean','min','max']].T
```

Out[137…

	mean	min	max
Schizophrenia disorders (share of population) - Sex: Both - Age: Age-standardized	0.266604	0.188416	0.462045
Depressive disorders (share of population) - Sex: Both - Age: Age-standardized	3.767036	1.522333	7.645899
Anxiety disorders (share of population) - Sex: Both - Age: Age-standardized	4.101840	1.879996	8.624634
Bipolar disorders (share of population) - Sex: Both - Age: Age-standardized	0.636968	0.181667	1.506730
Eating disorders (share of population) - Sex: Both - Age: Age-standardized	0.195664	0.044780	1.031688

Mode from dataframe

In [140…

```
df1.mode('index',True,True)
```

Out[140…

	Year	Schizophrenia disorders (share of population) - Sex: Both - Age: Age-standardized	Depressive disorders (share of population) - Sex: Both - Age: Age-standardized	Anxiety disorders (share of population) - Sex: Both - Age: Age-standardized	Bipolar disorders (share of population) - Sex: Both - Age: Age-standardized	Eating disorders (share of population) - Sex: Both - Age: Age-standardized
0	1990	0.211642	2.964739	3.531769	0.54848	0.065898

1	1991	0.215830	4.328565	4.091090	NaN	0.177606
2	1992	0.271035	4.440195	4.105643	NaN	0.417540
3	1993	0.273570	5.957178	NaN	NaN	NaN
4	1994	0.273879	NaN	NaN	NaN	NaN
5	1995	0.275704	NaN	NaN	NaN	NaN
6	1996	0.283287	NaN	NaN	NaN	NaN
7	1997	0.283584	NaN	NaN	NaN	NaN
8	1998	0.284089	NaN	NaN	NaN	NaN
9	1999	0.284910	NaN	NaN	NaN	NaN
10	2000	0.285301	NaN	NaN	NaN	NaN
11	2001	0.289377	NaN	NaN	NaN	NaN
12	2002	0.299869	NaN	NaN	NaN	NaN
13	2003	0.383200	NaN	NaN	NaN	NaN
14	2004	NaN	NaN	NaN	NaN	NaN
15	2005	NaN	NaN	NaN	NaN	NaN
16	2006	NaN	NaN	NaN	NaN	NaN
17	2007	NaN	NaN	NaN	NaN	NaN
18	2008	NaN	NaN	NaN	NaN	NaN
19	2009	NaN	NaN	NaN	NaN	NaN
20	2010	NaN	NaN	NaN	NaN	NaN
21	2011	NaN	NaN	NaN	NaN	NaN
22	2012	NaN	NaN	NaN	NaN	NaN
23	2013	NaN	NaN	NaN	NaN	NaN
24	2014	NaN	NaN	NaN	NaN	NaN
25	2015	NaN	NaN	NaN	NaN	NaN
26	2016	NaN	NaN	NaN	NaN	NaN
27	2017	NaN	NaN	NaN	NaN	NaN
28	2018	NaN	NaN	NaN	NaN	NaN
29	2019	NaN	NaN	NaN	NaN	NaN

Following is a function made for this project calling

- variables
- data types
- Missing and Uniques values

In [143…

```
def describe(df):

    variables = []
    dtypes = []
    count = []
    unique = []
    missing = []

    for item in df.columns:
        variables.append(item)
        dtypes.append(df[item].dtype)
        count.append(len(df[item]))
        unique.append(len(df[item].unique()))
        missing.append(df[item].isna().sum())

    output = pd.DataFrame({
        'variable': variables,
        'dtype': dtypes,
        'count': count,
        'unique': unique,
        'missing value': missing
    })

    return output
```

I like the different colors and learnt that from my past python courses since using it here

In [146…

```
class color:
   BLUE = '\033[94m'
   BOLD = '\033[1m'
   UNDERLINE = '\033[4m'
   END = '\033[0m'
   RED = '\033[41m'
   GREEN = '\033[42m'
   ORANGE = '\033[43m'
   PURPLE = '\033[45m'
   CYAN = '\033[46m'
   LIGHTGREY = '\033[47m'
```

In [148…

```python
print(color.BOLD + color.PURPLE + color.UNDERLINE +
      '"The describe table of df1 : Mental illness dataframe"' + color.END)
print(describe(df1))
```

```
"The describe table of df1 : Mental illness dataframe"
                                          variable    dtype  count  unique  \
0                                           Entity   object   6420     214
1                                             Code   object   6420     206
2                                             Year    int64   6420      30
3  Schizophrenia disorders (share of population) ...  float64   6420    6406
4  Depressive disorders (share of population) - S...  float64   6420    6416
5  Anxiety disorders (share of population) - Sex:...  float64   6420    6417
6  Bipolar disorders (share of population) - Sex:...  float64   6420    6385
7  Eating disorders (share of population) - Sex: ...  float64   6420    6417

   missing value
0              0
1            270
2              0
3              0
4              0
5              0
6              0
7              0
```

In [150…

```python
print(color.BOLD + color.ORANGE + color.UNDERLINE +
      '"The describe table of df2 : Adult population, mental illnesses"' + c
print(describe(df2))
```

```
"The describe table of df2 : Adult population, mental illnesses"
            variable    dtype  count  unique  missing value
0             Entity   object     22      22              0
1               Code   object     22       2             21
2               Year    int64     22       1              0
3   Major depression  float64     22      18              0
4   Bipolar disorder  float64     22      14              0
5   Eating disorders  float64     22      11              0
6          Dysthymia  float64     22      14              0
7      Schizophrenia   object     22      14              0
8  Anxiety disorders  float64     22      18              0
```

In [152…

```python
print(color.BOLD + color.CYAN + color.UNDERLINE +
      '"The describe table of df3 : Depressive"' + color.END)
print(describe(df3))
```

```
"The describe table of df3 : Depressive"
                  variable    dtype  count  unique  missing value
0                   Entity   object     10      10              0
1                     Code  float64     10       1             10
2                     Year    int64     10       1              0
3         Nearly every day  float64     10       9              0
4  More than half the days  float64     10      10              0
5             Several days  float64     10      10              0
6               Not at all  float64     10      10              0
```

```
In [154…
print(color.BOLD + color.LIGHTGREY + color.UNDERLINE +
      '"The describe table of df4 : Number of countries"' + color.END)
print(describe(df4))
```

```
"The describe table of df4 : Number of countries"
                                            variable    dtype  count  unique  \
0                                             Entity   object     15      15   
1                                               Code  float64     15       1   
2                                               Year    int64     15       1   
3  Number of countries with primary data on preva...    int64     15      11   

   missing value  
0              0  
1             15  
2              0  
3              0  
```

Visualizations with Plotly

```
In [157…
df2.sort_values(by= "Major depression" ,inplace=True)
plt.figure(dpi=200)
fig = px.bar(df2, x="Major depression", y="Entity", orientation='h',color='E
fig.show()
```

```
<Figure size 1280x960 with 0 Axes>
```

In [159…

```
df2.sort_values(by= "Eating disorders" ,inplace=True)
plt.figure(dpi=200)
fig = px.bar(df2, x="Eating disorders", y="Entity", orientation='h',color='D
fig.show()
```

```
<Figure size 1280x960 with 0 Axes>
```

In [160…

```
fig = make_subplots(rows=1, cols=2, specs=[[{}, {}]], shared_xaxes=True,
                    shared_yaxes=False, vertical_spacing=0.001)

x1 = ["Andean Latin America", "West Sub-Saharan Africa", "Tropical Latin Ame
    "Central Sub-Saharan Africa", "Southern Latin America", "North Africa/Mi
    "Southeast Asia", "Oceania", "Central Latin America", "Eastern Europe", 
    "Western Europe", "World", "East Asia", "Caribbean", "Asia Pacific", "Au

fig.append_trace(go.Bar(
    x=df2["Bipolar disorder"],
    y=x1,
    marker=dict(
        color='rgba(50, 171, 96, 0.6)',
        line=dict(
            color='rgba(20, 10, 56, 1.0)',
            width=0),
    ),
    name='Bipolar disorder in Mental Health',
    orientation='h',
), 1, 1)

fig.append_trace(go.Scatter(
    x=df2["Major depression"], y=x1,
    mode='lines+markers',
    line_color='rgb(40, 0, 128)',
    name='Major depression in Mental Health',
), 1, 2)

fig.update_layout(
    title='Major depression and Bipolar disorder',
    yaxis=dict(
        showgrid=False,
        showline=False,
        showticklabels=True,
        domain=[0, 0.85],
    ),
    yaxis2=dict(
        showgrid=False,
        showline=True,
        showticklabels=False,
        linecolor='rgba(102, 102, 102, 0.8)',
        linewidth=5,
        domain=[0, 0.85],
    ),
    xaxis=dict(
        zeroline=False,
        showline=False,
        showticklabels=True,
        showgrid=True,
        domain=[0, 0.45],
    ),
    xaxis2=dict(
        zeroline=False,
        showline=False,
        showticklabels=True,
        showgrid=True,
        domain=[0.47, 1],
        side='top',
        dtick=10000,
    ),
    legend=dict(x=0.029, y=1.038, font_size=10),
    margin=dict(l=100, r=20, t=70, b=70),
    paper_bgcolor='rgb(248, 248, 255)',
    plot_bgcolor='rgb(248, 248, 255)',
)

annotations = []
```

```
# Adding labels
for ydn, yd, xd in zip(df2["Major depression"], df2["Bipolar disorder"], x1)
    # labeling the scatter savings
    annotations.append(dict(xref='x2', yref='y2',
                            y=xd, x=ydn+10,
                            text='{:,}'.format(ydn) + '%',
                            font=dict(family='Arial', size=10,
                                      color='rgb(128, 0, 128)'),
                            showarrow=False))
    # labeling the bar net worth
    annotations.append(dict(xref='x1', yref='y1',
                            y=xd, x=yd+10 ,
                            text=str(yd) + '%',
                            font=dict(family='Arial', size=10,
                                      color='rgb(50, 171, 96)'),
                            showarrow=False))
# Source
annotations.append(dict(xref='paper', yref='paper',
                        x=-0.2, y=-0.109,
                        text="Mental health visualization",
                        font=dict(family='Arial', size=20, color='rgb(150,15
                        showarrow=False))

fig.update_layout(annotations=annotations)

fig.show()
```

In [162…

```
x = ["Appetite change", "Average across symptoms", "Depressed mood", "Diffic
    "Low energy", "Low self-esteem", "Psychomotor agitation", "Psychomotor a

fig = go.Figure()

# Create and style traces
fig.add_trace(go.Scatter(x=x, y=df3["Nearly every day"], name='Nearly every 
                         line=dict(color='firebrick', width=4)))
fig.add_trace(go.Scatter(x=x, y=df3["More than half the days"], name = 'More
                         line=dict(color='royalblue', width=4)))
fig.add_trace(go.Scatter(x=x, y=df3["Several days"], name='Several days',
                         line=dict(color='black', width=4,
                              dash='dashdot')
))

# Edit the layout
fig.update_layout(title='Depressive symptoms across us population',
                   xaxis_title='Entity',
                        yaxis_title='Types of days')

fig.show()
```

Listing the column names

In [166…

```
df1_column_names = list(df1.columns.values)
df1_column_names
```

Out[166…

```
['Entity',
 'Code',
 'Year',
 'Schizophrenia disorders (share of population) - Sex: Both - Age: Age-stan
dardized',
 'Depressive disorders (share of population) - Sex: Both - Age: Age-standar
dized',
 'Anxiety disorders (share of population) - Sex: Both - Age: Age-standardiz
ed',
 'Bipolar disorders (share of population) - Sex: Both - Age: Age-standardiz
ed',
 'Eating disorders (share of population) - Sex: Both - Age: Age-standardize
d']
```

In [168…

```
df1 = df1.rename(columns={'Schizophrenia disorders (share of population) - S
                          'Depressive disorders (share of population) - Sex:
                         'Anxiety disorders (share of population) - Sex: Bot
                         'Bipolar disorders (share of population) - Sex: Bot
                         'Eating disorders (share of population) - Sex: Both
```

In [170…

```
df1_variables = df1[["Schizophrenia disorders","Depressive disorders","Anxie
                       "Eating disorders"]]
```

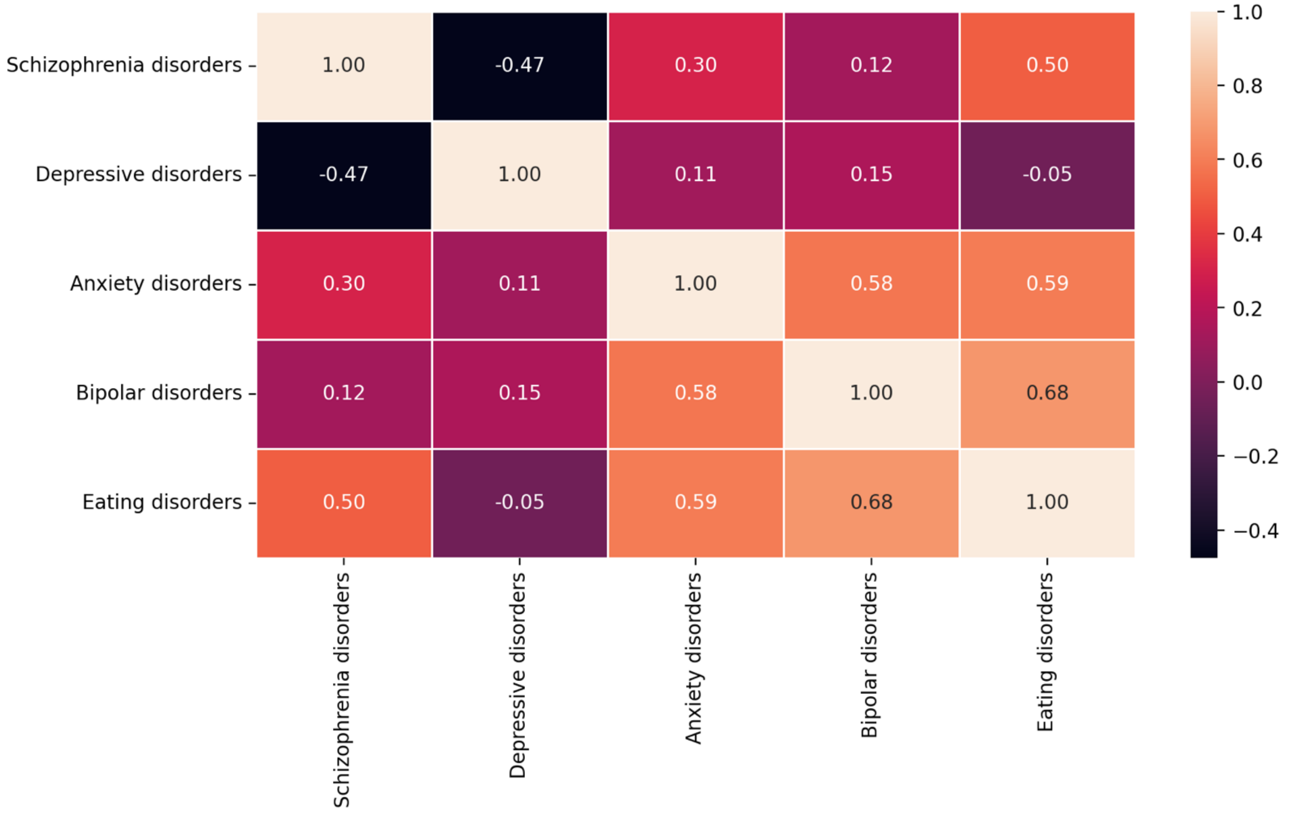
This is correlation example of the data used for this project

In [173…

```
Corrmat = df1_variables.corr()
plt.figure(figsize=(10, 5), dpi=200)
sns.heatmap(Cormat, annot=True,fmt=".2f", linewidth=.5)
```

Out[173…

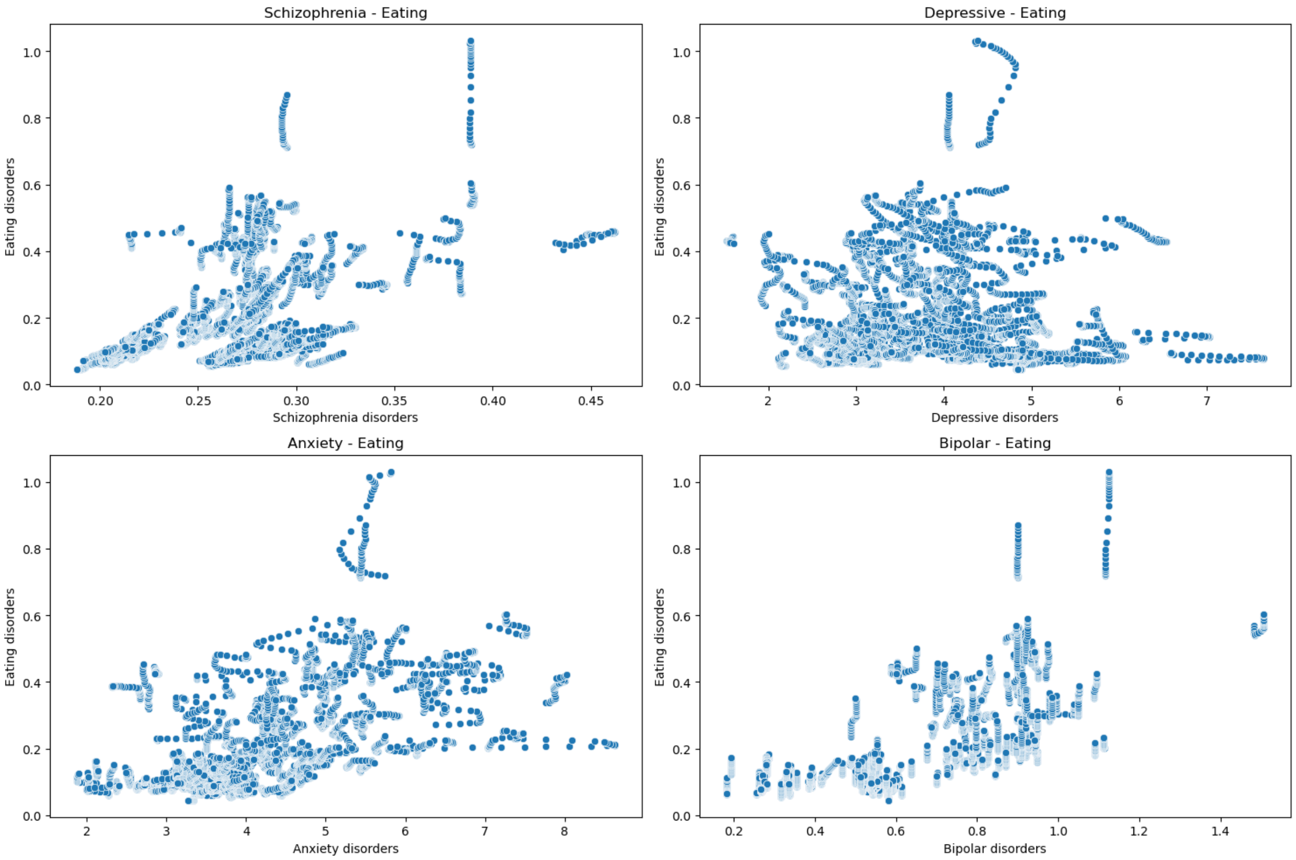
```
<Axes: >
```



Few Scatter Plotts for the disorders

In [176…

```
fig, ((ax1, ax2), (ax3, ax4)) = plt.subplots(ncols=2,nrows=2,figsize= (15,10

ax1.set_title('Schizophrenia - Eating')
sns.scatterplot(x="Schizophrenia disorders", y="Eating disorders", data=df1_

ax2.set_title('Depressive - Eating')
sns.scatterplot(x='Depressive disorders', y="Eating disorders", data=df1_var

ax3.set_title('Anxiety - Eating')
sns.scatterplot(x='Anxiety disorders', y="Eating disorders", data=df1_variab

ax4.set_title('Bipolar - Eating')
sns.scatterplot(x='Bipolar disorders', y="Eating disorders", data=df1_variab

plt.tight_layout()
```



In [177…
```
features = ['Schizophrenia disorders', 'Depressive disorders','Anxiety disor
X_model = df1[features]
y_model = df1["Eating disorders"]
```

In [180…
```
scaler = preprocessing.MinMaxScaler()
X_model_norm = scaler.fit_transform(X_model)
```

In [182…
```
X_model_norm
```

Out[182…
```
array([[0.12714204, 0.56728135, 0.42008448, 0.39345779],
       [0.12439376, 0.56616628, 0.41842183, 0.39273757],
       [0.1218262 , 0.56486898, 0.41570011, 0.39177399],
       ...,
       [0.04832425, 0.30858363, 0.19399437, 0.26936249],
       [0.0495569 , 0.30776117, 0.19157658, 0.26935944],
       [0.05140367, 0.30589079, 0.1863733 , 0.26935592]])
```

In [184…
```
X_train, X_test, y_train, y_test = train_test_split(X_model_norm, y_model, t
```

In [186…
```
print("Shape of x_train : ", X_train.shape)
print("Shape of y_train : ", y_train.shape)
print("Shape of x_test : ", X_test.shape)
print("Shape of y_test : ", y_test.shape)
```

```
Shape of x_train :  (6400, 4)
Shape of y_train :  (6400,)
Shape of x_test :  (20, 4)
Shape of y_test :  (20,)
```

In [188…

```
Model = LinearRegression()
Model.fit(X_train, y_train)
```

Out[188…

```
▾ LinearRegression
LinearRegression()
```

In [190…

```
y_pred = Model.predict(X_test)
```

In [192…

```
print("Mean Absolute Error of Model is: ", metrics.mean_absolute_error(y_tes
print("Mean Squared Error of Model is: ", metrics.mean_squared_error(y_test,
print("Root Mean Squared of Model is: ", np.sqrt(metrics.mean_squared_error(
```

```
Mean Absolute Error of Model is:  0.08003250281357936
Mean Squared Error of Model is:  0.02178632883846133
Root Mean Squared of Model is:  0.14760192694697902
```

In [194…

```
k_fold = KFold(10)
print (cross_val_score(Model, X_model_norm, y_model.ravel(), cv=k_fold, n_jc
```

```
[0.67019159 0.30224538 0.34774549 0.6311535  0.62898747 0.59061848
 0.66269011 0.57389516 0.64517085 0.84017723]
```

CDF for variables defined in this project

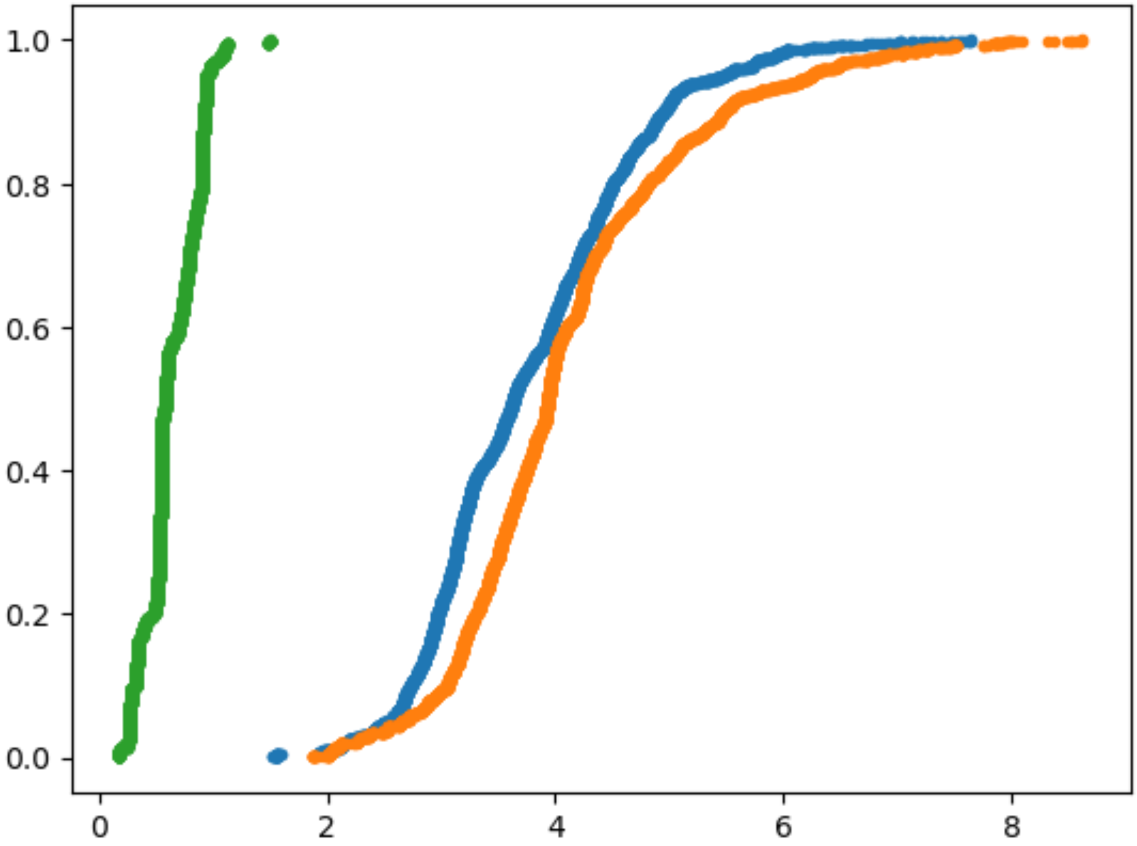
In [197…

```
def ecdf(data):

    x= np.sort(data)
    n = x.size
    y = np.arange(1,n+1)/n

    return(x,y)
```

In [199…

```
depressive = df1_variables["Depressive disorders"]

Anxiety = df1_variables["Anxiety disorders"]

Bipolar = df1_variables["Bipolar disorders"]

#cumulative = np.linspace(0,1,len(depressive))

#sorted_data = np.sort(depressive)
```

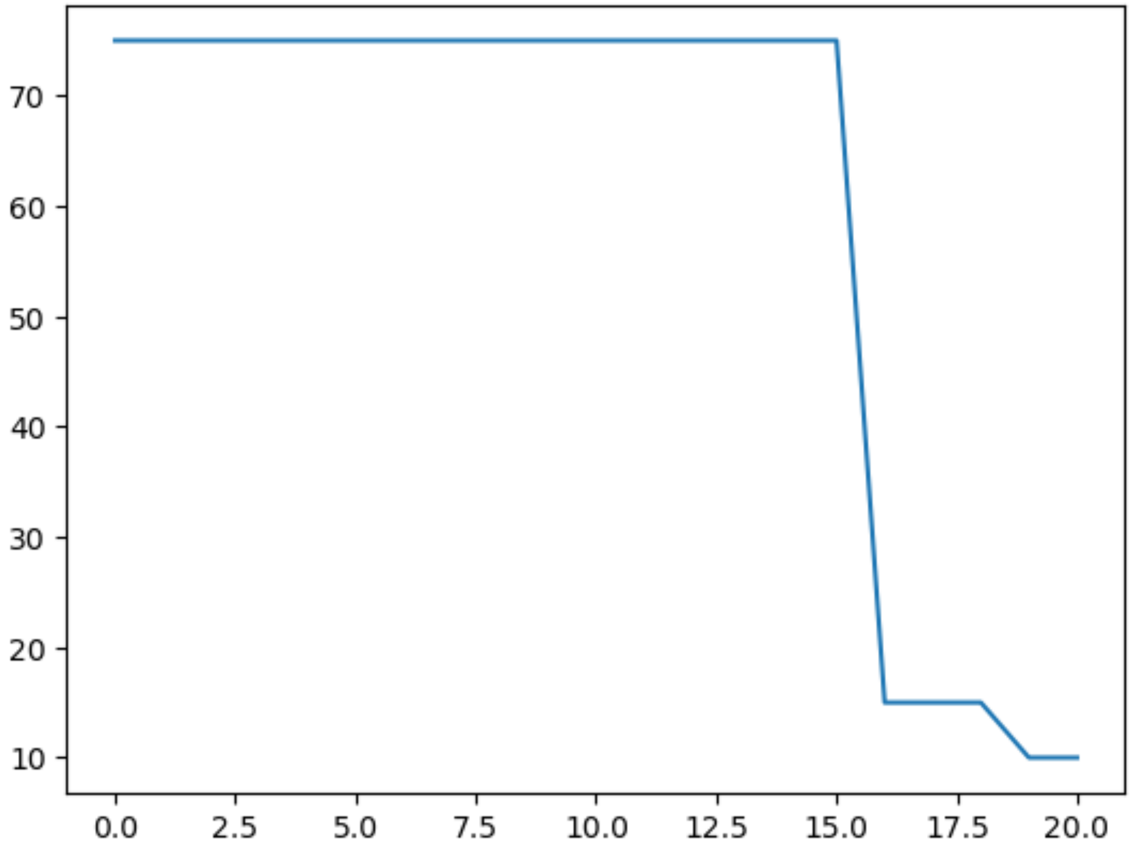
```
#cumulative_data = np.cumsum(sorted_data)/np.sum(sorted_data)

x_dep,y_dep = ecdf(depressive)

x_anx,y_anx = ecdf(Anxiety)

x_bipolar,y_bipolar = ecdf(Bipolar)


#plt.plot(sorted_data,cumulative_data)

plt.plot(x_dep,y_dep,marker = '.',linestyle='none')
plt.plot(x_anx,y_anx,marker = '.',linestyle='none')
plt.plot(x_bipolar,y_bipolar,marker = '.',linestyle='none')

#plt.xlabel("depressive")
#plt.ylabel("Cumulative Proportion")
#plt.title("CDF of depression")

plt.show()
```



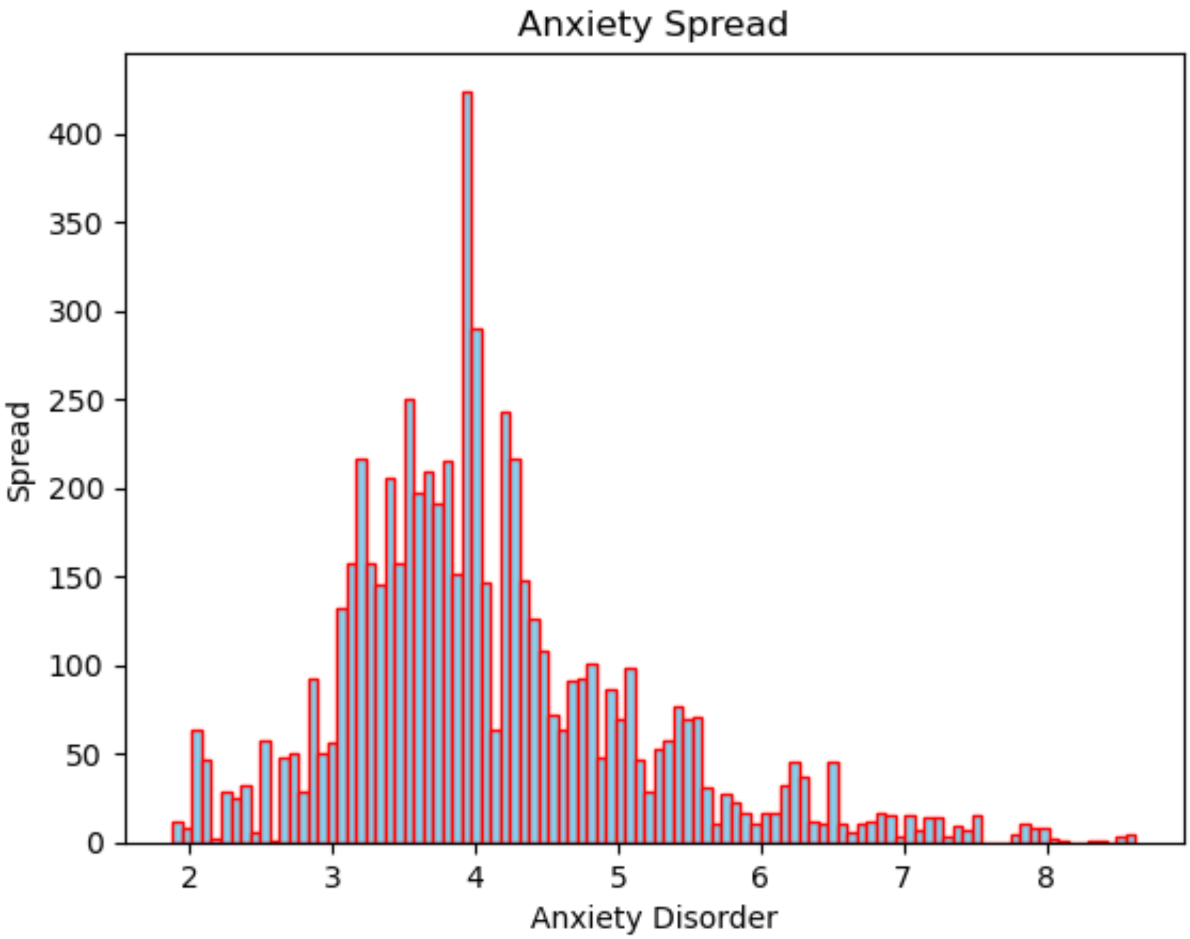
Spread Percentage for Anxiety Disorder

```
In [202…  target = [75,15,10]

          group = pd.cut(df1_variables["Anxiety disorders"].cumsum(), bins= np.r_[0,np

          df1_variables.index.groupby(group)

          plt.plot(group)
```

```
Out[202…  [<matplotlib.lines.Line2D at 0x304965c40>]
```



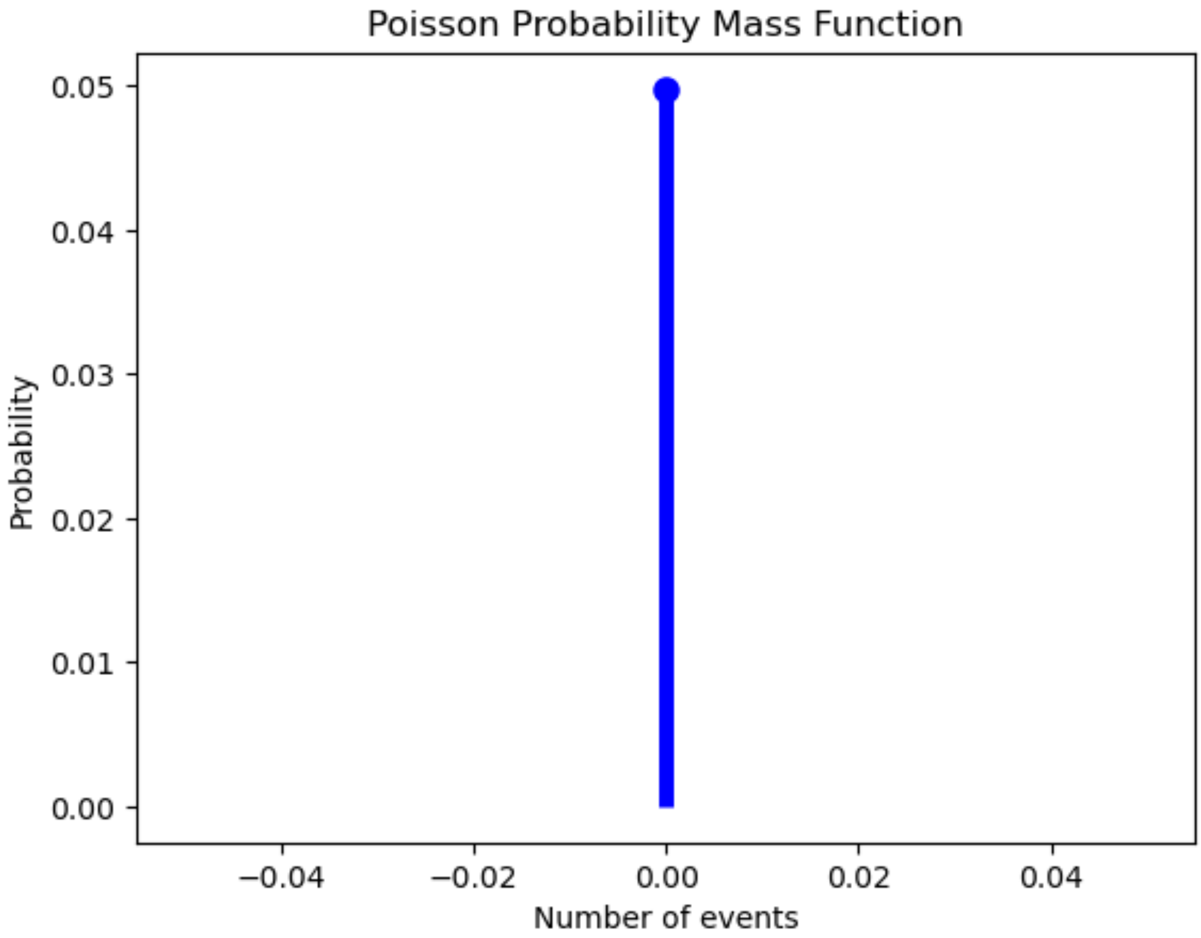
```
In [204…  # Plotting a basic histogram
          plt.hist(df1_variables["Anxiety disorders"], bins=100, color='skyblue', edge

          # Adding labels and title
          plt.xlabel('Anxiety Disorder')
          plt.ylabel('Spread')
          plt.title('Anxiety Spread')

          # Display the plot
          plt.show()
```



PMF for dataset used in this term project

In [218…

```
lam = 3

# Create an array of x values
x = np.arange(0,df1_variables["Bipolar disorders"].mean()).tolist()

# Create the Poisson probability mass function
pmf = poisson.pmf(x, lam)

# Create the plot
plt.plot(x, pmf, 'bo', ms=8)
plt.vlines(x, 0, pmf, colors='b', lw=5)
plt.title('Poisson Probability Mass Function')
plt.xlabel('Number of events')
plt.ylabel('Probability')
plt.show()
```


Poisson Probability Mass Function
Probability
0.05
0.04
0.03
0.02
0.01
0.00
−0.04
−0.02
0.00
0.02
0.04
Number of events

In [ ]:

In [ ]: