DSC530-302 Data Exploration and Analysis

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Title: "DSC530-302 Week-12 Final Project on Music and Mental health EDA analysis"

In [295…

```
import warnings
warnings.filterwarnings('ignore')

# Required python basic libraries

import numpy as np
import pandas as pd

#Required python visualization libraries

# import missingno as msno
import matplotlib
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
import plotly.graph_objects as go
#matplotlib inli

from os.path import basename, exists


def download(url):
    filename = basename(url)
    if not exists(filename):
        from urllib.request import urlretrieve

        local, _ = urlretrieve(url, filename)
        print("Downloaded " + local)


download("https://github.com/AllenDowney/ThinkStats2/raw/master/code/thinkstats2.py")
download("https://github.com/AllenDowney/ThinkStats2/raw/master/code/thinkplot.py")

import thinkstats2
import thinkplot

df = pd.read_csv("C:\\Users\\14024\\Desktop\\MS-DSC\\DSC-530\\Final-Project\\mxmh_surv

# Check first 5 rows of the dataset
df.head()
```

```
999999999.0
```

In [135…

```
# Check lat 5 rows of the dataset
df.tail()
```

Out[135]:

	Timestamp	Age	Primary streaming service	Hours per day	While working	Instrumentalist	Composer	Fav genre	Exploratory
731	10/30/2022 14:37:28	17.0	Spotify	2.0	Yes	Yes	No	Rock	Yes
732	11/1/2022 22:26:42	18.0	Spotify	1.0	Yes	Yes	No	Pop	Yes
733	11/3/2022 23:24:38	19.0	Other streaming service	6.0	Yes	No	Yes	Rap	Yes
734	11/4/2022 17:31:47	19.0	Spotify	5.0	Yes	Yes	No	Classical	No
735	11/9/2022 1:55:20	29.0	YouTube Music	2.0	Yes	No	No	Hip hop	Yes

5 rows × 33 columns

In [136…

```
# Check column name and datatype and constraints
# Identify the columns (variables) from the dataset will be used for analysis

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 736 entries, 0 to 735
Data columns (total 33 columns):
 #   Column                        Non-Null Count  Dtype  
---  ------                        --------------  -----  
 0   Timestamp                     736 non-null    object 
 1   Age                           735 non-null    float64
 2   Primary streaming service     735 non-null    object 
 3   Hours per day                 736 non-null    float64
 4   While working                 733 non-null    object 
 5   Instrumentalist               732 non-null    object 
 6   Composer                      735 non-null    object 
 7   Fav genre                     736 non-null    object 
 8   Exploratory                   736 non-null    object 
 9   Foreign languages             732 non-null    object 
 10  BPM                           629 non-null    float64
 11  Frequency [Classical]         736 non-null    object 
 12  Frequency [Country]           736 non-null    object 
 13  Frequency [EDM]               736 non-null    object 
 14  Frequency [Folk]              736 non-null    object 
 15  Frequency [Gospel]            736 non-null    object 
 16  Frequency [Hip hop]           736 non-null    object 
 17  Frequency [Jazz]              736 non-null    object 
 18  Frequency [K pop]             736 non-null    object 
 19  Frequency [Latin]             736 non-null    object 
 20  Frequency [Lofi]              736 non-null    object 
 21  Frequency [Metal]             736 non-null    object 
 22  Frequency [Pop]               736 non-null    object 
 23  Frequency [R&B]               736 non-null    object 
 24  Frequency [Rap]               736 non-null    object 
 25  Frequency [Rock]              736 non-null    object 
 26  Frequency [Video game music]  736 non-null    object 
 27  Anxiety                       736 non-null    float64
 28  Depression                    736 non-null    float64
 29  Insomnia                      736 non-null    float64
 30  OCD                           736 non-null    float64
 31  Music effects                 728 non-null    object 
 32  Permissions                   736 non-null    object 
dtypes: float64(7), object(26)
memory usage: 189.9+ KB
```

Identify the variables will be used during analysis and describe them

```
    1.   Age                           : Respondent's age
    2.   Primary streaming service     : Respondent's primary
streaming service.
    3.   Hours per day                 : Number of hours the
respondent listens to music per day.
    4.   Anxiety                       : Anxiety level between 1 to
10.
    5.   Depression                    : Depression level between 1 to
10.
    6.   Insomnia                      : Insomnia level between 1 to
10.
    7.   BPM                           : BPM is the abbreviation of
beats per minute, a musical term
                                         that means measuring the
```

```
tempo of the music.
    8.   While working                  : Does the respondent listen to
music while studying/working?
    9.   Instrumentalist                : Does the respondent play an
instrument regularly?
   10.   Composer                       : Does the respondent compose
music?
   11.   Fav genre                      : Respondent's favorite or top
genre?
   12.   Exploratory                    : Does the respondent actively
explore new artists/genres?
   13.   Foreign languages              : Listen to Foreign language
music?
```

In [139…

```python
# Check Age wise record count in the dataset

print(df['Age'].value_counts())
print("\n \n")

# Display unique Streaming services from the dataset
print(df['Primary streaming service'].unique())
```

```
18.0    85
19.0    61
17.0    59
21.0    52
16.0    44
        ..
39.0     1
73.0     1
72.0     1
69.0     1
89.0     1
Name: Age, Length: 61, dtype: int64



['Spotify' 'Pandora' 'YouTube Music' 'I do not use a streaming service.'
 'Apple Music' 'Other streaming service' nan]
```

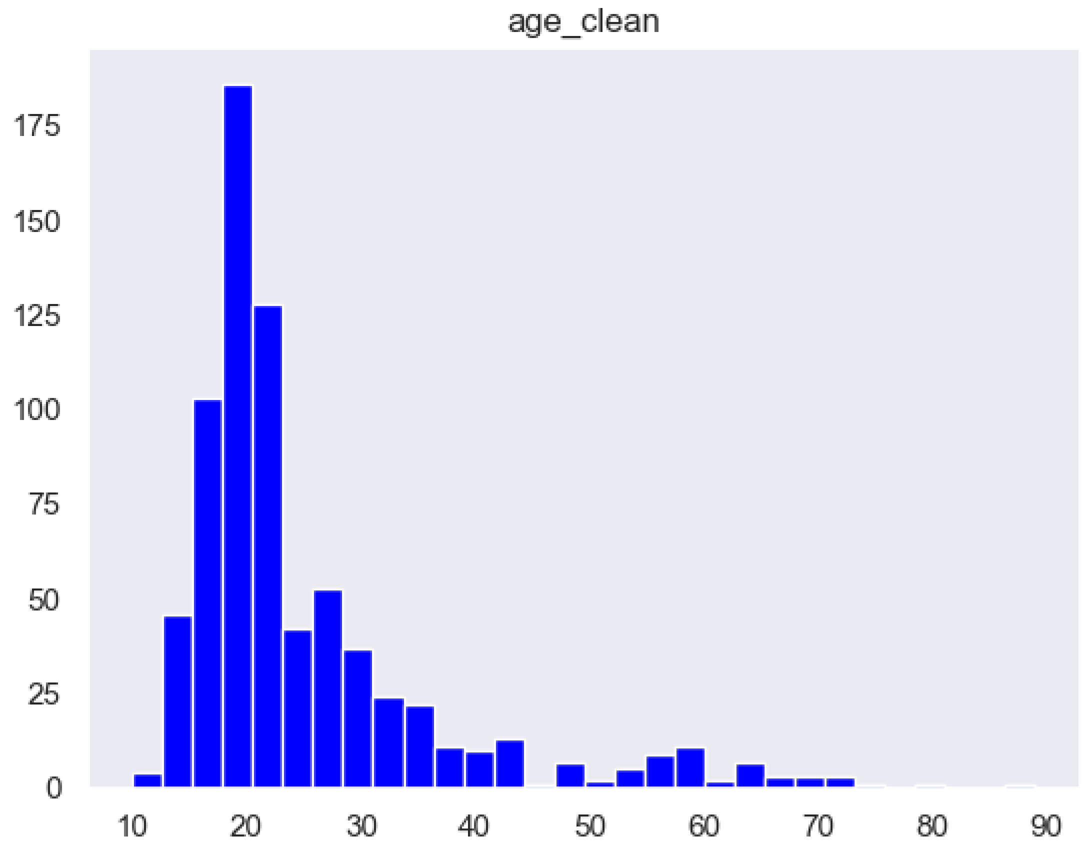
Include a histogram of each of the 5 variables and identify any outliers

In [296…

```python
# Explore the numeric variable Age to confirm whether all values are within a reasonab
print("'Age'")
print("Minimum value: ", df["Age"].min())
print("Maximum value: ", df["Age"].max())
print("How many values are NaN?: ", pd.isnull(df['Age']).sum())

# Create a new column "age_clean" that replaces out-of-range ages with "NaN"

def clean_age(Age):
    if Age>=0 and Age<=90:
        return Age
    else:
        return np.nan
df['age_clean'] = df['Age'].apply(clean_age)
```

```
# Check out the new column and make sure it looks right

print("'Age'")
print("Minimum value: ", df["age_clean"].min())
print("Maximum value: ", df["age_clean"].max())
print("How many values are NaN?: ", pd.isnull(df['age_clean']).sum())
print("Frequency table for age_clean:")
df["age_clean"].value_counts().sort_index(0)

# Plot a histogram of the respondents' ages (remove any NaN values)

df.hist(['age_clean'], bins=30, color='blue', grid=False)
```

```
'Age'
Minimum value:  10.0
Maximum value:  89.0
How many values are NaN?:  1
'Age'
Minimum value:  10.0
Maximum value:  89.0
How many values are NaN?:  1
Frequency table for age_clean:
999999999.0
```



In [152…

```
print("Ages for which record count is more than 50 in dataset:")

df['age_clean'].value_counts().loc[lambda x : x>50]
```

```
Ages for which record count is more than 50 in dataset:
```

Out[152]:

```
18.0    85
19.0    61
17.0    59
21.0    52
Name: age_clean, dtype: int64
```

In [153…

```
df['age_clean'].max()

# Most respondents are in their late teens or early twenties. A single 89 year old res
```

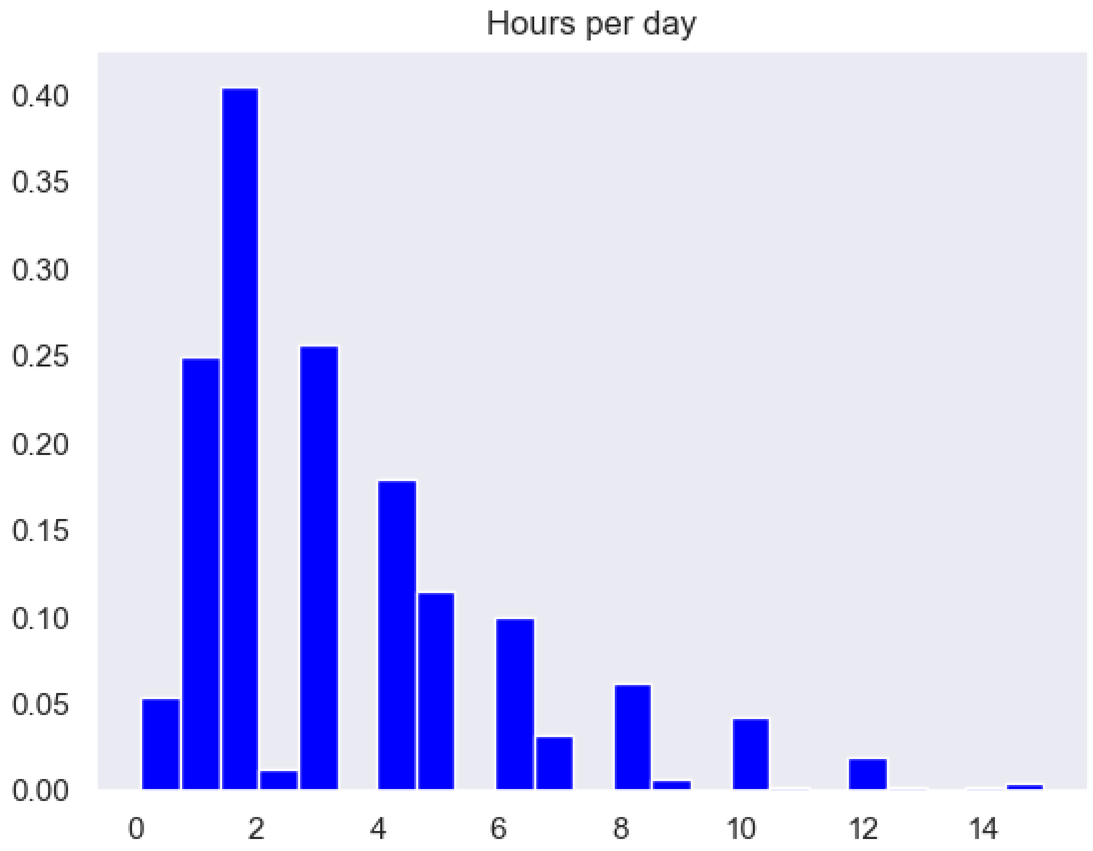
Out[153]:

```
89.0
```

In [297…

```
# majority of respondents listen to music between 0-5 hours per day. Total 24 responde
# to music more than 12Hrs a day. 3 respondents claims they listen music 24hrs a day w
# Data also contains 0 in hours per day, which will consider outliers for this analysi

df = df[(df['Hours per day'] <= 15) & (df['Hours per day'] > 0)]
print('Max Hours per day:' , df['Hours per day'].max())
print('Min Hours per day:' , df['Hours per day'].min())

# Evaluate variable 'Hours per day' from the dataset and plot histogram and identify c

df.hist(['Hours per day'], bins='auto', density=True, color = 'blue', grid=False)

df['Hours per day'].value_counts().loc[lambda x : x>1]
```

```
Max Hours per day: 15.0
Min Hours per day: 0.1
999999999.0
```



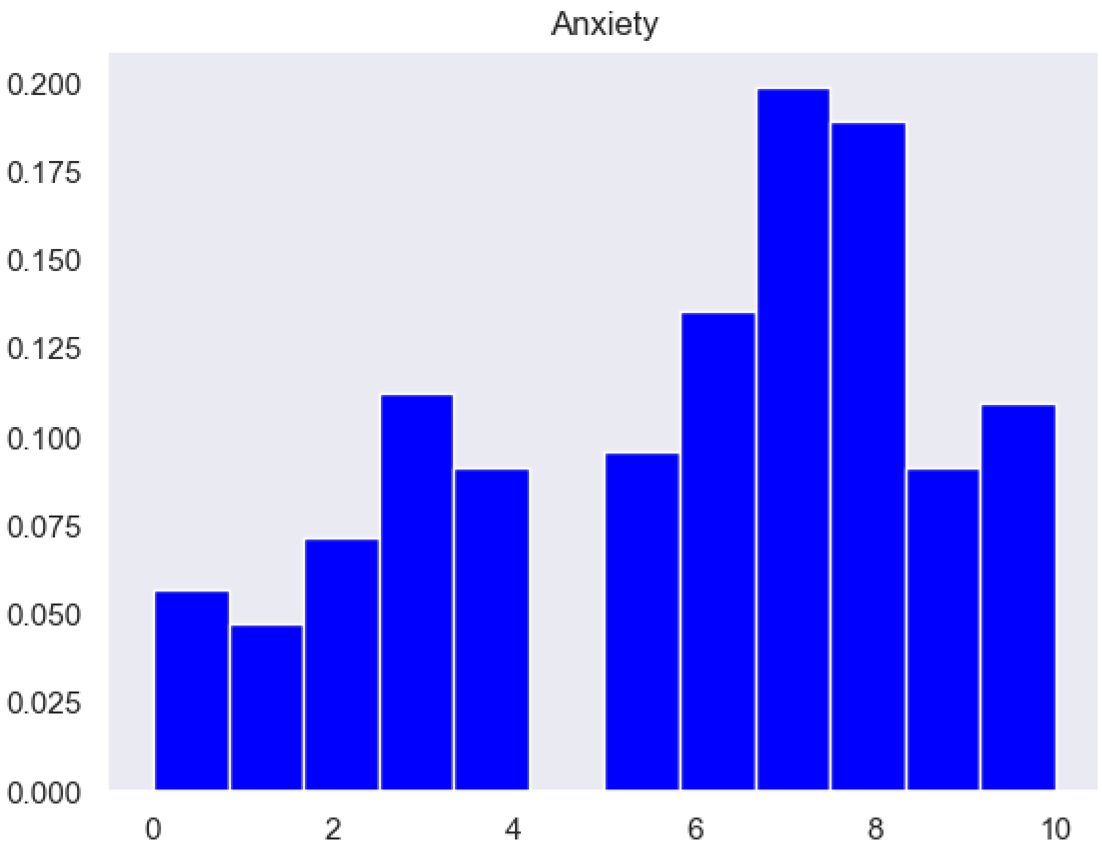
In [278…

```
# Histogram plot based on Anxiety

df.hist(['Anxiety'], bins='auto', density=True, color = 'blue', grid=False)
```

```
# All respondent provided input for Anxiety based on the scale of 1 to 10. So don't fi
```

Out[278]:

```
array([[<AxesSubplot:title={'center':'Anxiety'}>]], dtype=object)
```

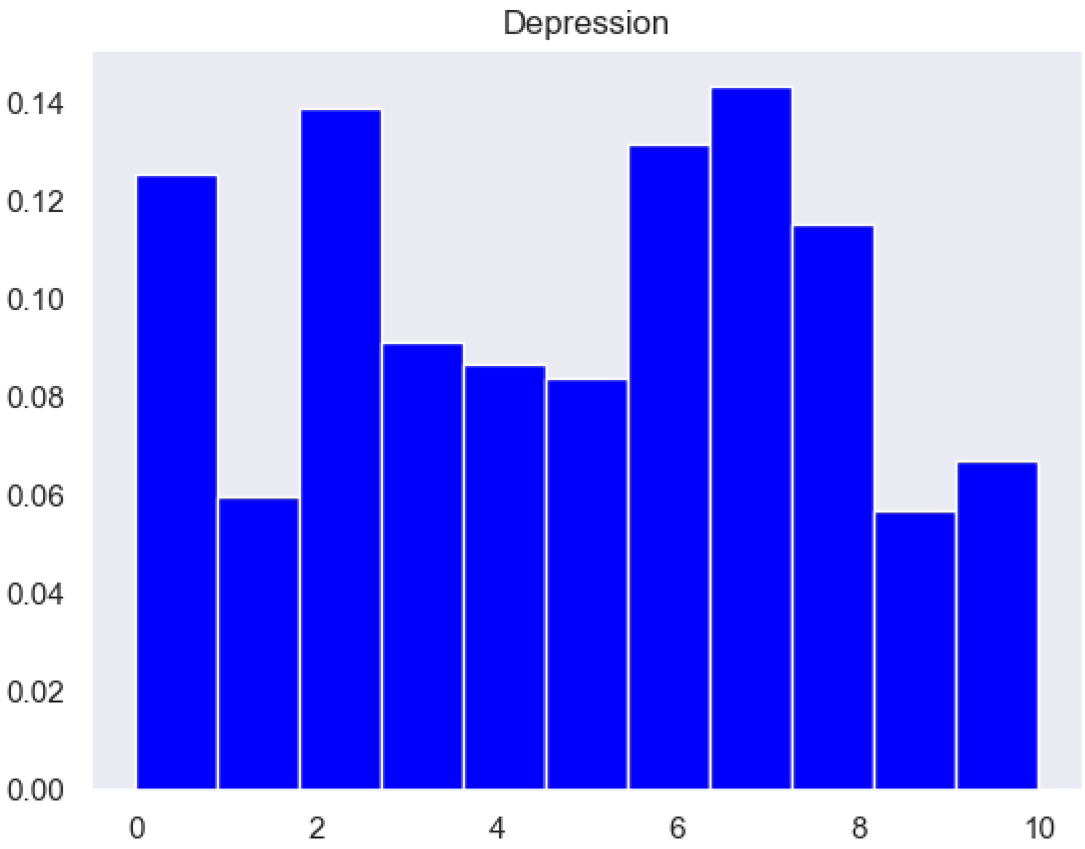


In [276…

```
# Histogram plot based on Depression

df.hist(['Depression'], bins='auto', density=True, color = 'blue', grid=False)

# All respondent provided input for Depression based on the scale of 1 to 10. So don't
```

Out[276]:

```
array([[<AxesSubplot:title={'center':'Depression'}>]], dtype=object)
```

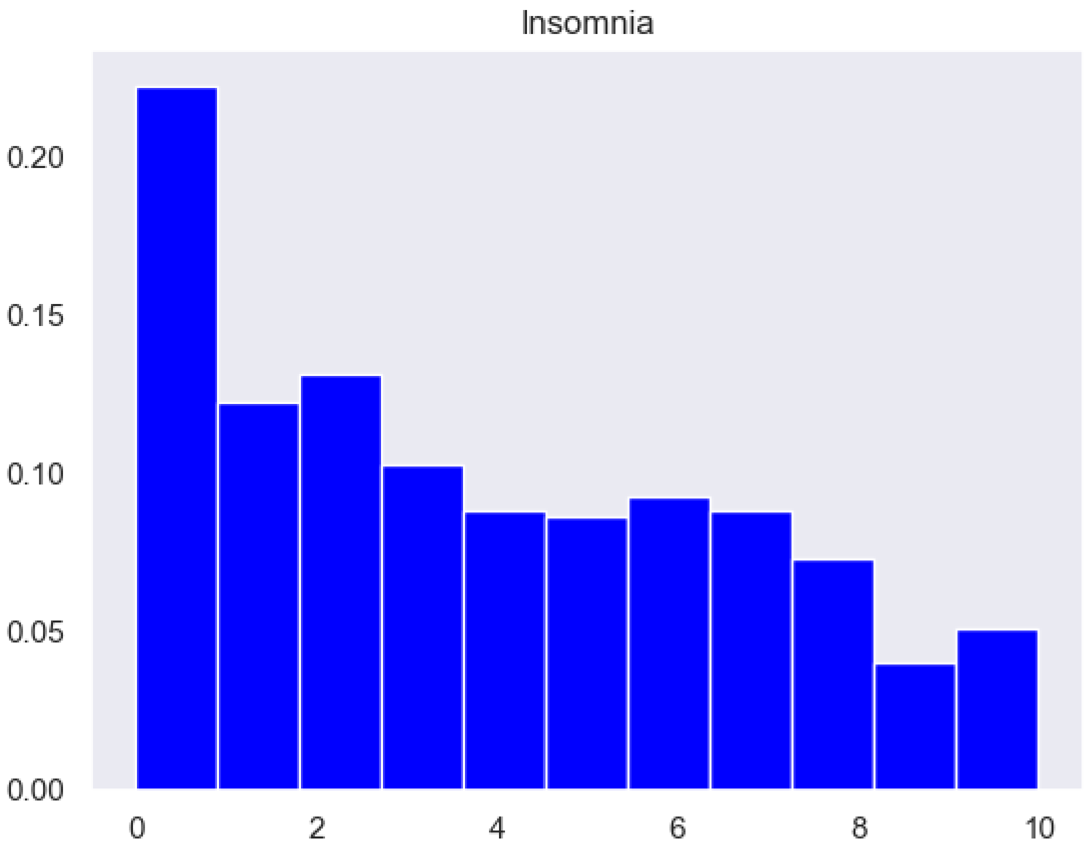


In [277…

```
# Histogram plot based on Insomnia

df.hist(['Insomnia'], bins='auto', density=True, color = 'blue', grid=False)

# All respondent provided input for Insomnia based on the scale of 1 to 10. So don't f
```

Out[277]:

```
array([[<AxesSubplot:title={'center':'Insomnia'}>]], dtype=object)
```



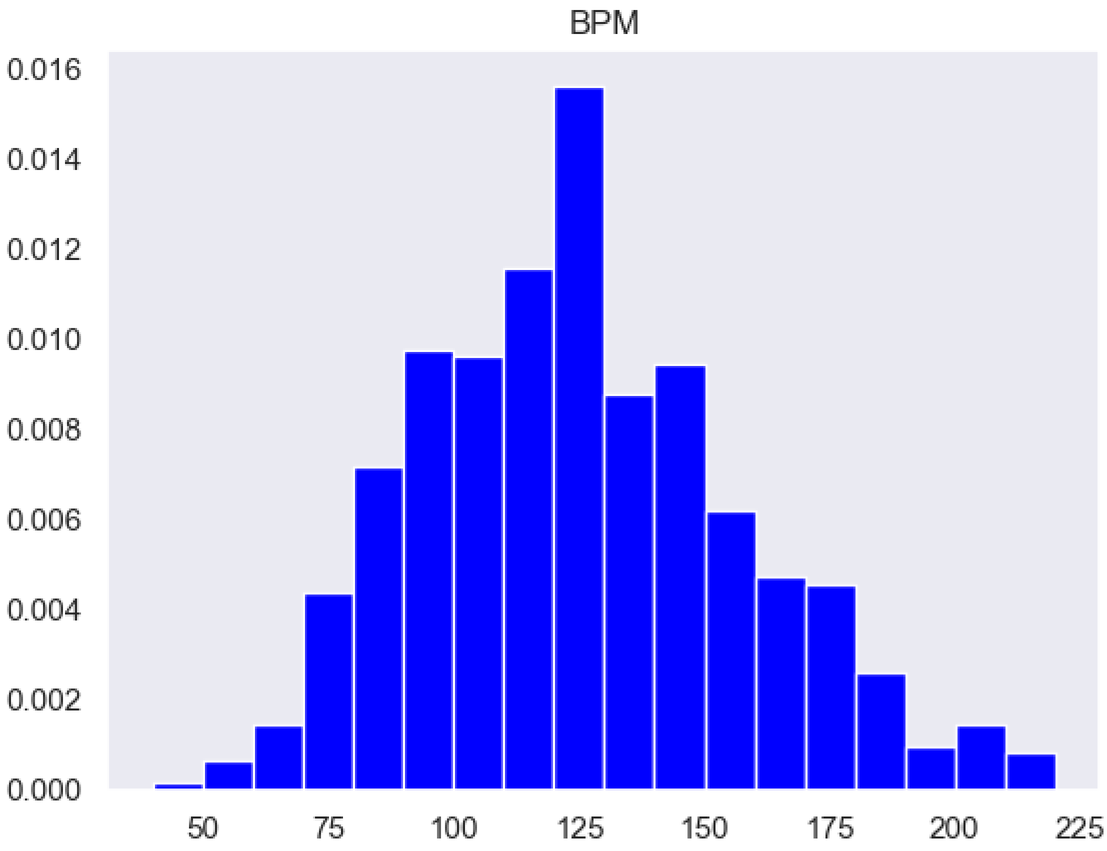
In [298…

```
# Remove outliers from BPM and plot histogram

print(df['BPM'].max())
print(df['BPM'].min())

# filter out outliers by creating upper and lower bounds

df = df[(df.BPM < 500) & (df.BPM > 20)]
print(df['BPM'].max())
print(df['BPM'].min())

# Histogram plot based on BPM

df.hist(['BPM'], bins='auto', density=True, color = 'blue', grid=False)
```

```
999999999.0
0.0
220.0
40.0
```

Out[298]:

```
array([[<AxesSubplot:title={'center':'BPM'}>]], dtype=object)
```



Include the other descriptive characteristics about the variables

In [176…

```
# Calculate the mean, modes, variance and standard deviation of different numeric vari

print('Calculated Age mean:' , df.age_clean.mean())
print('Calculated Age mode:' , df.age_clean.mode())
print('Calculated Age var:' , df.age_clean.var())
print('Calculated Age std:' , df.age_clean.std())

print('Calculated Hours per day mean:' , df['Hours per day'].mean())
print('Calculated Hours per day mode:' , df['Hours per day'].mean())
print('Calculated Hours per day var:' , df['Hours per day'].mean())
print('Calculated Hours per day std:' , df['Hours per day'].mean())

print('Calculated Anxiety mean:' , df.Anxiety.mean())
print('Calculated Anxiety mode:' , df.Anxiety.mode())
print('Calculated Anxiety var:' , df.Anxiety.var())
print('Calculated Anxiety std:' , df.Anxiety.std())

print('Calculated Depression mean:' , df.Depression.mean())
print('Calculated Depression mode:' , df.Depression.mode())
print('Calculated Depression var:' , df.Depression.var())
print('Calculated Depression std:' , df.Depression.std())

print('Calculated Insomnia mean:' , df.Anxiety.mean())
print('Calculated Insomnia mode:' , df.Anxiety.mode())
print('Calculated Insomnia var:' , df.Anxiety.var())
print('Calculated Insomnia std:' , df.Anxiety.std())
```

```
Calculated Age mean: 25.206802721088437
Calculated Age mode: 0    18.0
Name: age_clean, dtype: float64
Calculated Age var: 145.32229698418882
Calculated Age std: 12.05496980436653
Calculated Hours per day mean: 3.5727581521739125
Calculated Hours per day mode: 3.5727581521739125
Calculated Hours per day var: 3.5727581521739125
Calculated Hours per day std: 3.5727581521739125
Calculated Anxiety mean: 5.837635869565218
Calculated Anxiety mode: 0    7.0
Name: Anxiety, dtype: float64
Calculated Anxiety var: 7.801153042738856
Calculated Anxiety std: 2.7930544288894295
Calculated Depression mean: 4.796195652173913
Calculated Depression mode: 0    7.0
Name: Depression, dtype: float64
Calculated Depression var: 9.174053534457263
Calculated Depression std: 3.028870009501442
Calculated Insomnia mean: 5.837635869565218
Calculated Insomnia mode: 0    7.0
Name: Anxiety, dtype: float64
Calculated Insomnia var: 7.801153042738856
Calculated Insomnia std: 2.7930544288894295
```

In [272…

```
# Spotify is the most popular music streaming service, accounting for 62% of all respo
# Apple Music, also has a marginally younger userbase than other streaming platforms.
# by far, with the median user age at ~60 years old.

s_df = df.groupby(['Primary streaming service'])
s_ages = []
s_ages.append(s_df['Age'].median())

s_ages
```

Out[272]:

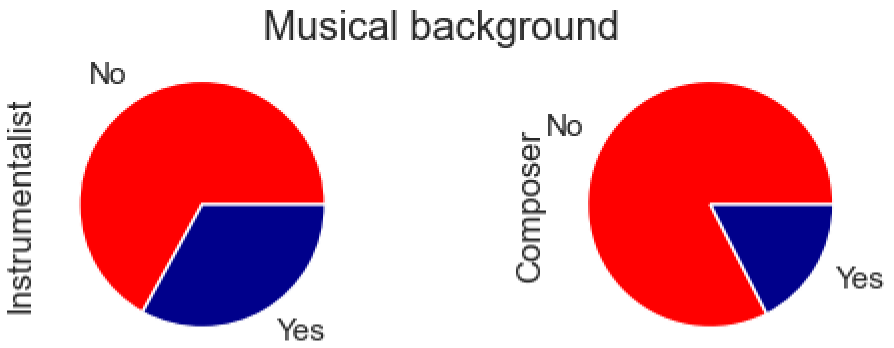
```
[Primary streaming service
 Apple Music                          20.0
 I do not use a streaming service.    24.0
 Other streaming service              25.0
 Pandora                              60.0
 Spotify                              20.0
 YouTube Music                        22.0
 Name: Age, dtype: float64]
```

In [317…

```
# Does most of the music listener likes to play instrument or music composer who liste
fig = plt.figure(figsize=(6,2))

plt.suptitle("Musical background")

ax = fig.add_subplot(121)

inst = df['Instrumentalist'].value_counts()
inst.plot(kind='pie', colors = ["red", "darkblue"], labeldistance = 1.2)

ax = fig.add_subplot(122)

comp = df['Composer'].value_counts()
comp.plot(kind='pie', colors = ["red", "darkblue"], labeldistance = 1.2)
```

Out[317]:

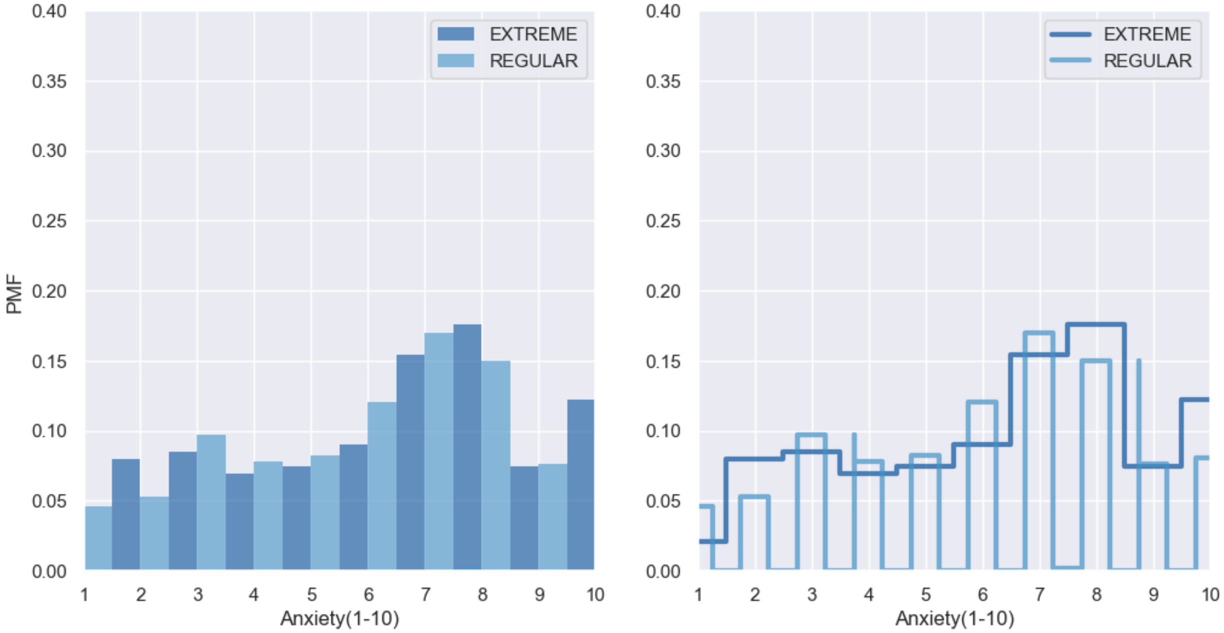
```
<AxesSubplot:ylabel='Composer'>
```



Compare two scenarios in your data using a PMF

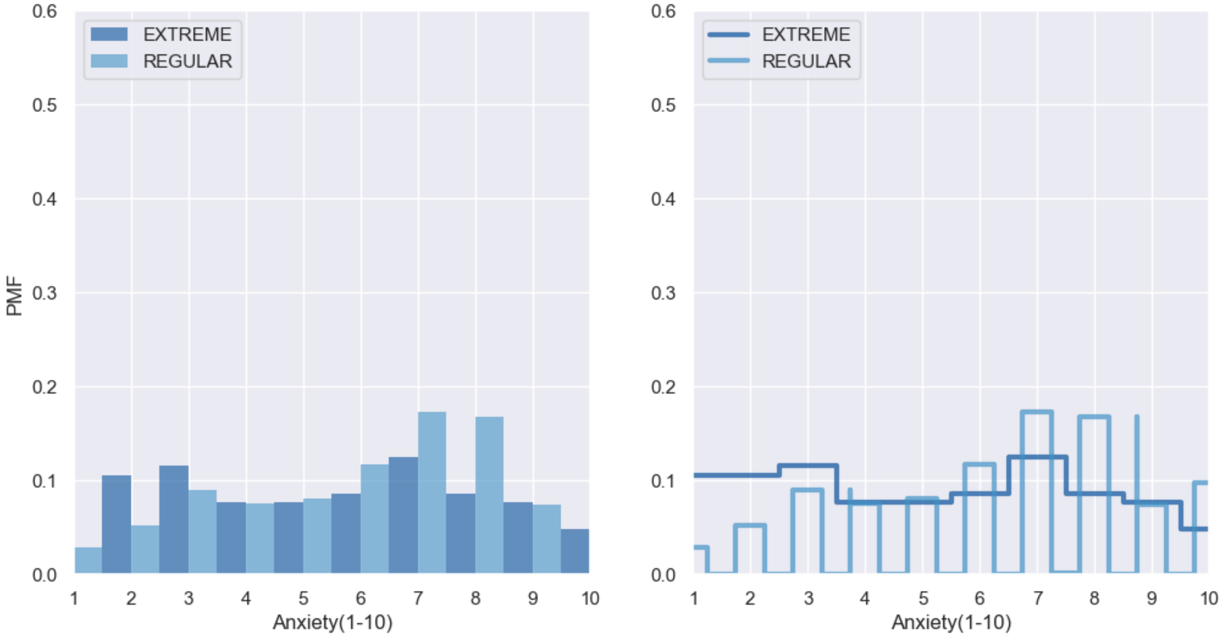
In [230…

```
# plotting of Anxiety based on hours per day music listening. difference in probabilit
# between Hours per day >= 5 and less than 5.

import thinkstats2
import thinkplot

extr_hpd = df[df['Hours per day'] >= 5]
extr_anx = extr_hpd.Anxiety
rglr_hpd = df[df['Hours per day'] < 5]

n = hist.Total()
pmf = hist.Copy()
for x, freq in hist.Items():
    pmf[x] = freq / n

first_pmf = thinkstats2.Pmf(extr_hpd.Anxiety, label="EXTREME")
other_pmf = thinkstats2.Pmf(rglr_hpd.Anxiety, label="REGULAR")

width = 0.5
axis = [1, 10, 0, .4]
thinkplot.PrePlot(2, cols=2)
thinkplot.Hist(first_pmf, align="right", width=width)
thinkplot.Hist(other_pmf, align="left", width=width)
thinkplot.Config(xlabel="Anxiety(1-10)", ylabel="PMF", axis=axis)

thinkplot.PrePlot(2)
thinkplot.SubPlot(2)
thinkplot.Pmfs([first_pmf, other_pmf])
thinkplot.Config(xlabel="Anxiety(1-10)", axis=axis)
```



In [247…

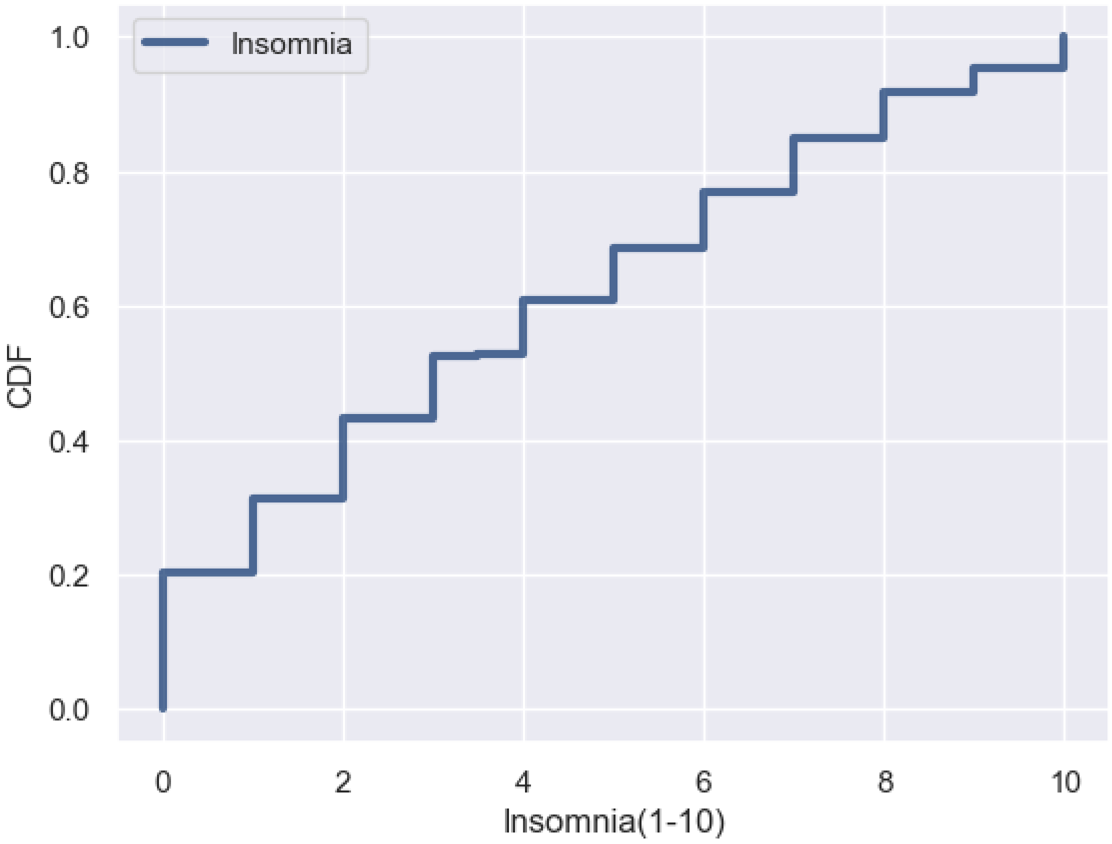
```
# ploting of Anxiety based on Age. difference in probability of Anxiety (in percentage
# between Age greater than 35 and less than 35.

import thinkstats2
import thinkplot

grown_age = df[df.Age >= 35]
extr_anx = grown_age.Anxiety
rglr_age = df[df.Age < 35]

n = hist.Total()
pmf = hist.Copy()
for x, freq in hist.Items():
    pmf[x] = freq / n

first_pmf = thinkstats2.Pmf(grown_age.Anxiety, label="EXTREME")
other_pmf = thinkstats2.Pmf(rglr_age.Anxiety, label="REGULAR")

width = 0.5
axis = [1, 10, 0, .6]
thinkplot.PrePlot(2, cols=2)
thinkplot.Hist(first_pmf, align="right", width=width)
thinkplot.Hist(other_pmf, align="left", width=width)
thinkplot.Config(xlabel="Anxiety(1-10)", ylabel="PMF", axis=axis)

thinkplot.PrePlot(2)
thinkplot.SubPlot(2)
thinkplot.Pmfs([first_pmf, other_pmf])
thinkplot.Config(xlabel="Anxiety(1-10)", axis=axis)
```



Create 1 CDF with one of your variables

In [246…

```
# ploting CDF against the Insomnia (1-10) rating provided by the respondent in the sur

cdf = thinkstats2.Cdf(df.Insomnia, label='Insomnia')
thinkplot.Cdf(cdf)
thinkplot.Config(xlabel='Insomnia(1-10)', ylabel='CDF', loc='upper left')
```



In [241…

```
# cdf provides probability, it computes the fraction of values less than or equal to t
# respondent have entered Insomnia 7 or less.
```

```
cdf.Prob(7)
```

Out[241]:

```
0.8505434782608695
```

In [243…

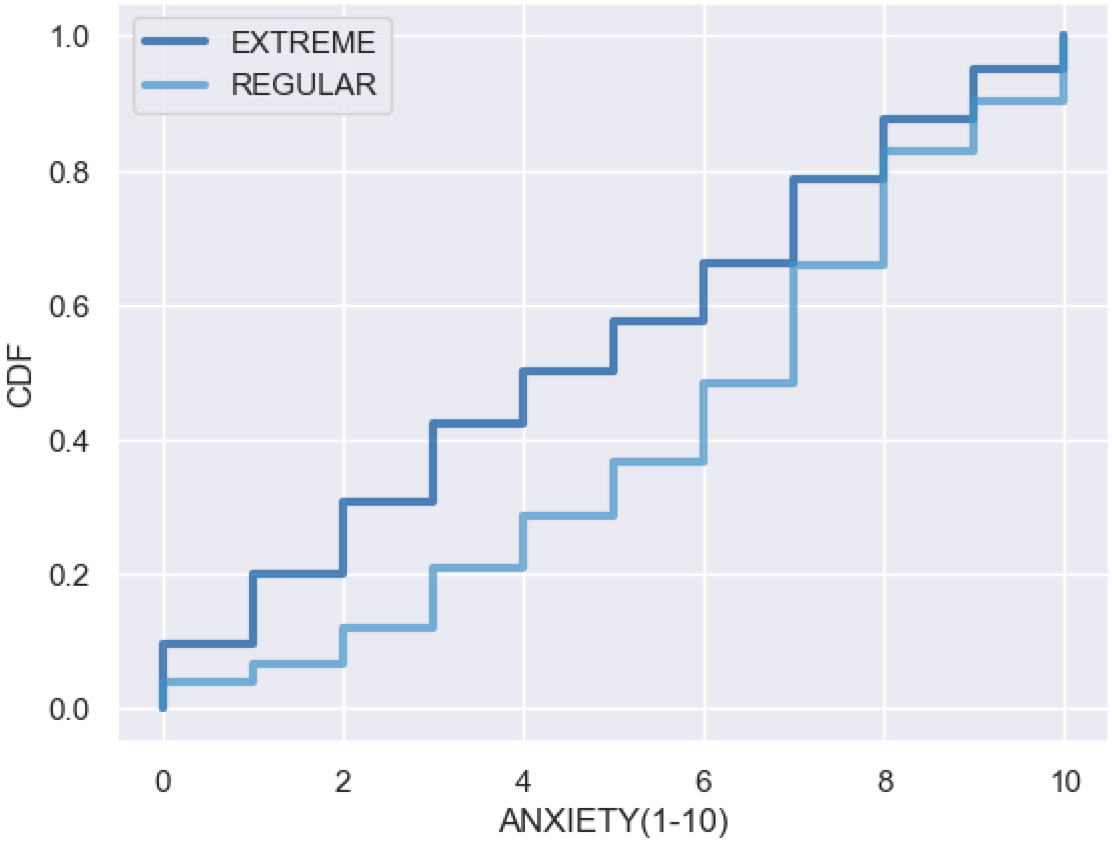
```
# Value evaluates the inverse CDF, given a fraction, it computes the corresponding val

cdf.Value(0.5)
```

Out[243]:

```
3.0
```

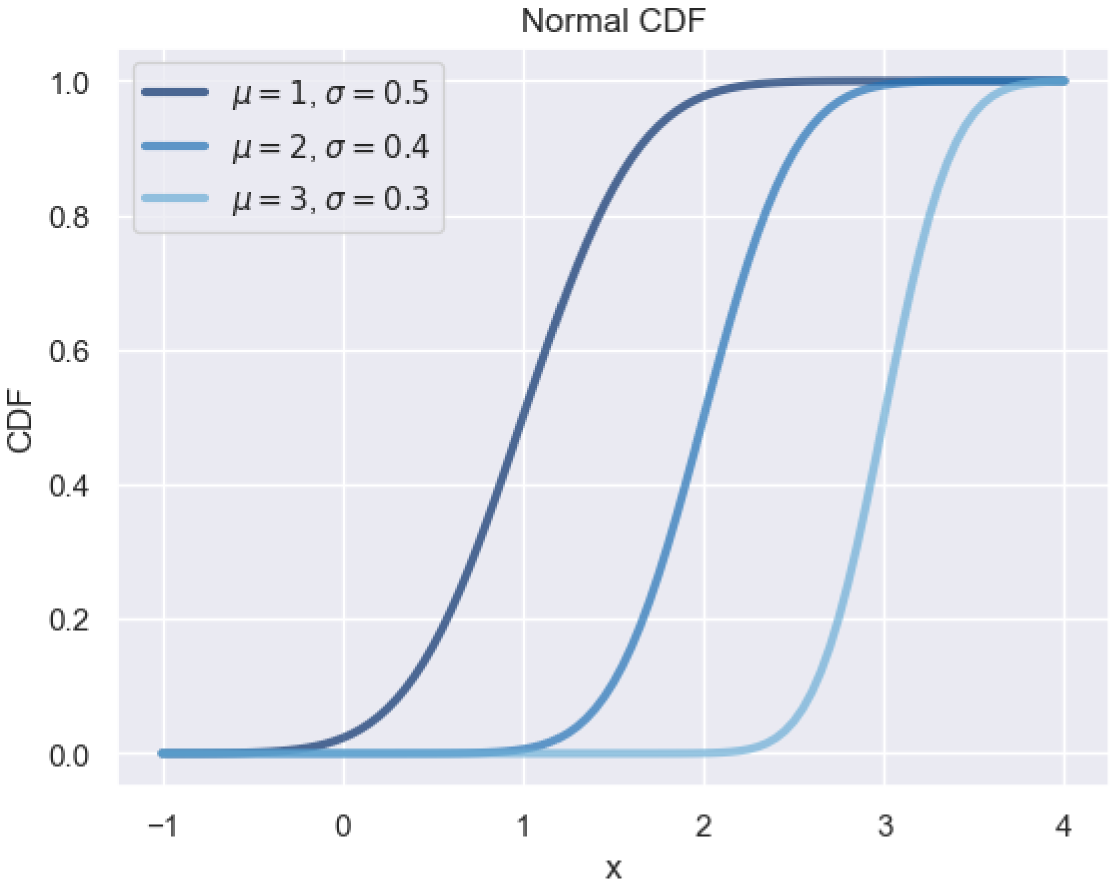
In [249…

```
# CDF vs EXTREME and REGULAR ANXIETY ploting.

first_cdf = thinkstats2.Cdf(extr_hpd.Anxiety, label='EXTREME')
other_cdf = thinkstats2.Cdf(rglr_hpd.Anxiety, label='REGULAR')

thinkplot.PrePlot(2)
thinkplot.Cdfs([first_cdf, other_cdf])
thinkplot.Config(xlabel='ANXIETY(1-10)', ylabel='CDF')
```



In [250…

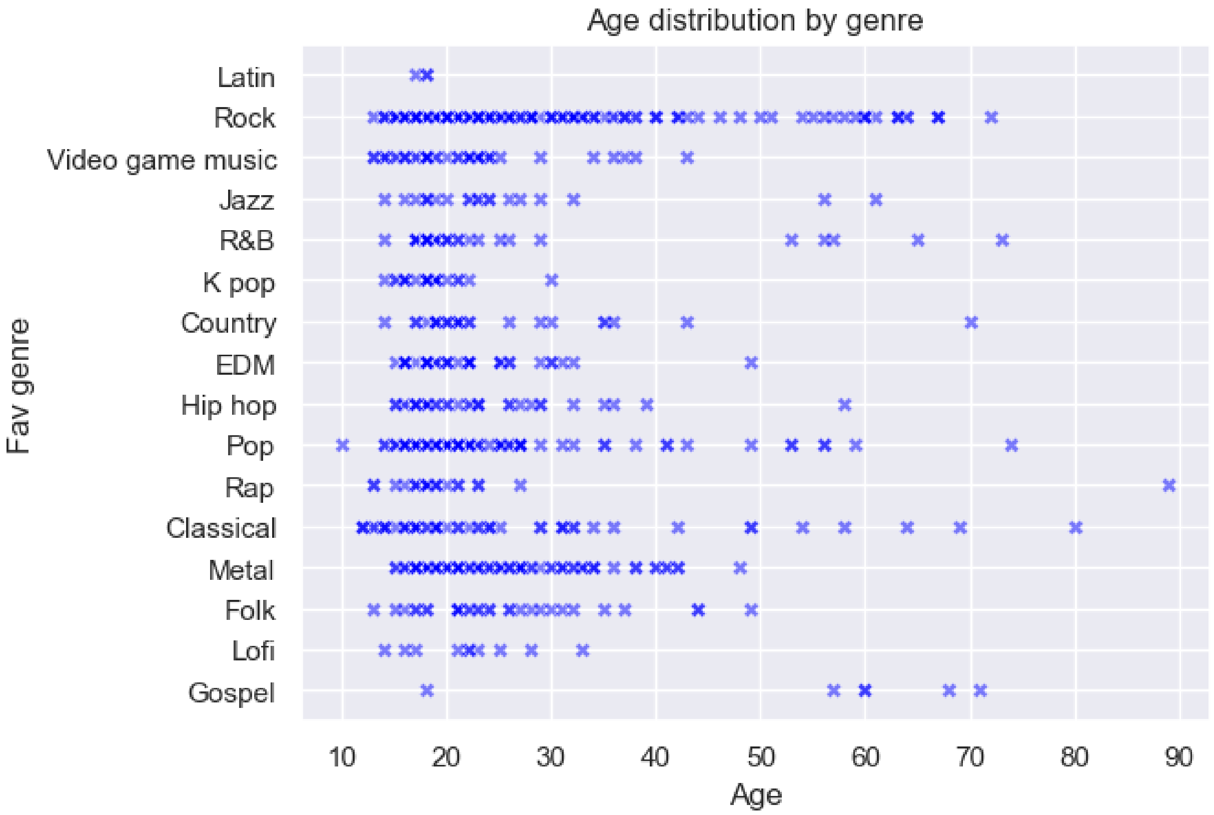
```
thinkplot.PrePlot(3)

mus = [1.0, 2.0, 3.0]
sigmas = [0.5, 0.4, 0.3]
for mu, sigma in zip(mus, sigmas):
    xs, ps = thinkstats2.RenderNormalCdf(mu=mu, sigma=sigma, low=-1.0, high=4.0)
    label = r"$\mu=%g$, $\sigma=%g$" % (mu, sigma)
    thinkplot.Plot(xs, ps, label=label)

thinkplot.Config(title="Normal CDF", xlabel="x", ylabel="CDF", loc="upper left")
```



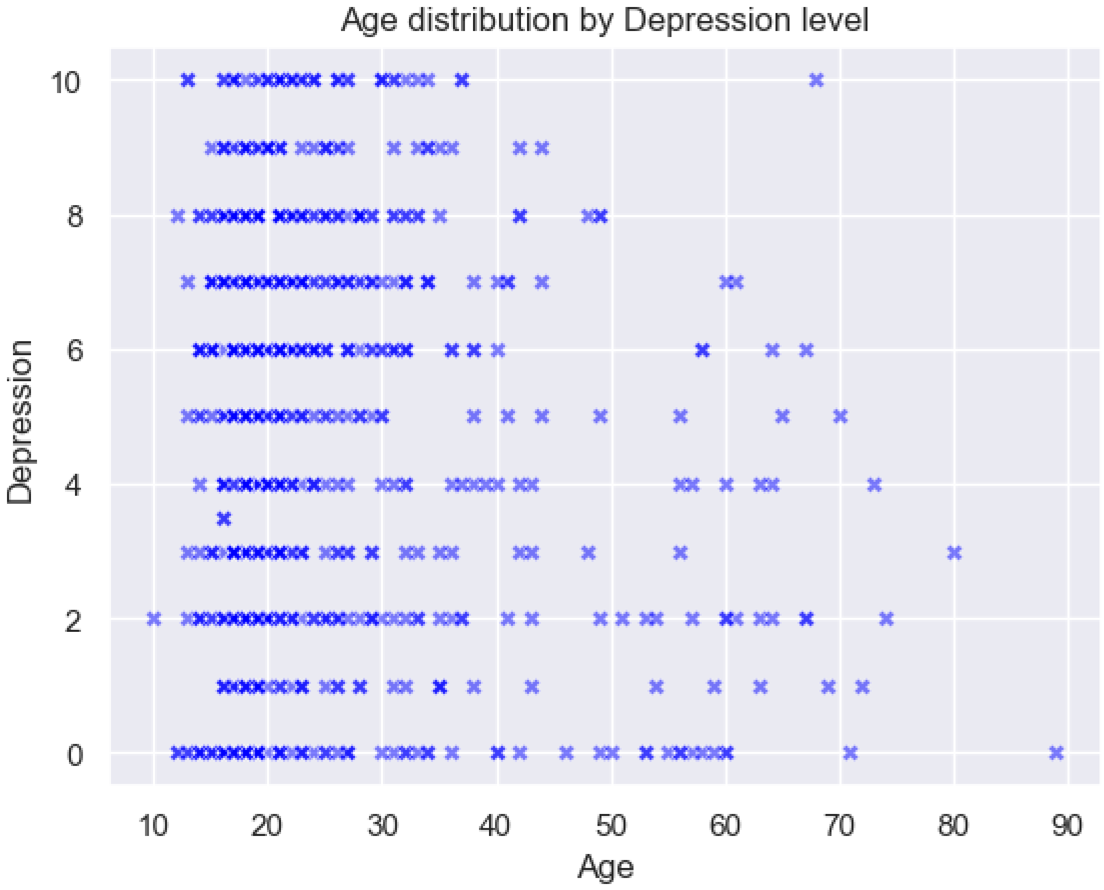
Create two scatter plots comparing two variables and provide your analysis on correlation and causation.

In [253…

```
sns.scatterplot(data=df, y="Fav genre", x="Age", alpha = 0.5, marker = "X", color = "E
plt.title('Age distribution by genre');

# Rock has the most diverse range of ages. Classical and Pop listeners also have a wic
# to other genres. Some music genres, such as K pop and Lofi appear to attract a more
```



```
In [254…
sns.scatterplot(data=df, y="Depression", x="Age", alpha = 0.5, marker = "X", color = '
plt.title('Age distribution by Depression level');
```



In [262…

```
cleaned = df.dropna(subset=['Age', 'Anxiety'])

def Cov(xs, ys, meanx=None, meany=None):
    xs = np.asarray(xs)
    ys = np.asarray(ys)

    if meanx is None:
        meanx = np.mean(xs)
    if meany is None:
        meany = np.mean(ys)

    cov = np.dot(xs-meanx, ys-meany) / len(xs)
    return cov

Age, Anxiety = cleaned.Age, cleaned.Anxiety
Cov(Age, OCD)
```

Out[262]:

```
-4.447559813040863
```

In [263…

```
def Corr(xs, ys):
    xs = np.asarray(xs)
    ys = np.asarray(ys)

    meanx, varx = thinkstats2.MeanVar(xs)
    meany, vary = thinkstats2.MeanVar(ys)

    corr = Cov(xs, ys, meanx, meany) / np.sqrt(varx * vary)
    return corr

Corr(Age, Anxiety)
```

Out[263]:

```
-0.1766620165968846
```

In [264…

```
np.corrcoef(Age, Anxiety)
```

Out[264]:

```
array([[ 1.        , -0.17666202],
       [-0.17666202,  1.        ]])
```

In [265…

```
import pandas as pd

def SpearmanCorr(xs, ys):
    xranks = pd.Series(xs).rank()
    yranks = pd.Series(ys).rank()
    return Corr(xranks, yranks)

SpearmanCorr(Age, Anxiety)
```

Out[265]:

```
-0.0694192637435047
```

In [269…

```
class PregLengthTest(thinkstats2.HypothesisTest):

    def MakeModel(self):
        firsts, others = self.data
        self.n = len(firsts)
        self.pool = np.hstack((firsts, others))

        pmf = thinkstats2.Pmf(self.pool)
        self.values = range(35, 44)
        self.expected_probs = np.array(pmf.Probs(self.values))

    def RunModel(self):
        np.random.shuffle(self.pool)
        data = self.pool[:self.n], self.pool[self.n:]
        return data

    def TestStatistic(self, data):
        firsts, others = data
        stat = self.ChiSquared(firsts) + self.ChiSquared(others)
        return stat

    def ChiSquared(self, lengths):
        hist = thinkstats2.Hist(lengths)
        observed = np.array(hist.Freqs(self.values))
        expected = self.expected_probs * len(lengths)
        stat = sum((observed - expected)**2 / expected)
        return stat

data = grown_age.Anxiety.values, rglr_age.Anxiety.values
ht = PregLengthTest(data)
p_value = ht.PValue()
print('p-value =', p_value)
print('actual =', ht.actual)
print('ts max =', ht.MaxTestStat())
```

```
p-value = 0.0
actual = nan
ts max = nan
```

For this project, conduct a regression analysis on either one dependent and one explanatory variable

In [270…

```
import statsmodels.formula.api as smf

formula = 'Anxiety ~ Age'
model = smf.ols(formula, data=live)
results = model.fit()
results.summary()
```

Out[270]:

OLS Regression Results

Dep. Variable:	Anxiety	**R-squared:**	0.029
Model:	OLS	**Adj. R-squared:**	0.027
Method:	Least Squares	**F-statistic:**	20.73
Date:	Sat, 03 Jun 2023	**Prob (F-statistic):**	6.24e-06
Time:	01:42:06	**Log-Likelihood:**	-1709.2
No. Observations:	704	**AIC:**	3422.
Df Residuals:	702	**BIC:**	3431.
Df Model:	1		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
Intercept	6.8176	0.239	28.473	0.000	6.347	7.288
Age	-0.0392	0.009	-4.553	0.000	-0.056	-0.022

Omnibus:	55.858	**Durbin-Watson:**	1.947
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	33.662
Skew:	-0.397	**Prob(JB):**	4.90e-08
Kurtosis:	2.281	**Cond. No.**	64.4

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

In [271…

```
formula = 'Age ~ Insomnia + Anxiety'
results = smf.ols(formula, data=live).fit()
results.summary()
```

Out[271]:

OLS Regression Results

Dep. Variable:	Age	**R-squared:**	0.032
Model:	OLS	**Adj. R-squared:**	0.029
Method:	Least Squares	**F-statistic:**	11.62
Date:	Sat, 03 Jun 2023	**Prob (F-statistic):**	1.08e-05
Time:	01:44:39	**Log-Likelihood:**	-2738.1
No. Observations:	704	**AIC:**	5482.
Df Residuals:	701	**BIC:**	5496.
Df Model:	2		
Covariance Type:	nonrobust		

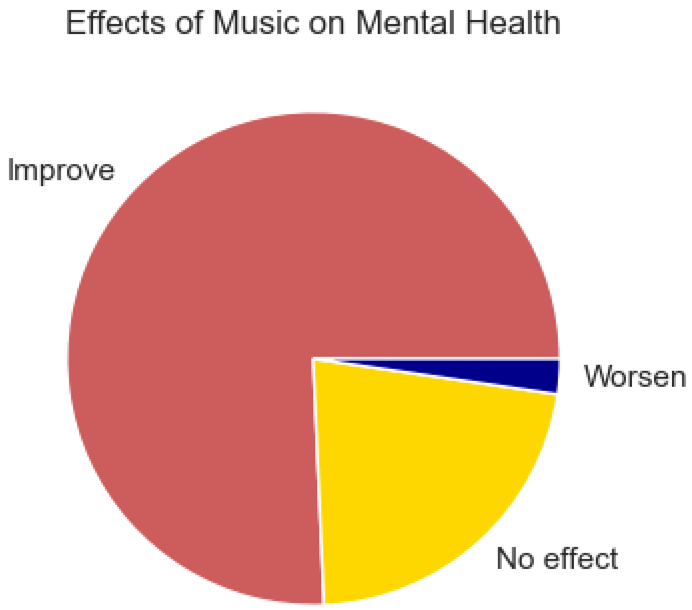
	coef	std err	t	P>|t|	[0.025	0.975]
Intercept	28.9243	1.072	26.982	0.000	26.820	31.029
Insomnia	0.2395	0.152	1.574	0.116	-0.059	0.538
Anxiety	-0.8132	0.169	-4.821	0.000	-1.144	-0.482

Omnibus:	292.658	**Durbin-Watson:**	1.659
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	1040.320
Skew:	2.011	**Prob(JB):**	1.25e-226
Kurtosis:	7.393	**Cond. No.**	18.7

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

In [301…

```
# Effects of Music on Mental health, pie diagram

plt.figure(figsize=(5,4))
plt.title('Effects of Music on Mental Health')

effects = df['Music effects'].value_counts()
effects.plot(kind='pie', colors = ["indianred", "gold", "darkblue"], ylabel= '');
```

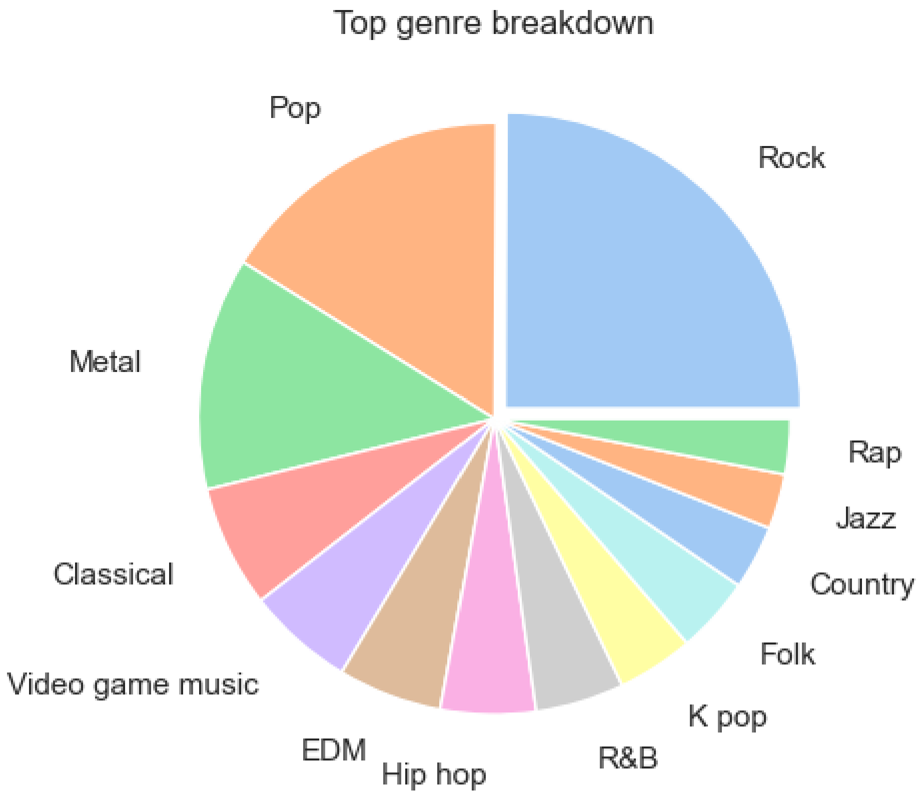


In [302…

```
# Most popular genre of music as per the survey data

genre = df["Fav genre"].value_counts().loc[lambda x: x>10]
genre.plot(kind='pie', labeldistance = 1.2,
            explode=[0.05, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,],
            colors = sns.color_palette('pastel')[0:13])

plt.title('Top genre breakdown')
plt.ylabel("")

# Rock is the most popular followed by pop and Metal.
```

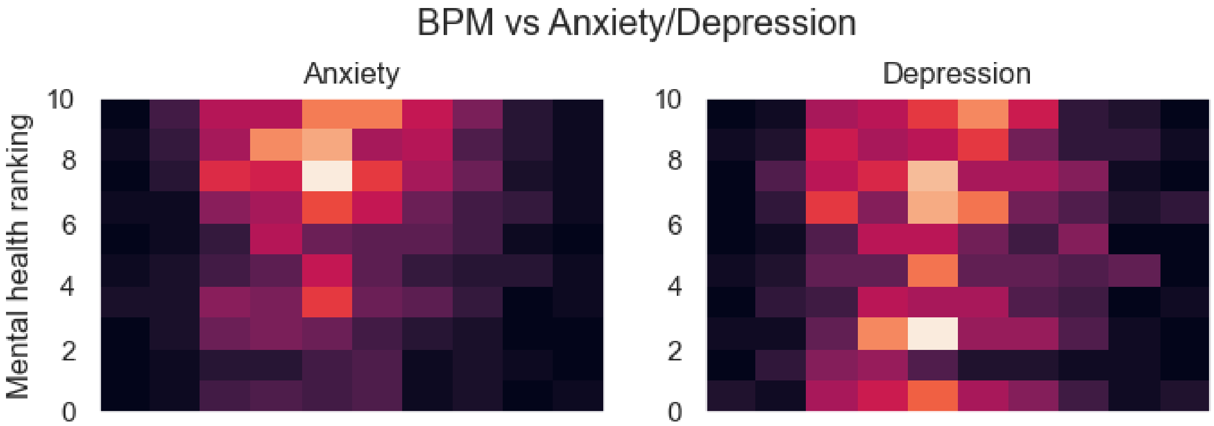
Out[302]:

```
Text(0, 0.5, '')
```



In [309…

```
fig = plt.figure(figsize=(8, 5))

plt.suptitle("BPM vs Anxiety/Depression")

y = df["Anxiety"]
y2 = df["Depression"]
x = df["BPM"]

ax = fig.add_subplot(221)
plt.title('Anxiety')
plt.xticks([])
plt.ylabel('Mental health ranking')
plt.hist2d(x,y, density = True);


ax = fig.add_subplot(222)
plt.title('Depression')
plt.xticks([])
plt.hist2d(x,y2, density = True);
```



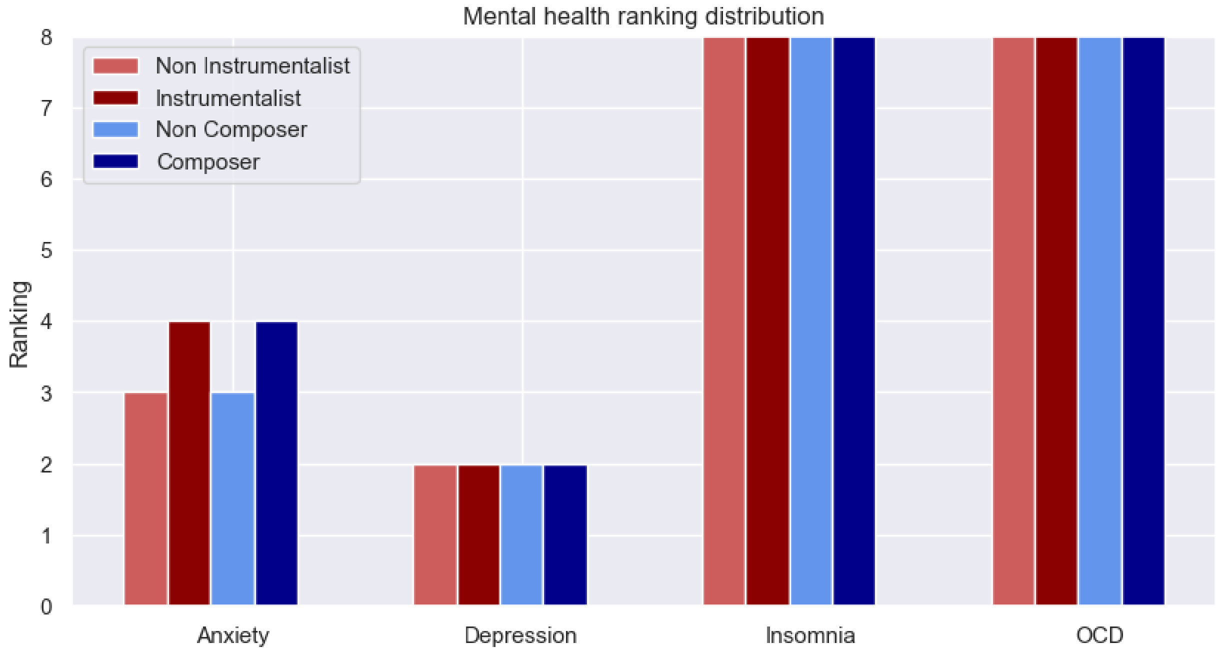
In [310…

```
df['MH Score'] = df['Anxiety'] + df['Depression']
print(df.nsmallest(50, ['MH Score'])['BPM'].mean())
print(df.nlargest(50, ['MH Score'])['BPM'].mean())

# There is no clear correlation between BPM and Anxiety/Depression.
```

```
117.7
126.16
```

In [322…

```
# MH ranking distrubution based on Instrumentalist, nonInstrumentalist, composer and r

df.replace(['No', 'Yes'],
                        [0, 1], inplace=True)

labels = ['Anxiety', 'Depression','Insomnia', 'OCD']
x = np.arange(len(labels))
width = 0.15

fig, ax = plt.subplots(figsize=(10, 5))

b1 = ax.bar(x-2*width, df[(df.Instrumentalist == 0)].median()[-4:], width, color = 'ir
b2 = ax.bar(x-width, df[(df.Instrumentalist == 1)].median()[-4:], width, color = 'dark
b3 = ax.bar(x, df[(df.Composer == 0)].median()[-4:], width, color = 'cornflowerblue',
b4 = ax.bar(x+width, df[(df.Composer == 1)].median()[-4:], width, color = 'darkblue',

ax.set_ylim([0, 8])
ax.set_ylabel('Ranking')
ax.set_title('Mental health ranking distribution')
ax.set_xticks(x, labels)
ax.legend()

plt.show()

# Instrumentalists and composers have slightly higher MH rankings. However, OCD
# rankings are low regardless of musical background.
```

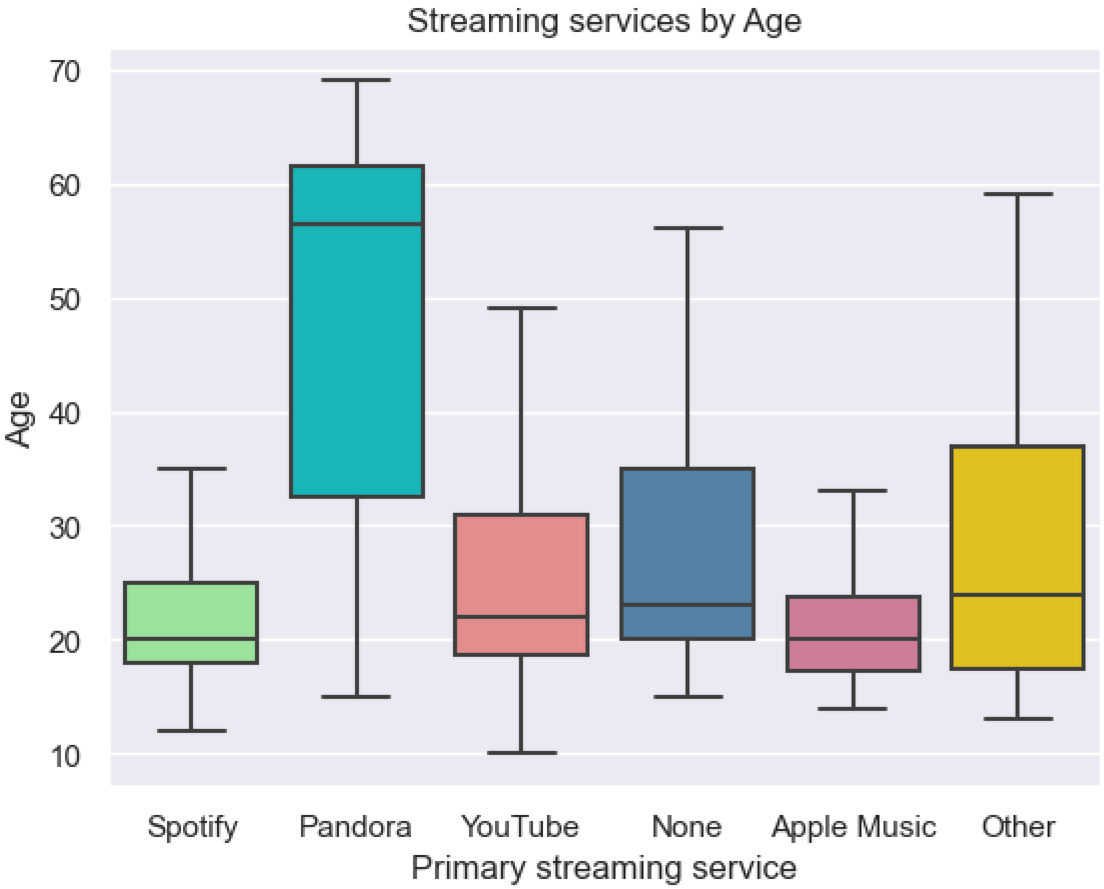


In [324…

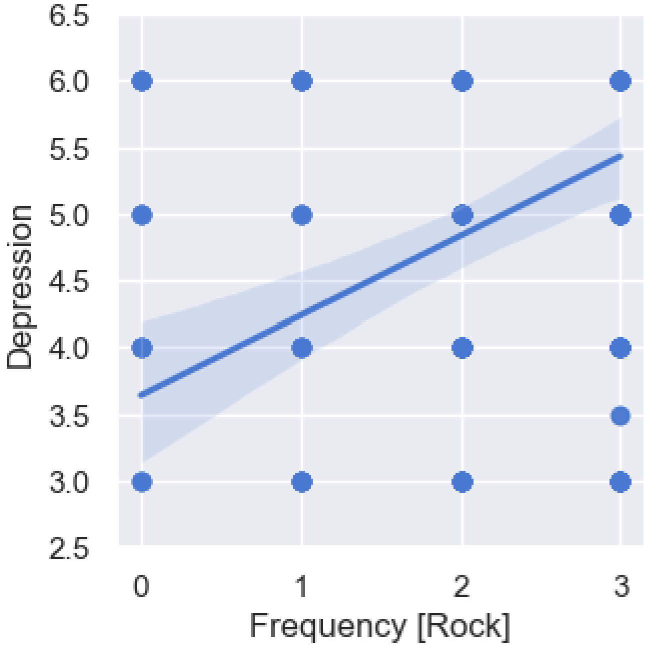
```
# Streaming service by age plotting

import seaborn as sns

s_colors2 = ['lightgreen', 'darkturquoise', 'lightcoral', 'steelblue', 'palevioletred'

df.replace(['Other streaming service', 'I do not use a streaming service.', 'YouTube M
                       ['Other', 'None', 'YouTube'], inplace=True)

bplot = sns.boxplot(data=df, x="Primary streaming service", y = "Age",
            showfliers = False,
            palette = s_colors2)

plt.title('Streaming services by Age')

#pandora is the most widely used between 33-62 years of age, younger people are mostly
```

Out[324]:

```
Text(0.5, 1.0, 'Streaming services by Age')
```



```
In [316…  fig = sns.lmplot(x ='Frequency [Rock]', y ='Depression', data = df, height=3.5)
          fig.set(ylim=(2.5, 6.5))

Out[316]: <seaborn.axisgrid.FacetGrid at 0x26454610370>
```


Depression
Frequency [Rock]