Project1030

October 13, 2020

1 Introduction

[499]:
```
import numpy as ny
import pandas as pd

data = pd.read_csv('2018-personality-data.csv')
print(data.shape)
#print(rating.shape)
```

```
(1834, 34)
```

[500]:
```
# Check for missing values
data.isna().sum()
# No missing value! Good News!
```

[500]:
```
userid                  0
 openness               0
 agreeableness          0
 emotional_stability    0
 conscientiousness      0
 extraversion           0
 assigned metric        0
 assigned condition     0
 movie_1                0
 predicted_rating_1     0
 movie_2                0
 predicted_rating_2     0
 movie_3                0
 predicted_rating_3     0
 movie_4                0
 predicted_rating_4     0
 movie_5                0
 predicted_rating_5     0
 movie_6                0
 predicted_rating_6     0
 movie_7                0
 predicted_rating_7     0
 movie_8                0
```

```
 predicted_rating_8     0
 movie_9                0
 predicted_rating_9     0
 movie_10               0
 predicted_rating_10    0
 movie_11               0
 predicted_rating_11    0
 movie_12               0
 predicted_rating_12    0
 is_personalized        0
 enjoy_watching         0
dtype: int64
```

[527]:
```
data.columns
```

[527]:
```
Index([' openness', ' agreeableness', ' emotional_stability',
       ' conscientiousness', ' extraversion', ' assigned metric',
       ' assigned condition', ' is_personalized', ' enjoy_watching '],
      dtype='object')
```

[503]:
```
#drop the features which cannot be used as the predictors to classify the␣
 ↪"enjoy_watching".
#since we cannot use the predicted_rating to predict another column.
data = data.drop(columns = [' movie_1', ' predicted_rating_1', ' movie_2', '␣
 ↪predicted_rating_2', ' movie_3',
                            ' predicted_rating_3', ' movie_4', '␣
 ↪predicted_rating_4', ' movie_5',
                            ' predicted_rating_5', ' movie_6', '␣
 ↪predicted_rating_6', ' movie_7',
                            ' predicted_rating_7', ' movie_8', '␣
 ↪predicted_rating_8', ' movie_9',
                            ' predicted_rating_9', ' movie_10', '␣
 ↪predicted_rating_10', ' movie_11',
                            ' predicted_rating_11', ' movie_12', '␣
 ↪predicted_rating_12','userid'])
```

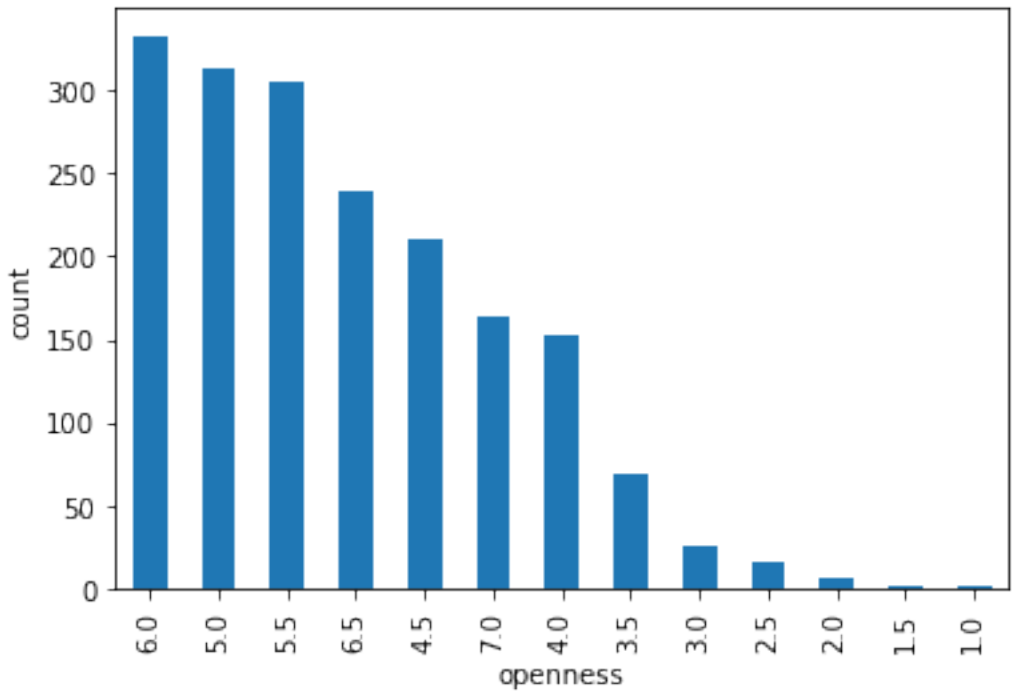
[504]:
```
#remove the space before and after the meaningful names
data_new = data.rename(columns={' openness' : 'openness',
                            ' agreeableness' : 'agreeableness',
                            ' emotional_stability' : 'emotional_stability',
                            ' conscientiousness' : 'conscientiousness',
                            ' extraversion' : 'extraversion',
                            ' assigned metric' : 'assigned metric',
                            ' assigned condition' : 'assigned condition',
                            ' is_personalized' : 'is_personalized',
                            ' enjoy_watching ' : 'enjoy_watching'})
```

[505]:
```
data_new.columns
```

[505]:
```
Index(['openness', 'agreeableness', 'emotional_stability', 'conscientiousness',
       'extraversion', 'assigned metric', 'assigned condition',
       'is_personalized', 'enjoy_watching'],
      dtype='object')
```

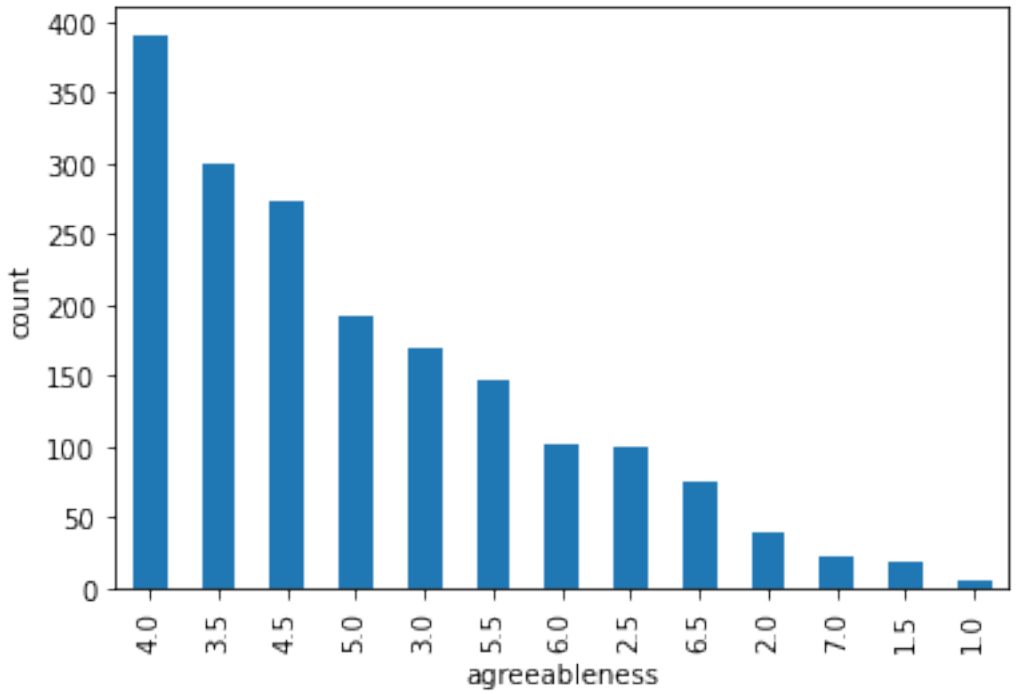
[506]:
```
#Implement value_counts for all categorical variables (all variables are␣
 ↪categorical)
#make bar plots for all variables
import matplotlib
import sklearn as sk
from matplotlib import pylab as plt

a = list(range(0,len(data_new.columns)))
for i in a:
        pd.value_counts(data_new.iloc[:,i]).plot.bar()
        plt.xlabel(data_new.columns[i])
        plt.ylabel('count')
        print(plt.show())
        print(pd.value_counts(data_new.iloc[:,i]))
```



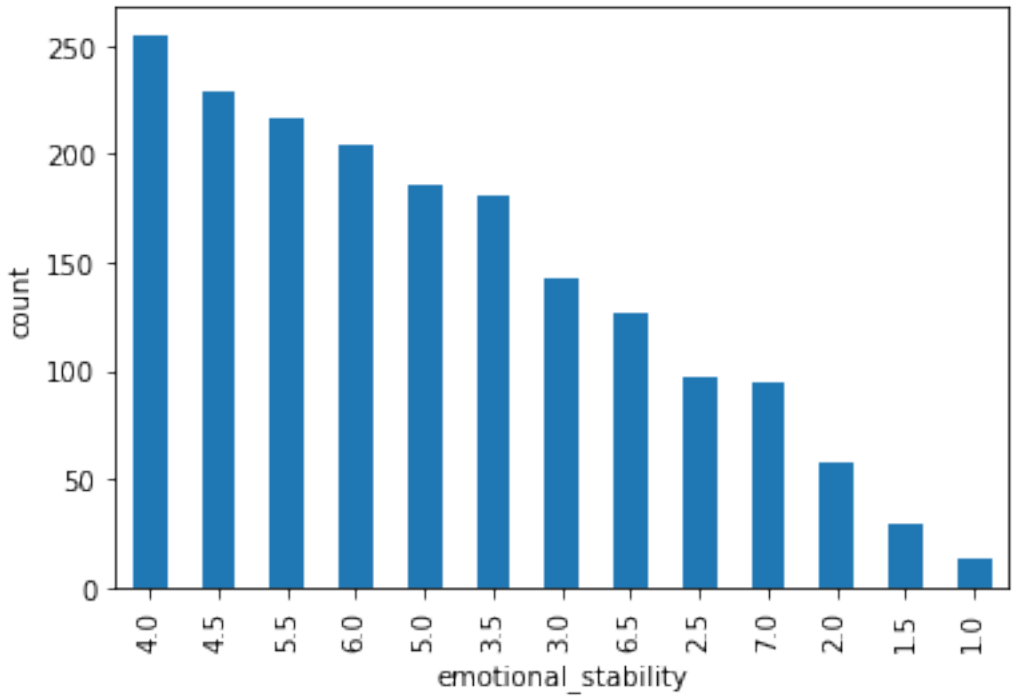

```
None
6.0    333
```

```
5.0    313
5.5    305
6.5    239
4.5    210
7.0    163
4.0    152
3.5     69
3.0     25
2.5     16
2.0      6
1.5      2
1.0      1
Name: openness, dtype: int64
```

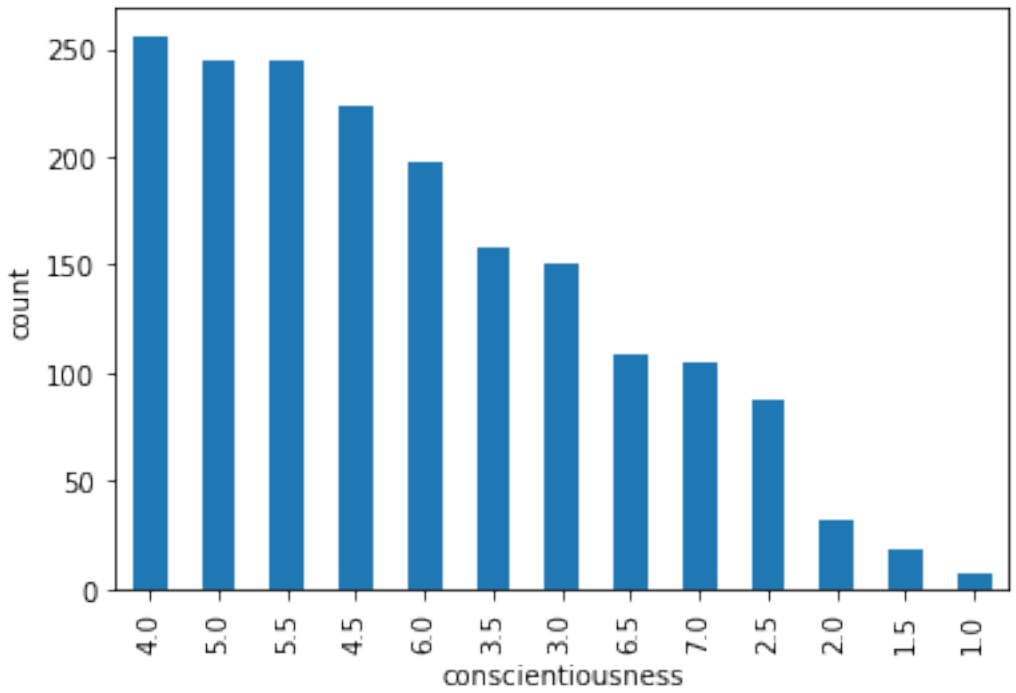



```
None
4.0    391
3.5    299
4.5    273
5.0    193
3.0    170
5.5    146
6.0    101
2.5    100
6.5     76
2.0     39
```

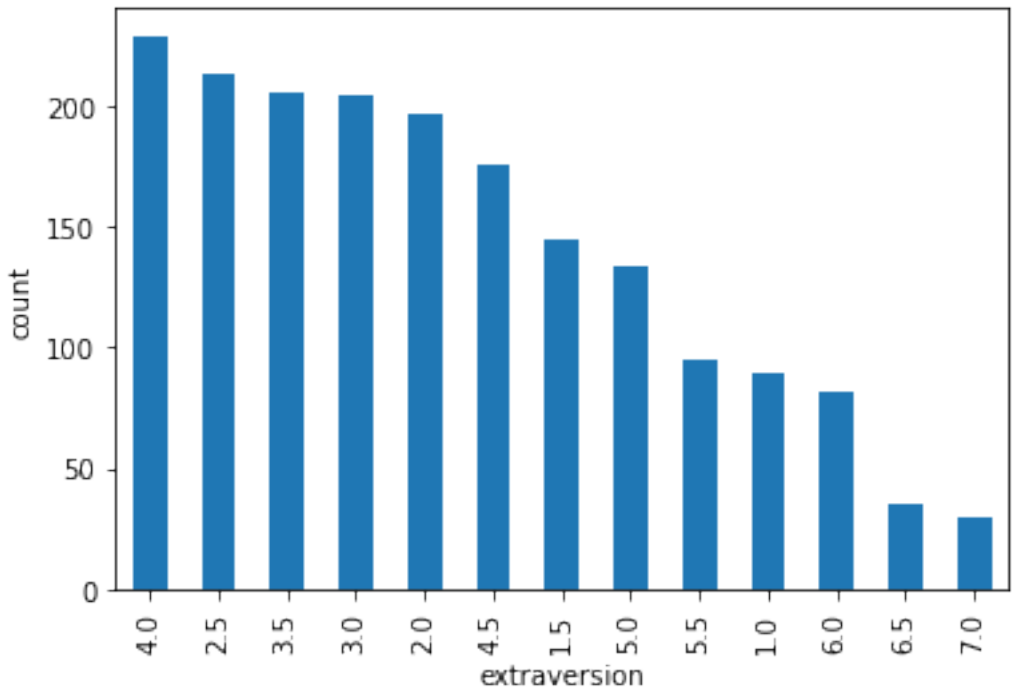
```
7.0     22
1.5     18
1.0      6
Name: agreeableness, dtype: int64
```



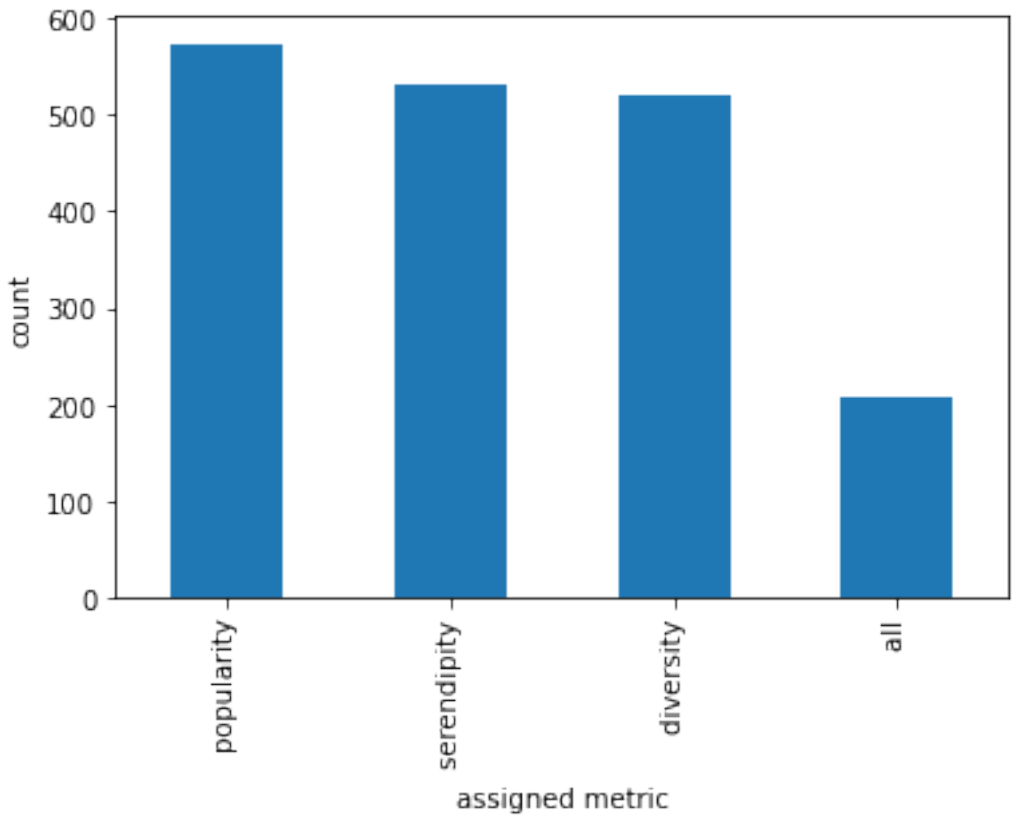

```
None
4.0    255
4.5    229
5.5    217
6.0    204
5.0    186
3.5    181
3.0    143
6.5    127
2.5     97
7.0     95
2.0     58
1.5     29
1.0     13
Name: emotional_stability, dtype: int64
```



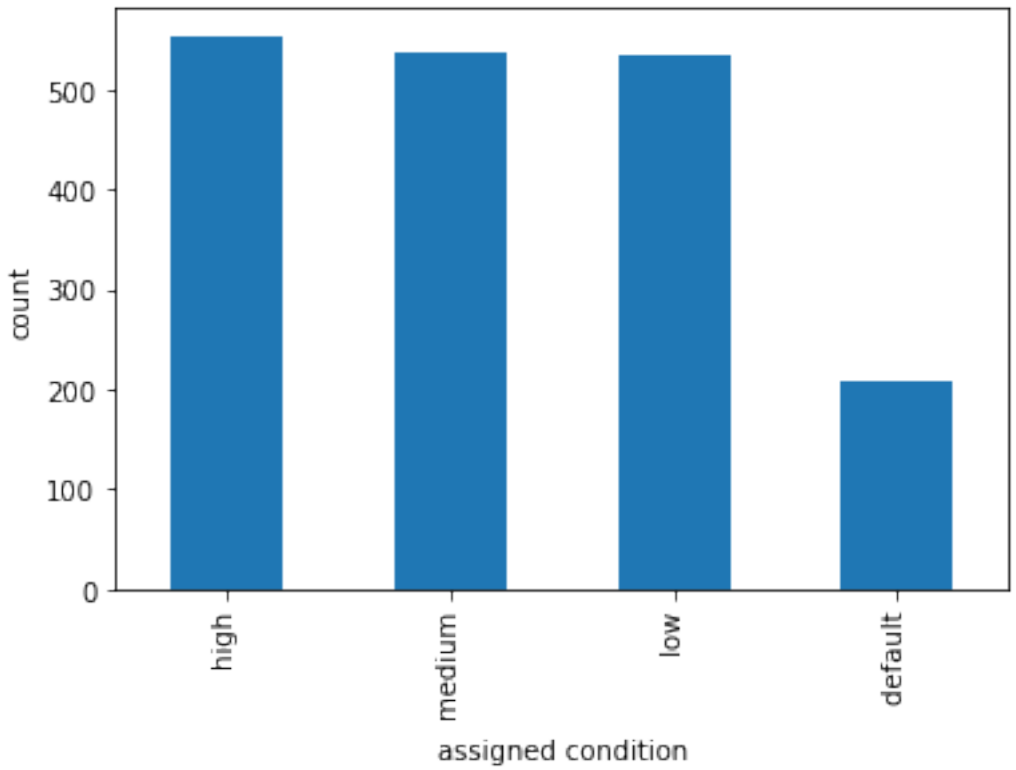

```
None
4.0    256
5.0    245
5.5    245
4.5    224
6.0    197
3.5    158
3.0    150
6.5    109
7.0    105
2.5     88
2.0     32
1.5     18
1.0      7
Name: conscientiousness, dtype: int64
```



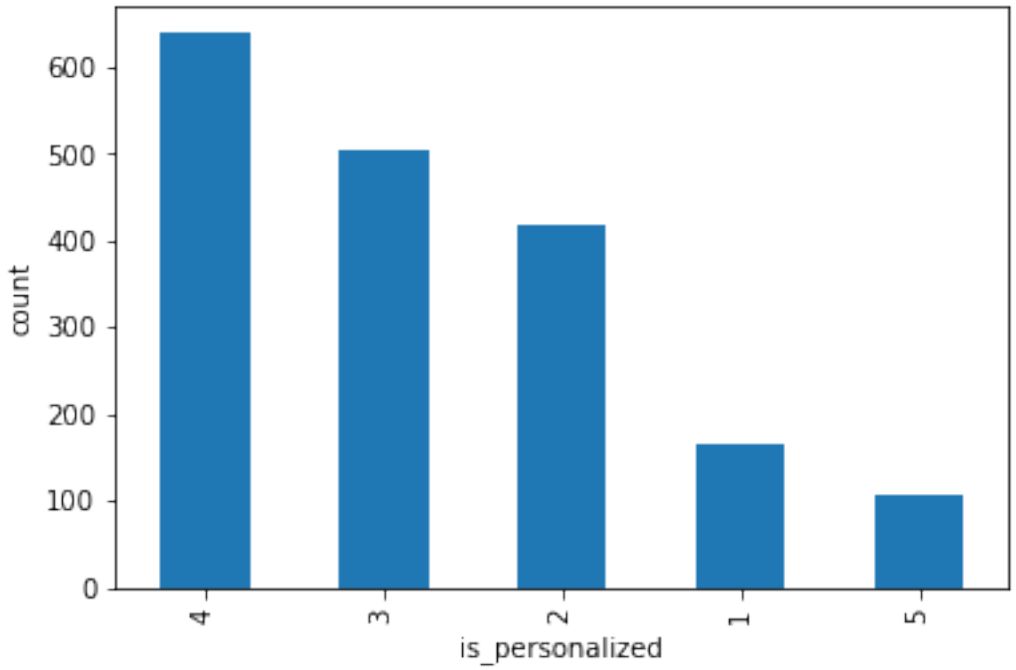

```
None
4.0    229
2.5    213
3.5    205
3.0    204
2.0    197
4.5    176
1.5    145
5.0    134
5.5     95
1.0     89
6.0     82
6.5     35
7.0     30
Name: extraversion, dtype: int64
```



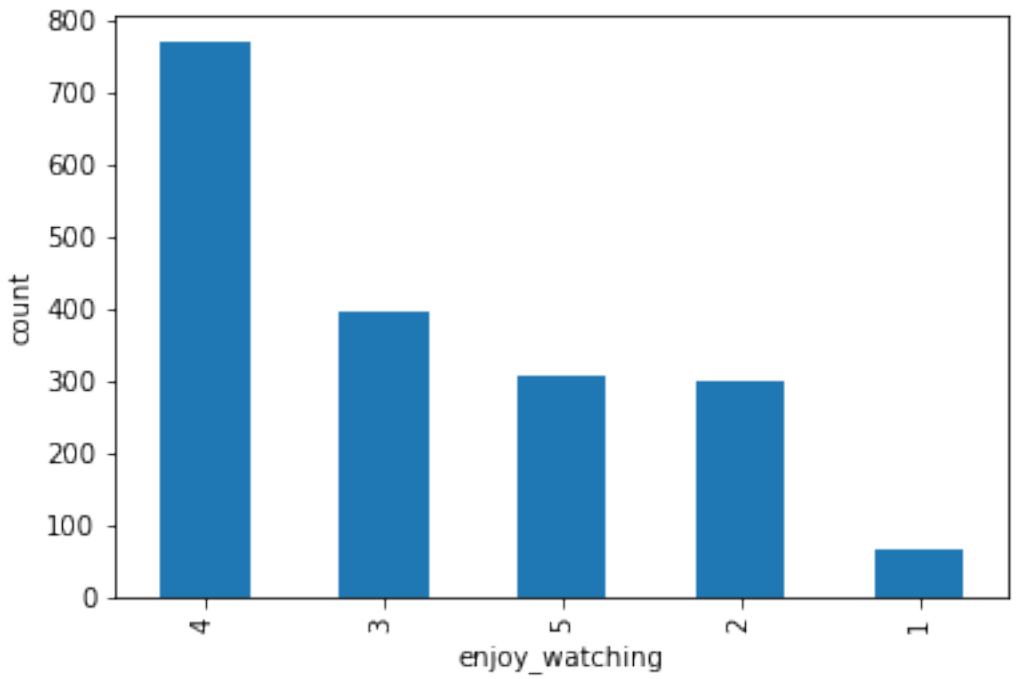

```
None
 popularity     574
 serendipity    532
 diversity      520
 all            208
Name: assigned metric, dtype: int64
```




```
None
 high       554
 medium     538
 low        534
 default    208
Name: assigned condition, dtype: int64
```




```
None
4    639
3    506
2    419
1    164
5    106
Name: is_personalized, dtype: int64
```



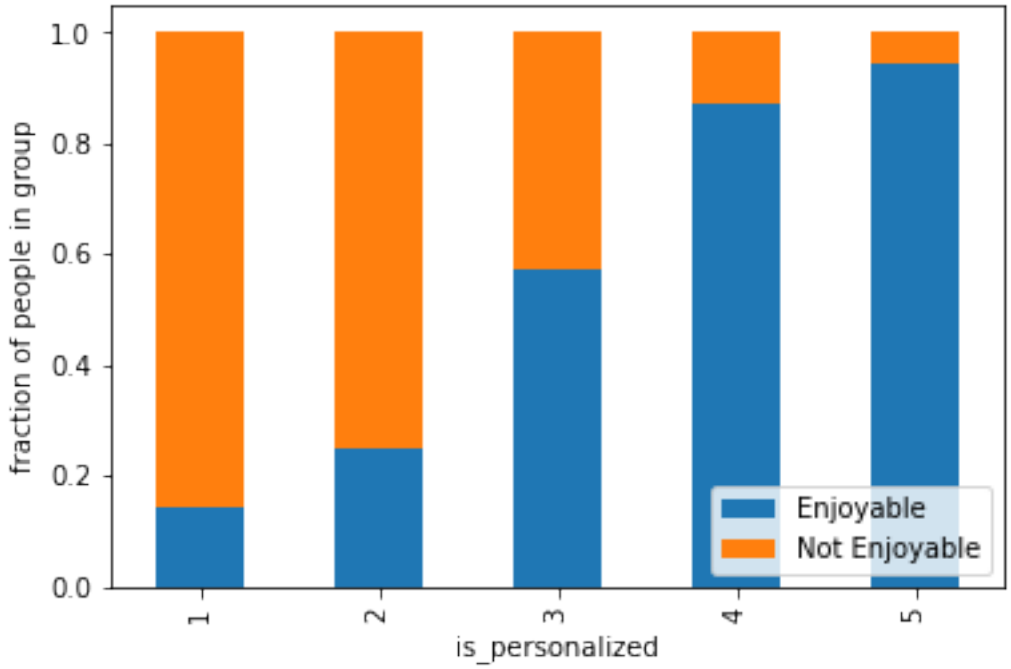

```
None
4    769
3    396
5    305
2    299
1     65
Name: enjoy_watching, dtype: int64
```

[501]:
```
# combine two columns based on the data description
#data = data.drop(columns = [' assigned metric', ' assigned condition'])
```

[526]:
```
count_matrix = data_new.groupby(['is_personalized', 'enjoy_watching']).size().
 ↪unstack()
count_matrix_norm = count_matrix.div(count_matrix.sum(axis=1),axis=0)
print(count_matrix_norm)
count_matrix_norm.plot(kind='bar', stacked=True)
plt.ylabel('fraction of people in group')
plt.legend(loc=4)
plt.show()
```

```
enjoy_watching   Enjoyable  Not Enjoyable
is_personalized
1                 0.140244       0.859756
2                 0.248210       0.751790
3                 0.573123       0.426877
```

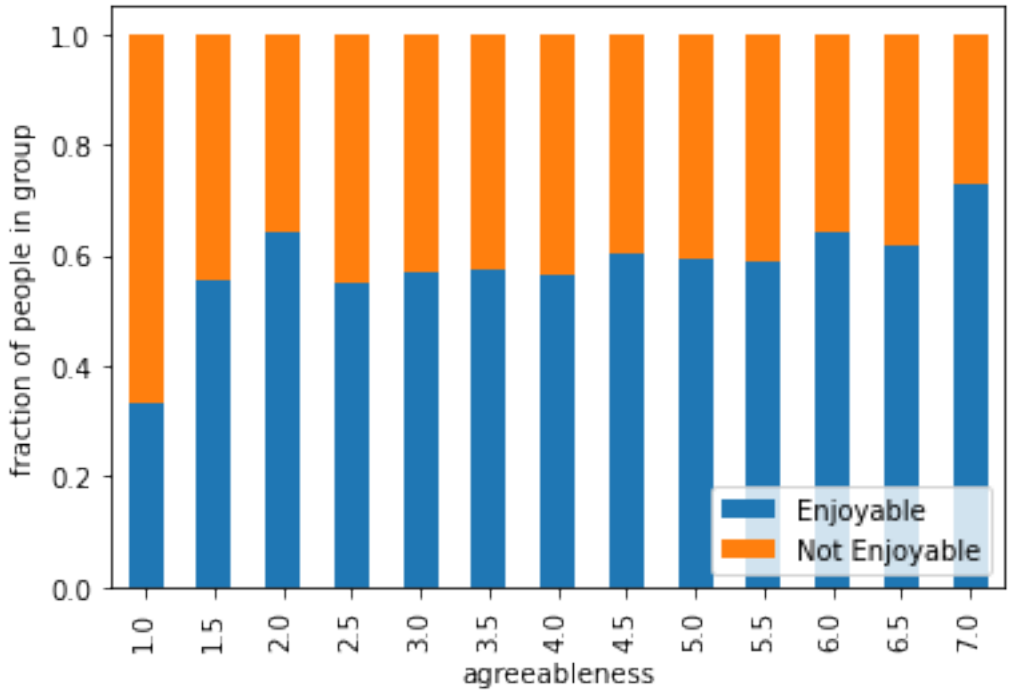
```
4                   0.871674        0.128326
5                   0.943396        0.056604
```



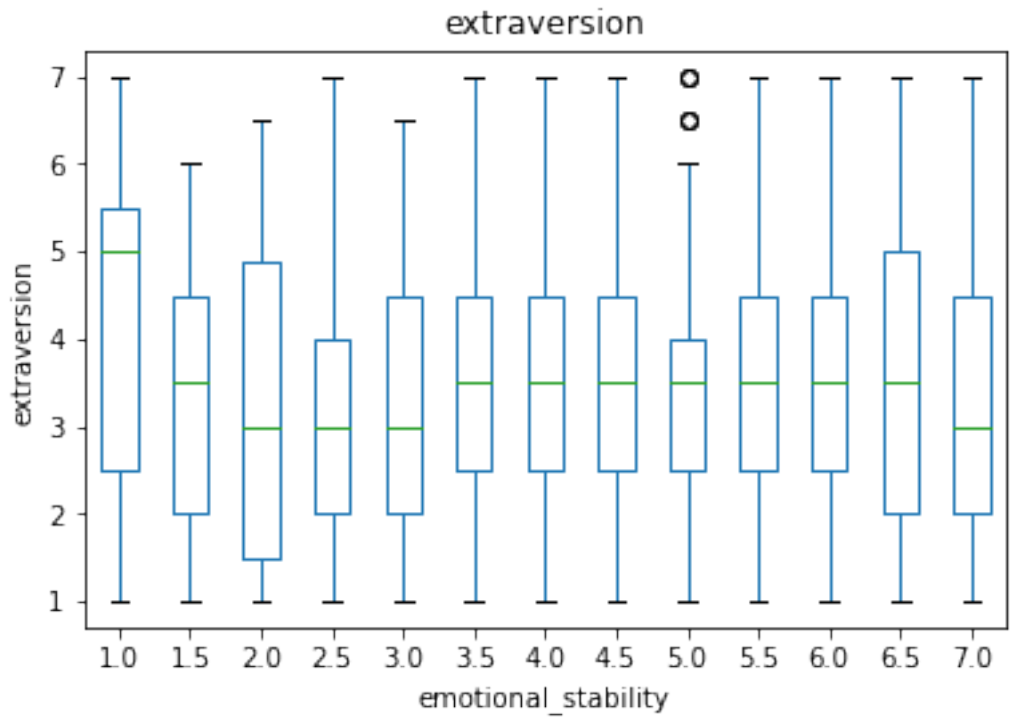
[525]:
```
count_matrix = data_new.groupby(['agreeableness', 'enjoy_watching']).size().
↪unstack()
count_matrix_norm = count_matrix.div(count_matrix.sum(axis=1),axis=0)
print(count_matrix_norm)
count_matrix_norm.plot(kind='bar', stacked=True)
plt.ylabel('fraction of people in group')
plt.legend(loc=4)
plt.show()
```

```
enjoy_watching  Enjoyable  Not Enjoyable
agreeableness
1.0               0.333333       0.666667
1.5               0.555556       0.444444
2.0               0.641026       0.358974
2.5               0.550000       0.450000
3.0               0.570588       0.429412
3.5               0.575251       0.424749
4.0               0.562660       0.437340
4.5               0.604396       0.395604
5.0               0.590674       0.409326
5.5               0.589041       0.410959
6.0               0.643564       0.356436
```

6.5	0.618421	0.381579
7.0	0.727273	0.272727



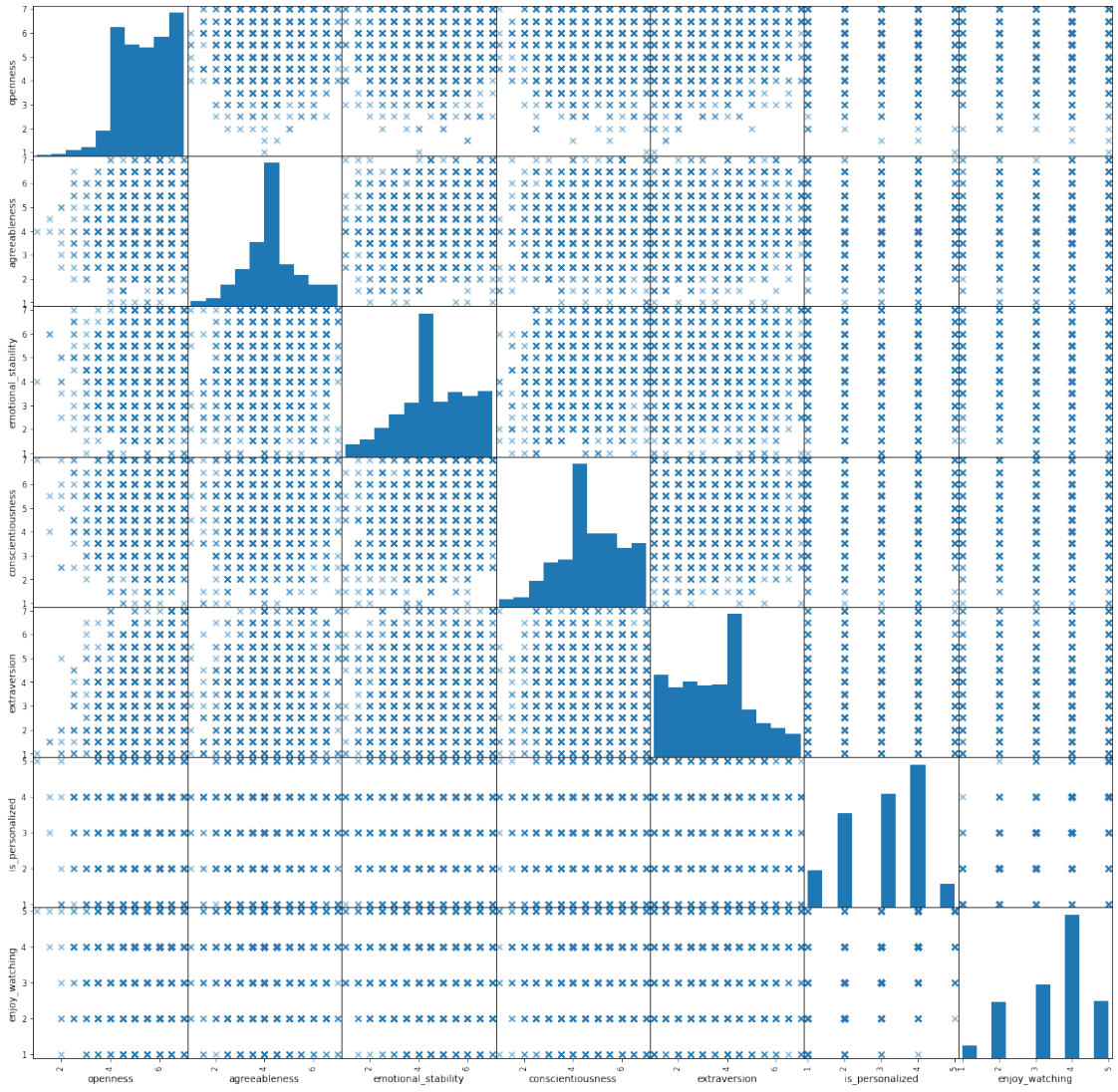
[523]:
```
import seaborn as sns
import matplotlib.pyplot as plt
data_new[['emotional_stability','extraversion']].
 ↪boxplot(by='emotional_stability',grid=False)
plt.ylabel('extraversion')
plt.xlabel('emotional_stability')
plt.suptitle('')
plt.show()
```



[510]:
```
# All variables are categorical variables so that the scatter matrix is not␣
 ↪interesting
from pandas.plotting import scatter_matrix
# make a scatter plot
scatter_matrix(data_new,figsize=[20,20],marker='x')
```

[510]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x1258767f0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x12c658430>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x12c677b50>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x132a562e0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x132a62a60>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x132a83160>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x132a83250>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x13827ca30>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x1c98ab8e0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x1c98b3100>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x1c98db820>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x133a6efa0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x133a94760>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x160696ee0>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x1606726a0>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x1339cae20>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x1339c75e0>,
```

```
  <matplotlib.axes._subplots.AxesSubplot object at 0x1339d4d60>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x133c2b520>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x133c41ca0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x12ac3b460>],
 [<matplotlib.axes._subplots.AxesSubplot object at 0x12ac55be0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x13392b3a0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x133932b20>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1339572e0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x12f017a60>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x12f03b220>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x13401f9a0>],
 [<matplotlib.axes._subplots.AxesSubplot object at 0x13403b160>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1340588e0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1c9920100>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1c9949820>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1339defa0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1339f9760>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x133a1cee0>],
 [<matplotlib.axes._subplots.AxesSubplot object at 0x132e7a6a0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x132e8fe20>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x12bdd85e0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x12bdf9d60>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x25cb80520>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x25cb93ca0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x25cbaf460>],
 [<matplotlib.axes._subplots.AxesSubplot object at 0x1c982cbe0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1c98433a0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x133b8bb20>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x133b752e0>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x133b8ea60>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x128063220>,
  <matplotlib.axes._subplots.AxesSubplot object at 0x1280779a0>]],
dtype=object)
```



[511]:
```
# It is reasonable to separate the "enjoy_watching" to be enjoyable/not␣
 ↪enjoyable based on score 4
for i in list(range(0,len(data_new))):
    if data_new['enjoy_watching'][i] >= 4:
         data_new['enjoy_watching'][i] = 'Enjoyable'
    else:
        data_new['enjoy_watching'][i] = 'Not Enjoyable'
```

```
<ipython-input-511-28106a0ec605>:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_new['enjoy_watching'][i] = 'Enjoyable'
```

```
/opt/anaconda3/lib/python3.8/site-packages/pandas/core/indexing.py:671:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  self._setitem_with_indexer(indexer, value)
<ipython-input-511-28106a0ec605>:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  data_new['enjoy_watching'][i] = 'Not Enjoyable'
```

[512]:
```
data_new.head()
```

[512]:

	openness	agreeableness	emotional_stability	conscientiousness	\
0	5.0	2.0	3.0	2.5	
1	7.0	4.0	6.0	5.5	
2	4.0	3.0	4.5	2.0	
3	5.5	5.5	4.0	4.5	
4	5.5	5.5	3.5	4.5	

	extraversion	assigned metric	assigned condition	is_personalized	\
0	6.5	serendipity	high	4	
1	4.0	all	default	2	
2	2.5	serendipity	medium	2	
3	4.0	popularity	medium	3	
4	2.5	popularity	medium	2	

	enjoy_watching
0	Enjoyable
1	Not Enjoyable
2	Not Enjoyable
3	Not Enjoyable
4	Not Enjoyable

[513]:
```
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import OneHotEncoder, OrdinalEncoder,LabelEncoder
# Preprocess
ordinal_ftrs =␣
 ↪['openness','agreeableness','emotional_stability','conscientiousness',
                'extraversion','is_personalized','assigned condition'] #Ranked␣
 ↪categorical
ordinal_cats = [[1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,5.0,5.5,6.0,6.5,7.0],
                [1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,5.0,5.5,6.0,6.5,7.0],
```

```
                [1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,5.0,5.5,6.0,6.5,7.0],
                [1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,5.0,5.5,6.0,6.5,7.0],
                [1.0,1.5,2.0,2.5,3.0,3.5,4.0,4.5,5.0,5.5,6.0,6.5,7.0],
                [1,2,3,4,5],
                [' default', ' low', ' medium', ' high']]

lab = LabelEncoder()
onehot_ftrs = ['assigned metric'] #
preprocessor = ColumnTransformer(transformers=[('onehot',␣
 ↪OneHotEncoder(sparse=False,handle_unknown='ignore'), onehot_ftrs),
                                                ('ord', OrdinalEncoder(categories␣
 ↪= ordinal_cats), ordinal_ftrs)])
clf = Pipeline(steps=[('preprocessor', preprocessor)])
```

[524]:
```
from sklearn.model_selection import train_test_split
from sklearn.model_selection import StratifiedKFold
X = data_new.loc[:, data_new.columns != 'enjoy_watching']
y = data_new['enjoy_watching']


random_state = 42

X_other, X_test, y_other, y_test = train_test_split(X,y,test_size = 0.
 ↪2,random_state=random_state)

kf = StratifiedKFold(n_splits=5,shuffle=True,random_state=random_state)
for train_index, val_index in kf.split(X_other,y_other):
    X_train = X_other.iloc[train_index]
    y_train = y_other.iloc[train_index]
    X_val = X_other.iloc[val_index]
    y_val = y_other.iloc[val_index]
    print('train balance:')
    print(y_train.value_counts(normalize=True))
    print('val balance:')
    print(y_val.value_counts(normalize=True))

    X_train_prep = clf.fit_transform(X_train)
    X_val_prep = clf.transform(X_val)
    X_test_prep = clf.transform(X_test)
    y_train_prep = le.fit_transform(y_train)
    y_val_prep = le.transform(y_val)
    y_test_prep = le.transform(y_test)


#    print(X_train_prep, y_train_prep)
#    print('   validation set:',X_val_prep, y_val_prep)
#    print('   test set:',X_test_prep, y_test_prep)
```

```
print(X_train.head())
print(X_train_prep[1:5])
```

```
train balance:
Enjoyable        0.578858
Not Enjoyable    0.421142
Name: enjoy_watching, dtype: float64
val balance:
Enjoyable        0.578231
Not Enjoyable    0.421769
Name: enjoy_watching, dtype: float64
train balance:
Enjoyable        0.578858
Not Enjoyable    0.421142
Name: enjoy_watching, dtype: float64
val balance:
Enjoyable        0.578231
Not Enjoyable    0.421769
Name: enjoy_watching, dtype: float64
train balance:
Enjoyable        0.578365
Not Enjoyable    0.421635
Name: enjoy_watching, dtype: float64
val balance:
Enjoyable        0.580205
Not Enjoyable    0.419795
Name: enjoy_watching, dtype: float64
train balance:
Enjoyable        0.578365
Not Enjoyable    0.421635
Name: enjoy_watching, dtype: float64
val balance:
Enjoyable        0.580205
Not Enjoyable    0.419795
Name: enjoy_watching, dtype: float64
train balance:
Enjoyable        0.579216
Not Enjoyable    0.420784
Name: enjoy_watching, dtype: float64
val balance:
Enjoyable        0.576792
Not Enjoyable    0.423208
Name: enjoy_watching, dtype: float64
      openness  agreeableness  emotional_stability  conscientiousness  \
383        5.5            6.0                  5.0                4.5
408        7.0            7.0                  4.5                4.0
1677       6.0            4.0                  4.0                5.5
```

```
1504       5.5            4.5                 7.0                5.5
593        4.5            5.5                 5.5                3.0

      extraversion assigned metric assigned condition  is_personalized
383            5.0     serendipity               low                4
408            3.0             all           default                2
1677           2.5      popularity              high                1
1504           5.0     serendipity            medium                3
593            1.5      popularity            medium                3
[[ 1.  0.  0.  0. 12. 12.  7.  6.  4.  1.  0.]
 [ 0.  0.  1.  0. 10.  6.  6.  9.  3.  0.  3.]
 [ 0.  0.  0.  1.  9.  7. 12.  9.  8.  2.  2.]
 [ 0.  0.  1.  0.  7.  9.  9.  4.  1.  2.  2.]]
```

[ ]: