20230828_assignment1

August 30, 2023

[ ]:

```
!pip install pandas numpy matplotlib
```

```
Requirement already satisfied: pandas in
/home/ziad/notes/.venv/lib/python3.8/site-packages (2.0.3)
Requirement already satisfied: numpy in
/home/ziad/notes/.venv/lib/python3.8/site-packages (1.24.4)
Requirement already satisfied: matplotlib in
/home/ziad/notes/.venv/lib/python3.8/site-packages (3.7.2)
Requirement already satisfied: python-dateutil>=2.8.2 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from pandas) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from pandas) (2023.3)
Requirement already satisfied: tzdata>=2022.1 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from pandas) (2023.3)
Requirement already satisfied: contourpy>=1.0.1 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (1.1.0)
Requirement already satisfied: cycler>=0.10 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (4.42.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (1.4.4)
Requirement already satisfied: packaging>=20.0 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (23.1)
Requirement already satisfied: pillow>=6.2.0 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (10.0.0)
Requirement already satisfied: pyparsing<3.1,>=2.3.1 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (3.0.9)
Requirement already satisfied: importlib-resources>=3.2.0 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from matplotlib) (6.0.1)
Requirement already satisfied: zipp>=3.1.0 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from importlib-
resources>=3.2.0->matplotlib) (3.16.2)
Requirement already satisfied: six>=1.5 in
/home/ziad/notes/.venv/lib/python3.8/site-packages (from python-
dateutil>=2.8.2->pandas) (1.16.0)
```

```
[ ]: import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt
```

1 Assignment 1

1.1 Ziad Arafat

1.1.1 1.

1. We read in the CSV using the pandas library and store it in a dataframe.
2. We print the data in the first two rows using the `head()` method

```
[ ]: df_default_credit = pd.read_csv("Default-of-Credit-Card-Clients.csv")
     print(df_default_credit.head(n=2))
```

```
   ID  LIMIT_BAL  SEX  EDUCATION  MARRIAGE  AGE  PAY_0  PAY_2  PAY_3  PAY_4  \
0   1      20000    2          2         1   24      2      2     -1     -1
1   2     120000    2          2         2   26     -1      2      0      0

   …  BILL_AMT4  BILL_AMT5  BILL_AMT6  PAY_AMT1  PAY_AMT2  PAY_AMT3  \
0  …          0          0          0         0       689         0
1  …       3272       3455       3261         0      1000      1000

   PAY_AMT4  PAY_AMT5  PAY_AMT6  default payment next month
0         0         0         0                           1
1      1000         0      2000                           1

[2 rows x 25 columns]
```

1.1.2 2.

1. The `dtypes` attribute contains all the types of each column and simply placing it in the cell will list out each column name and the corresponding type.

```
[ ]: df_default_credit.dtypes
```

```
[ ]: ID                            int64
     LIMIT_BAL                     int64
     SEX                           int64
     EDUCATION                     int64
     MARRIAGE                      int64
     AGE                           int64
     PAY_0                         int64
     PAY_2                         int64
     PAY_3                         int64
     PAY_4                         int64
     PAY_5                         int64
```

```
PAY_6                         int64
BILL_AMT1                     int64
BILL_AMT2                     int64
BILL_AMT3                     int64
BILL_AMT4                     int64
BILL_AMT5                     int64
BILL_AMT6                     int64
PAY_AMT1                      int64
PAY_AMT2                      int64
PAY_AMT3                      int64
PAY_AMT4                      int64
PAY_AMT5                      int64
PAY_AMT6                      int64
default payment next month    int64
dtype: object
```

1.1.3 3.

1. We can get both rows and columns count using the `shape` attribute.

```
[ ]: print("Columns: ", df_default_credit.shape[0])
     print("Rows: ", df_default_credit.shape[1])
```

```
Columns:  30000
Rows:  25
```

1.1.4 4.

1. The `unique()` method gives us a list of unique values in a column
2. We sort it so it's nicer to look at.

```
[ ]: print(sorted(df_default_credit['EDUCATION'].unique()))
```

```
[0, 1, 2, 3, 4, 5, 6]
```

1.1.5 5.

1. `value_counts()` will give us a table of the classes and their counts.

```
[ ]: df_default_credit['default payment next month'].value_counts()
```

```
[ ]: default payment next month
     0    23364
     1     6636
     Name: count, dtype: int64
```

1.1.6 6.

1. The `len()` function and the conditional syntax of pandas allows us to count how many entries match these conditions.

[ ]:
```
len(df_default_credit[(df_default_credit['default payment next month'] == 1)
                            & (df_default_credit['MARRIAGE'] == 1)])
```

[ ]:
```
3206
```

1.1.7 7.

1. We can use a similar syntax for the age condition .

[ ]:
```
len(df_default_credit[(df_default_credit['default payment next month'] == 1)
                            & (df_default_credit['AGE'] > 30)])
```

[ ]:
```
4165
```

1.1.8 8.

1. We can now use the `mean()` method to get the mean of the LIMIT_BAL column after filtering by conditions .
2. We do one for male (1) and then female (2)

[ ]:
```
df_default_credit[(df_default_credit['SEX'] == 1)]["LIMIT_BAL"].mean()
```

[ ]:
```
163519.8250336474
```

[ ]:
```
df_default_credit[(df_default_credit['SEX'] == 2)]["LIMIT_BAL"].mean()
```

[ ]:
```
170086.46201413427
```

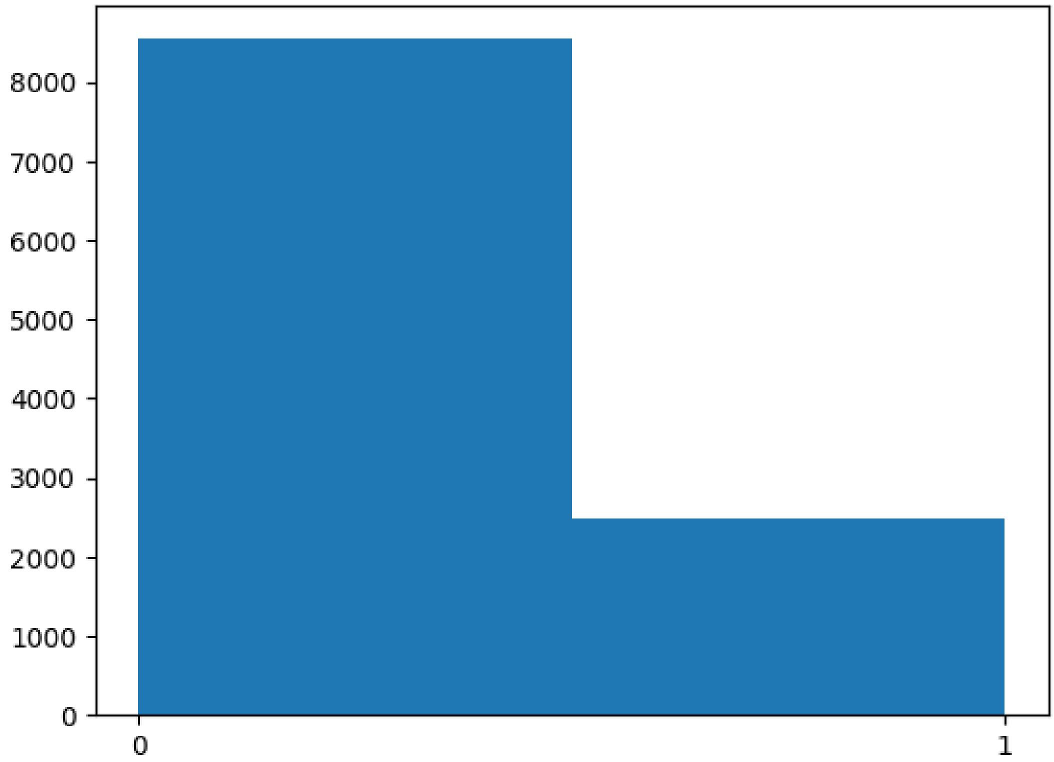
1.1.9 9.

1. First we can filter by age and select the default payment column.
2. Then we can create a histogram for the default payment column using the `hist()` method and we can make the ticks only 0 and 1 using the `xticks` method.
3. We repeat this for ≤ 30 and > 30

[ ]:
```
default_leq_30 = df_default_credit[(df_default_credit['AGE'] <= 30)]["default␣
 ↪payment next month"]

plt.xticks(np.arange(min(default_leq_30), max(default_leq_30)+1, 1.0))
plt.hist(default_leq_30,bins=2)
```

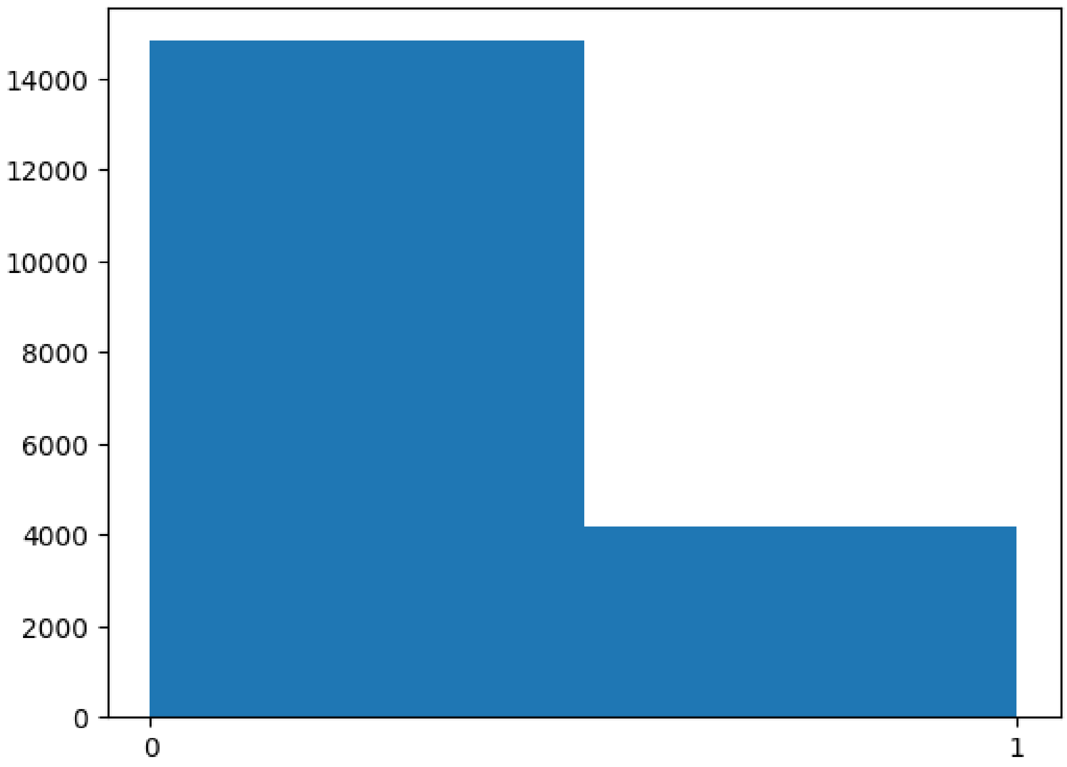
[ ]:
```
(array([8542., 2471.]),
 array([0. , 0.5, 1. ]),
 <BarContainer object of 2 artists>)
```



```
[ ]: default_gt_30 = df_default_credit[(df_default_credit['AGE'] > 30)]["default␣
      ↪payment next month"]

     plt.xticks(np.arange(min(default_gt_30), max(default_gt_30)+1, 1.0))
     plt.hist(default_gt_30,bins=2)
```

```
[ ]: (array([14822.,  4165.]),
      array([0. , 0.5, 1. ]),
      <BarContainer object of 2 artists>)
```



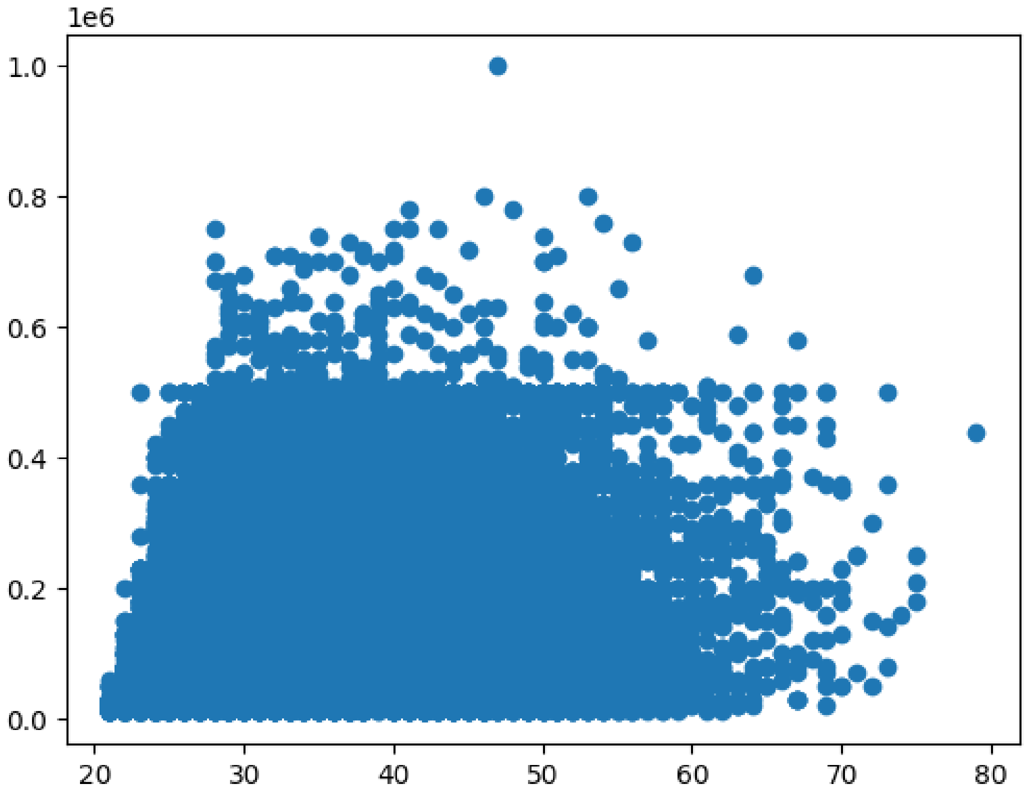
1.1.10 10.

1. Using matplotlib we can make a scatter plot.
2. Because the plot using all the data is extremely dense and difficult to interpret we can select a random sample from the data that is still representative.
3. Additionally we can give the dots some transparency so we can see where they overlap and we can make them a bit smaller so it looks clearer .

[ ]:
```
x_age = df_default_credit["AGE"]
y_limit_bal = df_default_credit["LIMIT_BAL"]

plt.scatter(x_age, y_limit_bal)
```

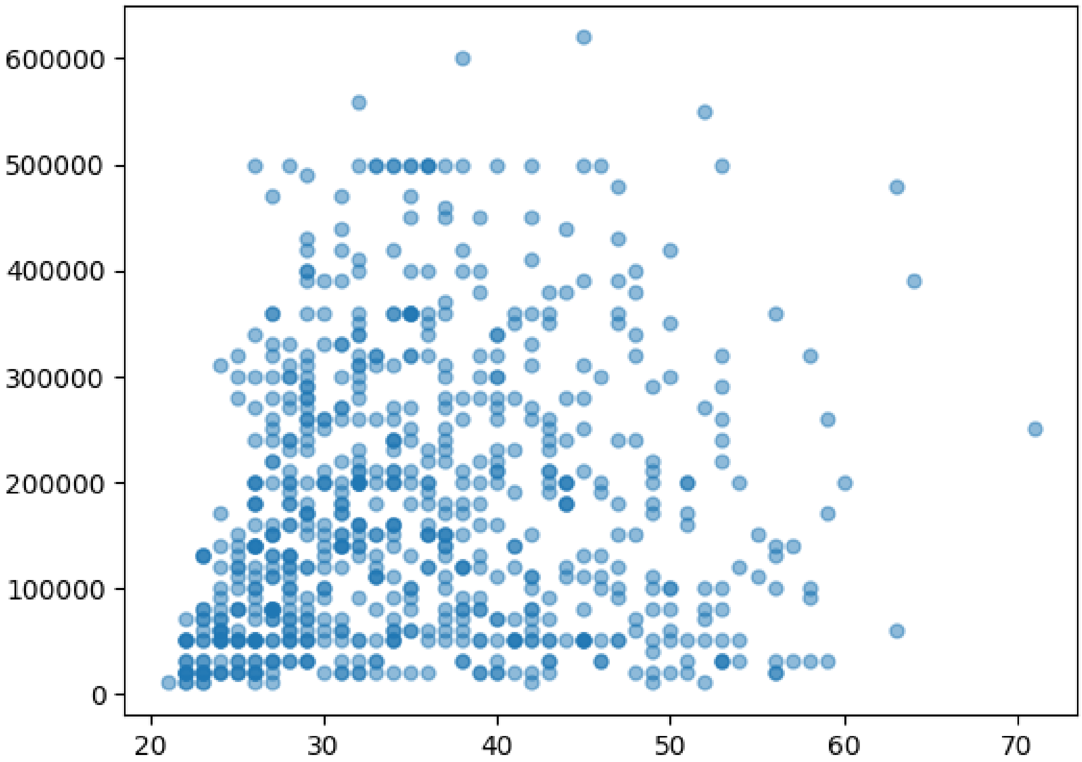
[ ]:
```
<matplotlib.collections.PathCollection at 0x7f565ea4bca0>
```



[ ]:
```
x_age = df_default_credit["AGE"].sample(n=35*20, random_state=1)
y_limit_bal = df_default_credit["LIMIT_BAL"].sample(n=35*20, random_state=1)

plt.scatter(x_age, y_limit_bal,alpha=0.5, s=25)
```

[ ]:
```
<matplotlib.collections.PathCollection at 0x7f565ea4bf10>
```


600000
500000
400000
300000
200000
100000
0
20
30
40
50
60
70

[ ]: