```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        %matplotlib inline
        %matplotlib inline
        from sklearn.model_selection import train_test_split
        from sklearn.preprocessing import StandardScaler
        from sklearn.linear_model import LogisticRegression
        from sklearn.metrics import confusion_matrix
        from sklearn.metrics import classification_report
        from sklearn.metrics import accuracy_score
        from sklearn.metrics import roc_curve
```

```
In [2]: df1 = pd.read_csv("data_train.")
```

```
In [3]: df1.head()
```

```
Out[3]:   Alcohol  Malic Acid  Ash  Alcalinity of Ash  ...  Hue  OD280/OD315 of Dilu  Proline  Class_Wine
        0    14.23        1.71 2.43               15.6  ...  1.04                  3.92     1065           1
        1    13.20        1.78 2.14               11.2  ...  1.05                  3.40     1050           1
        2    13.16        2.36 2.67               18.6  ...  1.03                  3.17     1185           1
        3    14.37        1.95 2.50               16.8  ...  0.86                  3.45     1480           1
        4    13.24        2.59 2.87               21.0  ...  1.35                  2.93      735           1
        [5 rows x 14 columns]
```

```
In [4]: df2 = pd.read_csv("
        df = pd.concat([df1,df2])
        df = df.sample(frac=1)
        df = df.reset_index()
        del df['index']
        df.shape
        df['Class_Wine'] = df['Class_Wine'] - 1
        df.tail()
```

```
Out[4]:   Alcohol  Malic Acid  Ash  Alcalinity of Ash  ...  Hue  OD280/OD315 of Dilu  Proline  Class_Wine
        0    13.71        5.65 2.45               20.5  ...  0.92                  3.05     1095           2
        1    12.37        0.94 1.36               10.6  ...  1.31                  2.62      632           1
        2    12.08        1.39 2.46               18.3  ...  1.05                  3.49     1265           1
        3    12.08        1.33 2.30               23.6  ...  0.83                  3.19      385           1
        4    12.08        1.83 2.32               18.5  ...  1.04                  3.17     1060           1
        [5 rows x 14 columns]
```

```
In [5]: df.shape
```

```
Out[5]: (178, 14)
```

```
In [6]: df.describe()
```

```
Out[6]:          Alcohol  Malic Acid         Ash  Alcalinity of Ash  ...  Hue  OD280/OD315 of Dilu  Proline  Class_Wine
        count  178.000000  178.000000  178.000000          178.000000  ...  178           178.000  178.000  178.000000
        mean    13.000618    2.336348    2.366517           19.494944  ...    0            2.611    746.    0.398876
        std      0.811827    1.117146    0.274344            3.339564  ...    1            0.709    314.    0.490808
        min     11.030000    0.740000    1.360000           10.600000  ...   -1            1.270    278.    0.000000
        25%     12.362500    1.603750    2.210000           17.200000  ...   -1            2.188    500.    0.000000
        50%     13.050000    1.865000    2.360000           19.500000  ...    0            2.804    673.    0.000000
        75%     13.677500    3.073750    2.557500           21.500000  ...    1            3.170    985.    1.000000
        max     14.830000    5.800000    3.230000           30.000000  ...    2            4.000   1680.    2.000000
        [8 rows x 14 columns]
```

```
In [7]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index]
```

```
Out[7]:                      Hue  OD280/OD315 of Dilu  Alcohol
        Hue                 1.000                0.565   -0.055
        OD280/OD315 of Dilu 0.565                1.000   -0.188
        Alcohol            -0.055                0.071    1.000
```

```
In [8]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail()
```

```
Out[8]:                      Hue  OD280/OD315 of Dilu  Alcohol
        Ash                 0.054                0.167    0.221
        Alcalinity of Ash   0.044                0.095    0.096
        Malic Acid          0.056                0.252    0.094
        Magnesium           0.055                0.195    0.273
        Class_Wine          1.000                0.565   -0.055
```

```
In [9]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(3)
```

```
Out[9]:                      Hue  OD280/OD315 of Dilu  Alcohol
        Magnesium           0.055                0.195    0.273
        Class_Wine          1.000                0.565   -0.055
        Proline             0.316                0.312    0.644
```

```
In [10]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(4)
```

```
Out[10]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Flavanoids          0.543                0.787    0.237
```

```
In [11]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(5)
```

```
Out[11]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Total Phenols       0.433                0.699    0.864
```

```
In [12]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(6)
```

```
Out[12]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Nonflavanoid Phenols -0.137               -0.503   -0.155
```

```
In [13]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(7)
```

```
Out[13]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Proanthocyanins     0.330                0.519    0.205
```

```
In [14]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(8)
```

```
Out[14]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Color Intensity     0.265                0.316    0.546
```

```
In [15]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(9)
```

```
Out[15]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Alcalinity of Ash   0.044                0.095    0.096
```

```
In [16]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(10)
```

```
Out[16]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Ash                 0.054                0.167    0.221
```

```
In [17]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(11)
```

```
Out[17]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Malic Acid          0.056                0.252    0.094
```

```
In [18]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(12)
```

```
Out[18]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         Hue                 1.000                0.565   -0.055
```

```
In [19]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(13)
```

```
Out[19]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
```

```
In [20]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(14)
```

```
Out[20]:                      Hue  OD280/OD315 of Dilu  Alcohol
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
```

```
In [21]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(15)
```

```
Out[21]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
```

```
In [22]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index]
```

```
Out[22]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Hue                 1.000                0.565   -0.055
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Proline             0.316                0.312    0.644
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
```

```
In [23]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(16)
```

```
Out[23]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
```

```
In [24]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(17)
```

```
Out[24]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
```

```
In [25]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(18)
```

```
Out[25]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
```

```
In [26]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(19)
```

```
Out[26]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
```

```
In [27]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(20)
```

```
Out[27]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
```

```
In [28]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(21)
```

```
Out[28]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
```

```
In [29]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(22)
```

```
Out[29]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
```

```
In [30]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(23)
```

```
Out[30]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
```

```
In [31]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(24)
```

```
Out[31]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
```

```
In [32]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(25)
```

```
Out[32]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
```

```
In [33]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(26)
```

```
Out[33]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
```

```
In [34]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(27)
```

```
Out[34]:                      Hue  OD280/OD315 of Dilu  Alcohol
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
```

```
In [35]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(28)
```

```
Out[35]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
```

```
In [36]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(29)
```

```
Out[36]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
```

```
In [37]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(30)
```

```
Out[37]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
```

```
In [38]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(31)
```

```
Out[38]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
```

```
In [39]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(32)
```

```
Out[39]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
```

```
In [40]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(33)
```

```
Out[40]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
```

```
In [41]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(34)
```

```
Out[41]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
```

```
In [42]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(35)
```

```
Out[42]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
```

```
In [43]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(36)
```

```
Out[43]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
```

```
In [44]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(37)
```

```
Out[44]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
```

```
In [45]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(38)
```

```
Out[45]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
```

```
In [46]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(39)
```

```
Out[46]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
```

```
In [47]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(40)
```

```
Out[47]:                      Hue  OD280/OD315 of Dilu  Alcohol
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
```

```
In [48]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(41)
```

```
Out[48]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
```

```
In [49]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(42)
```

```
Out[49]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
```

```
In [50]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(43)
```

```
Out[50]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Ash                 0.054                0.167    0.221
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
```

```
In [51]: df.corr()[df['Class_Wine'].sort_values(ascending=False)[1:3].index].tail(44)
```

```
Out[51]:                      Hue  OD280/OD315 of Dilu  Alcohol
         Alcalinity of Ash   0.044                0.095    0.096
         Color Intensity     0.265                0.316    0.546
         Proanthocyanins     0.330                0.519    0.205
         Nonflavanoid Phenols -0.137               -0.503   -0.155
         Total Phenols       0.433                0.699    0.864
         Flavanoids          0.543                0.787    0.237
         Magnesium           0.055                0.195    0.273
         Class_Wine          1.000                0.565   -0.055
         Proline             0.316                0.312    0.644
         OD280/OD315 of Dilu 0.565                1.000   -0.188
         Hue                 1.000                0.565   -0.055
         Malic Acid          0.056                0.252    0.094
         Ash                 0.054                0.167    0.221
```

```
In [52]: df.corr()[df['Class_Wine'].sort
```