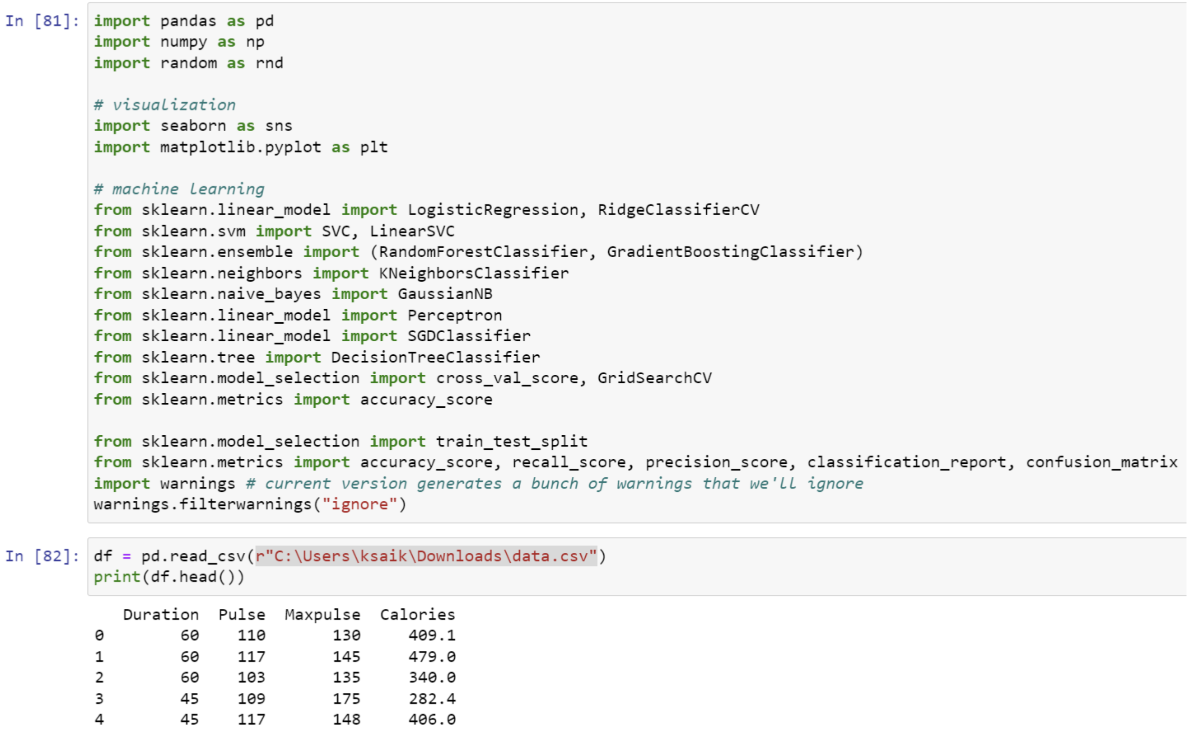
Sai Kiran Reddy Kotha

Banner 700746206

Link:

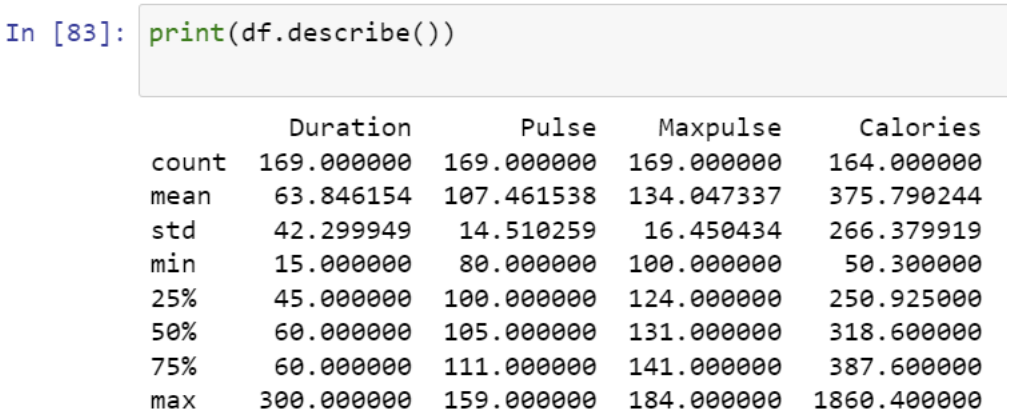
https://drive.google.com/file/d/1qe828APPGYQwurC_EK16CMR5R5XGZwMf/view?usp=share_link

1. Read the provided CSV file 'data.csv'.
   https://drive.google.com/drive/folders/1h8C3mLsso-R-sIOLsvoYwPLzy2fJ4IOF?usp=sharing

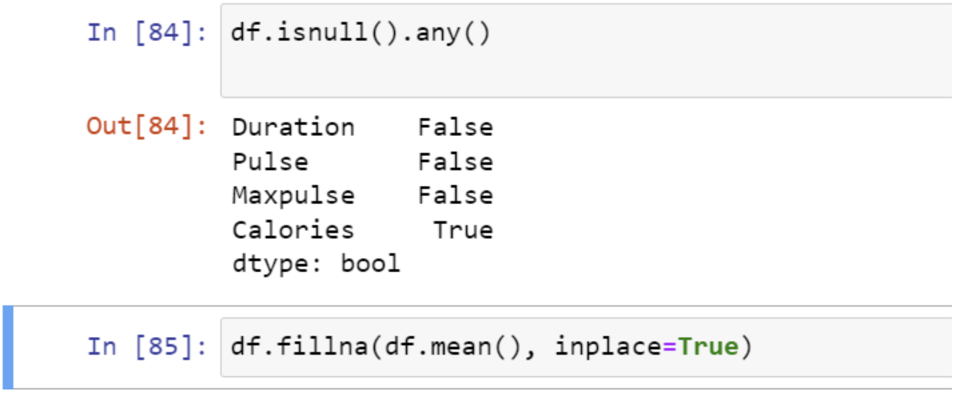


```
In [81]: import pandas as pd
         import numpy as np
         import random as rnd

         # visualization
         import seaborn as sns
         import matplotlib.pyplot as plt

         # machine learning
         from sklearn.linear_model import LogisticRegression, RidgeClassifierCV
         from sklearn.svm import SVC, LinearSVC
         from sklearn.ensemble import (RandomForestClassifier, GradientBoostingClassifier)
         from sklearn.neighbors import KNeighborsClassifier
         from sklearn.naive_bayes import GaussianNB
         from sklearn.linear_model import Perceptron
         from sklearn.linear_model import SGDClassifier
         from sklearn.tree import DecisionTreeClassifier
         from sklearn.model_selection import cross_val_score, GridSearchCV
         from sklearn.metrics import accuracy_score

         from sklearn.model_selection import train_test_split
         from sklearn.metrics import accuracy_score, recall_score, precision_score, classification_report, confusion_matrix
         import warnings # current version generates a bunch of warnings that we'll ignore
         warnings.filterwarnings("ignore")

In [82]: df = pd.read_csv(r"C:\Users\ksaik\Downloads\data.csv")
         print(df.head())

            Duration  Pulse  Maxpulse  Calories
         0        60    110       130     409.1
         1        60    117       145     479.0
         2        60    103       135     340.0
         3        45    109       175     282.4
         4        45    117       148     406.0
```

2. Show the basic statistical description about the data.
3. Check if the data has null values.
   a. Replace the null values with the mean



```
In [83]: print(df.describe())

                  Duration       Pulse    Maxpulse     Calories
         count  169.000000  169.000000  169.000000   164.000000
         mean    63.846154  107.461538  134.047337   375.790244
         std     42.299949   14.510259   16.450434   266.379919
         min     15.000000   80.000000  100.000000    50.300000
         25%     45.000000  100.000000  124.000000   250.925000
         50%     60.000000  105.000000  131.000000   318.600000
         75%     60.000000  111.000000  141.000000   387.600000
         max    300.000000  159.000000  184.000000  1860.400000
```

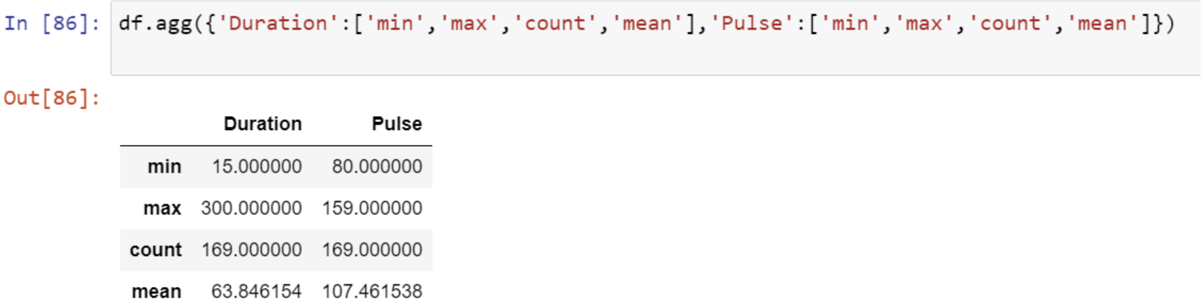


```
In [84]: df.isnull().any()
```

```
Out[84]: Duration    False
         Pulse       False
         Maxpulse    False
         Calories     True
         dtype: bool
```

```
In [85]: df.fillna(df.mean(), inplace=True)
```

4. Select at least two columns and aggregate the data using: min, max, count, mean.

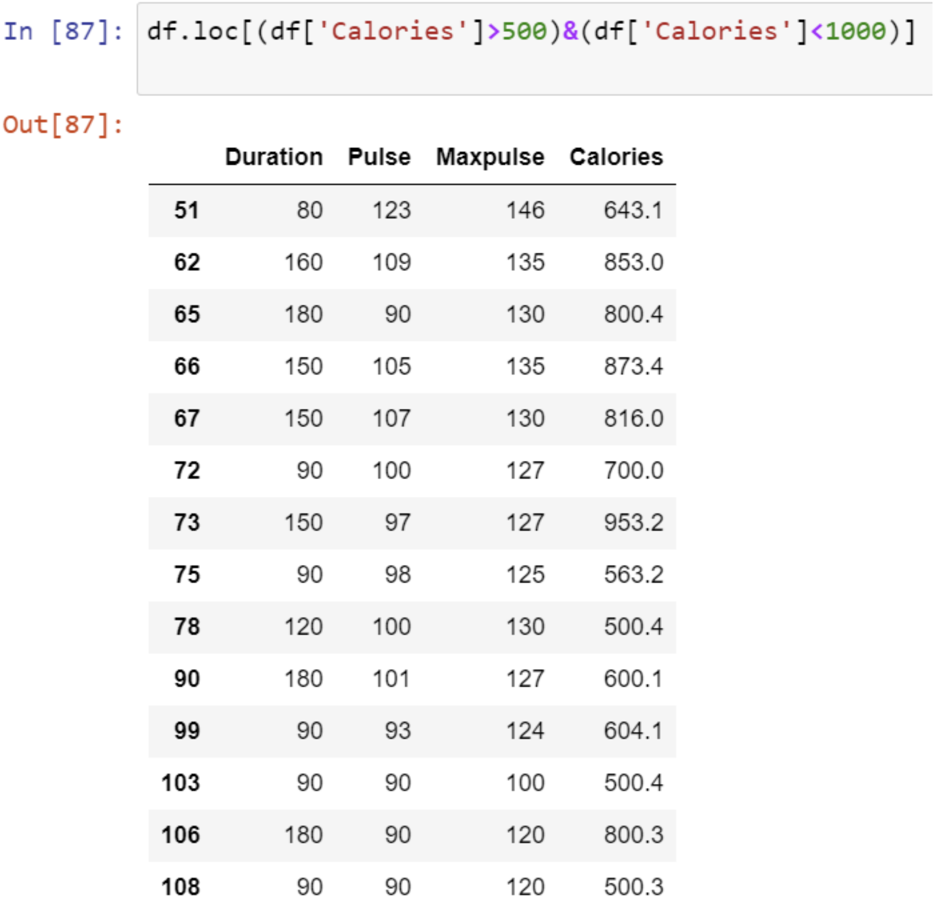


```
In [86]: df.agg({'Duration':['min','max','count','mean'],'Pulse':['min','max','count','mean']})
```

Out[86]:

	Duration	Pulse
min	15.000000	80.000000
max	300.000000	159.000000
count	169.000000	169.000000
mean	63.846154	107.461538

5. Filter the dataframe to select the rows with calories values between 500 and 1000.

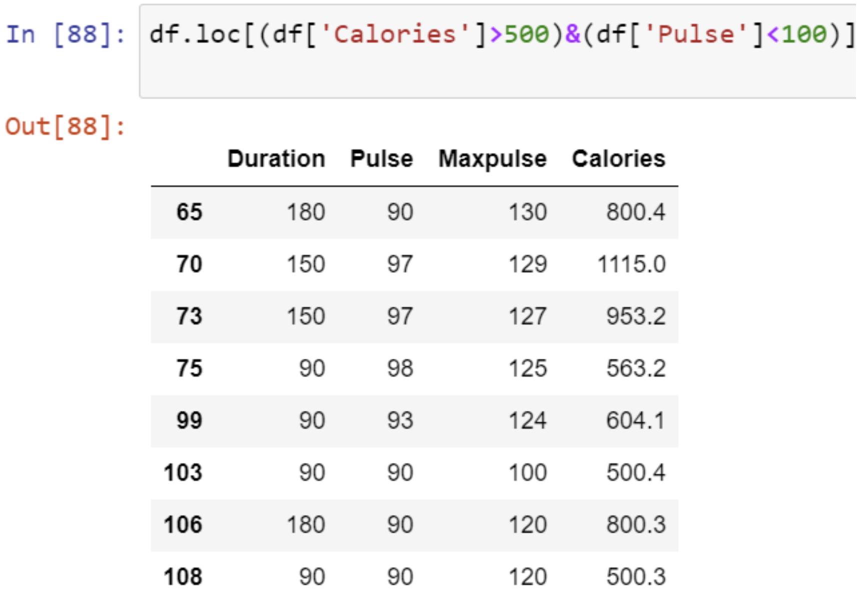


```
In [87]: df.loc[(df['Calories']>500)&(df['Calories']<1000)]
```

Out[87]:

	Duration	Pulse	Maxpulse	Calories
51	80	123	146	643.1
62	160	109	135	853.0
65	180	90	130	800.4
66	150	105	135	873.4
67	150	107	130	816.0
72	90	100	127	700.0
73	150	97	127	953.2
75	90	98	125	563.2
78	120	100	130	500.4
90	180	101	127	600.1
99	90	93	124	604.1
103	90	90	100	500.4
106	180	90	120	800.3
108	90	90	120	500.3

6. Filter the dataframe to select the rows with calories values > 500 and pulse < 100.

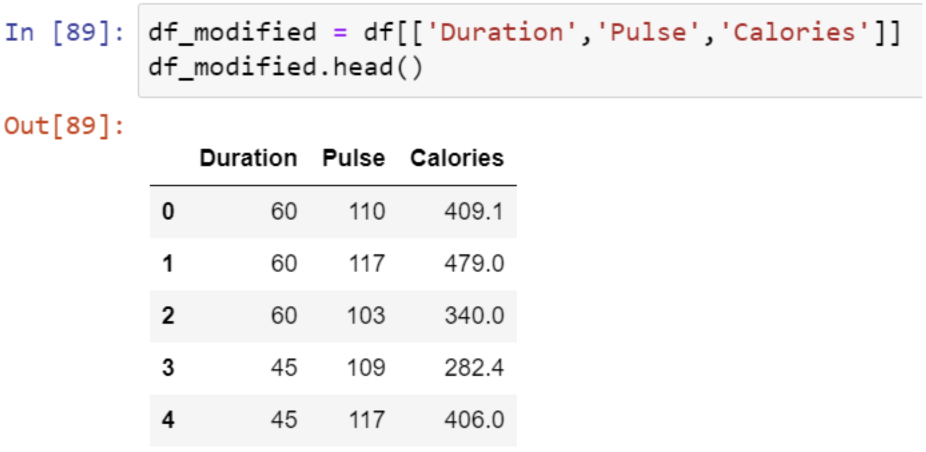


```
In [88]: df.loc[(df['Calories']>500)&(df['Pulse']<100)]
```

Out[88]:

	Duration	Pulse	Maxpulse	Calories
65	180	90	130	800.4
70	150	97	129	1115.0
73	150	97	127	953.2
75	90	98	125	563.2
99	90	93	124	604.1
103	90	90	100	500.4
106	180	90	120	800.3
108	90	90	120	500.3

7. Create a new “df_modified” dataframe that contains all the columns from df except for “Maxpulse”.

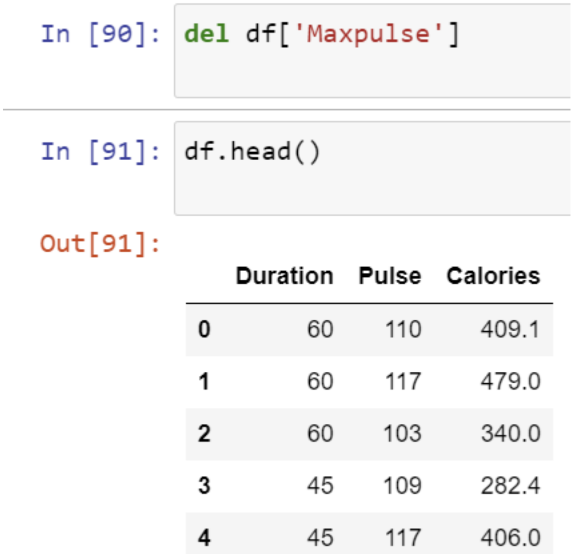


```
In [89]: df_modified = df[['Duration','Pulse','Calories']]
         df_modified.head()
```

Out[89]:

	Duration	Pulse	Calories
0	60	110	409.1
1	60	117	479.0
2	60	103	340.0
3	45	109	282.4
4	45	117	406.0

8. Delete the “Maxpulse” column from the main df dataframe



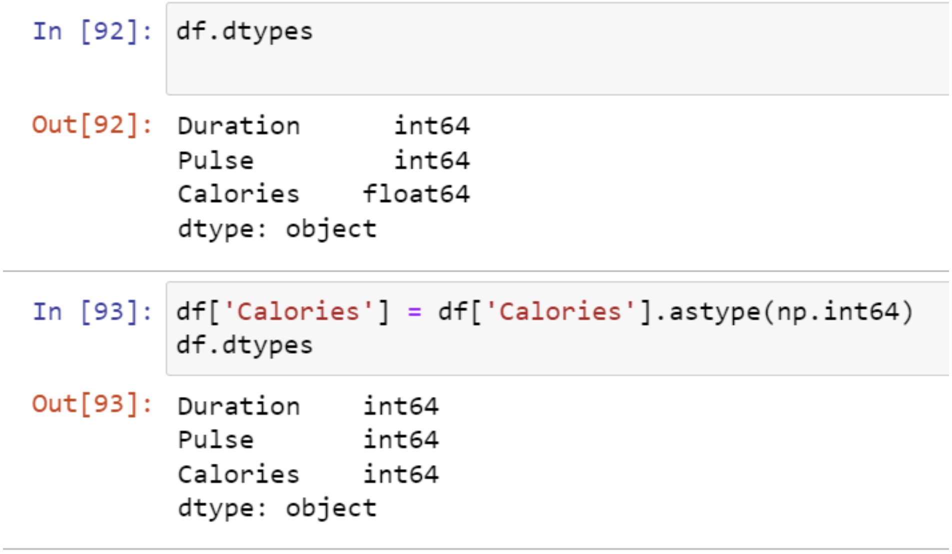
```
In [90]: del df['Maxpulse']
```

```
In [91]: df.head()
```

Out[91]:

	Duration	Pulse	Calories
0	60	110	409.1
1	60	117	479.0
2	60	103	340.0
3	45	109	282.4
4	45	117	406.0

9. Convert the datatype of Calories column to int datatype.

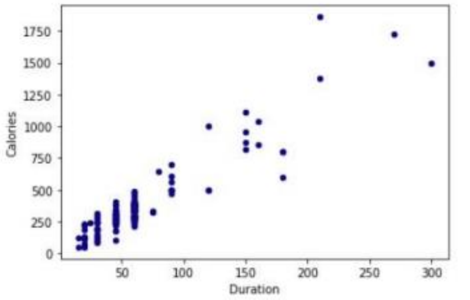


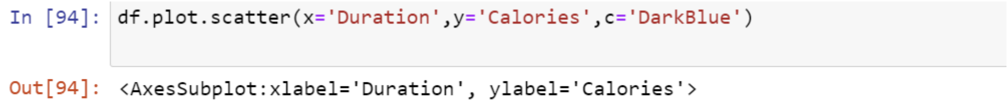
```
In [92]: df.dtypes

Out[92]: Duration       int64
         Pulse          int64
         Calories     float64
         dtype: object
```

```
In [93]: df['Calories'] = df['Calories'].astype(np.int64)
         df.dtypes

Out[93]: Duration     int64
         Pulse        int64
         Calories     int64
         dtype: object
```

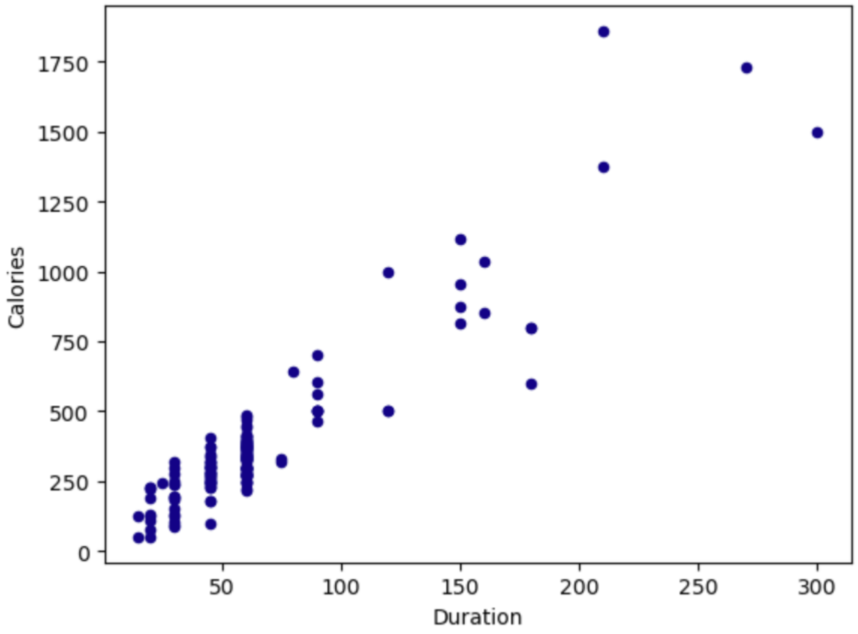
10. Using pandas create a scatter plot for the two columns (Duration and Calories).

   a. Example:



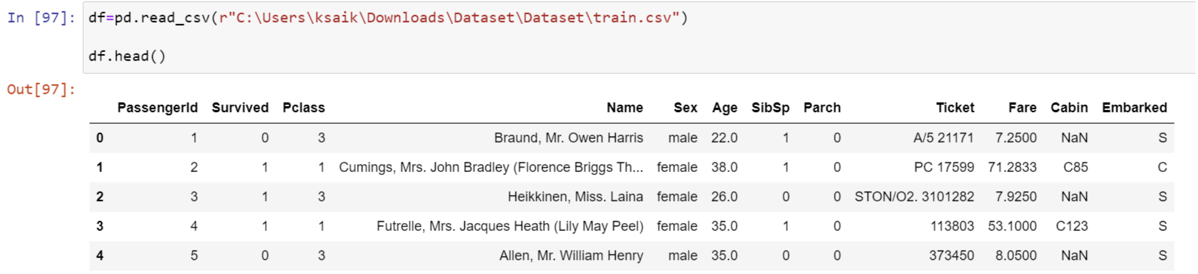


```
In [94]: df.plot.scatter(x='Duration',y='Calories',c='DarkBlue')

Out[94]: <AxesSubplot:xlabel='Duration', ylabel='Calories'>
```



1. **(Titanic Dataset)**

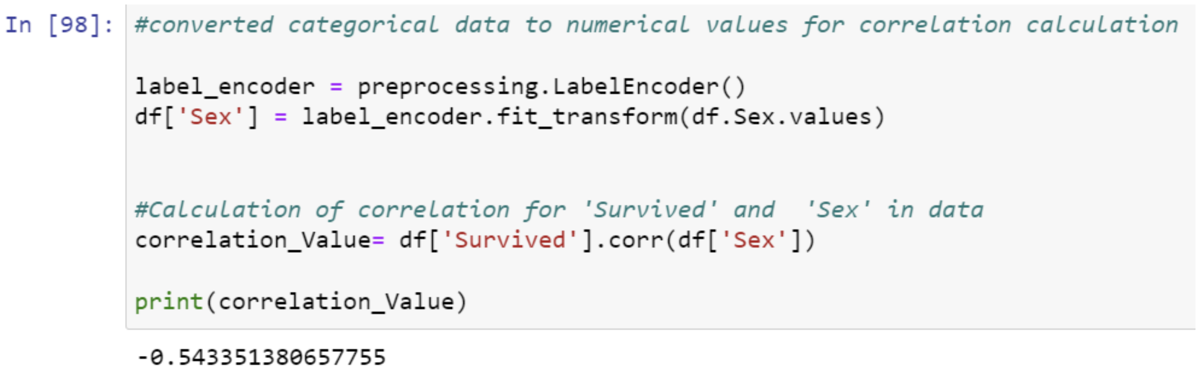
1. Find the correlation between ‘survived’ (target column) and ‘sex’ column for the Titanic use case in class.
   a. Do you think we should keep this feature?



```
In [97]: df=pd.read_csv(r"C:\Users\ksaik\Downloads\Dataset\Dataset\train.csv")

         df.head()
```

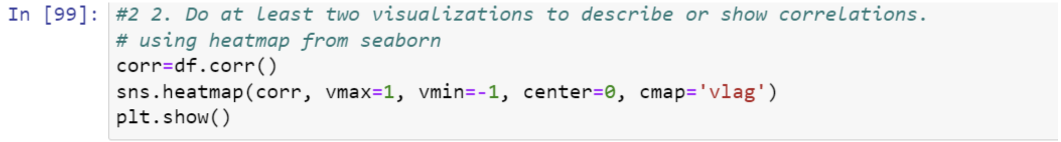
Out[97]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123	S
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN	S

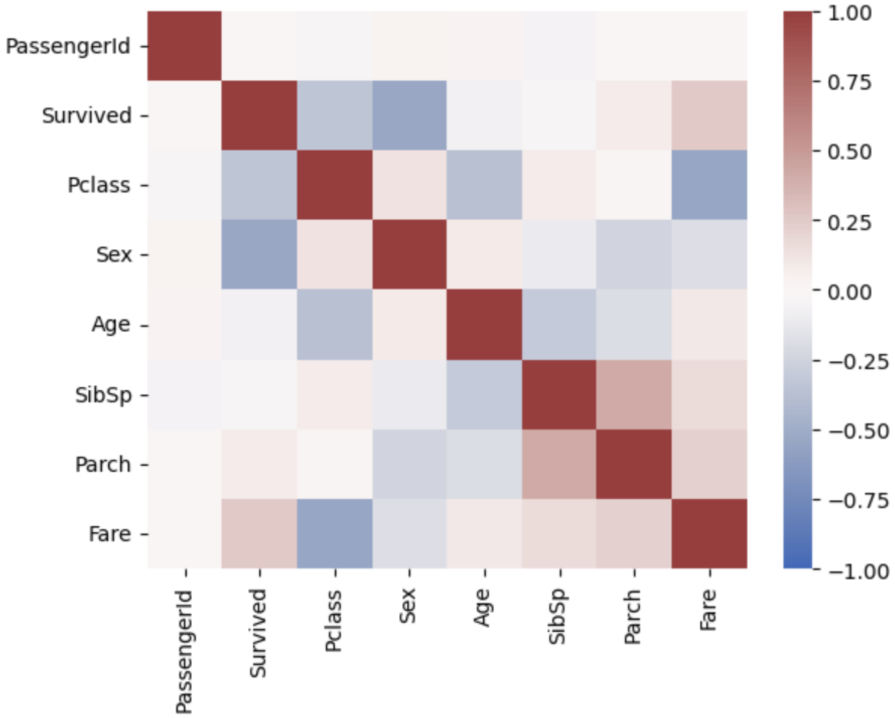


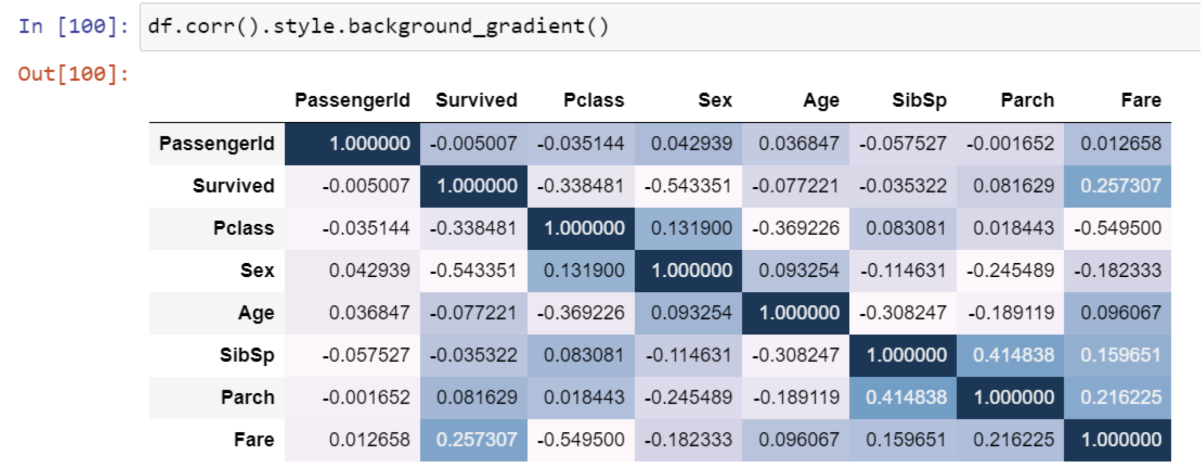
```
In [98]: #converted categorical data to numerical values for correlation calculation

         label_encoder = preprocessing.LabelEncoder()
         df['Sex'] = label_encoder.fit_transform(df.Sex.values)


         #Calculation of correlation for 'Survived' and  'Sex' in data
         correlation_Value= df['Survived'].corr(df['Sex'])

         print(correlation_Value)

         -0.543351380657755
```

2. Do at least two visualizations to describe or show correlations.



```
In [99]: #2 2. Do at least two visualizations to describe or show correlations.
         # using heatmap from seaborn
         corr=df.corr()
         sns.heatmap(corr, vmax=1, vmin=-1, center=0, cmap='vlag')
         plt.show()
```

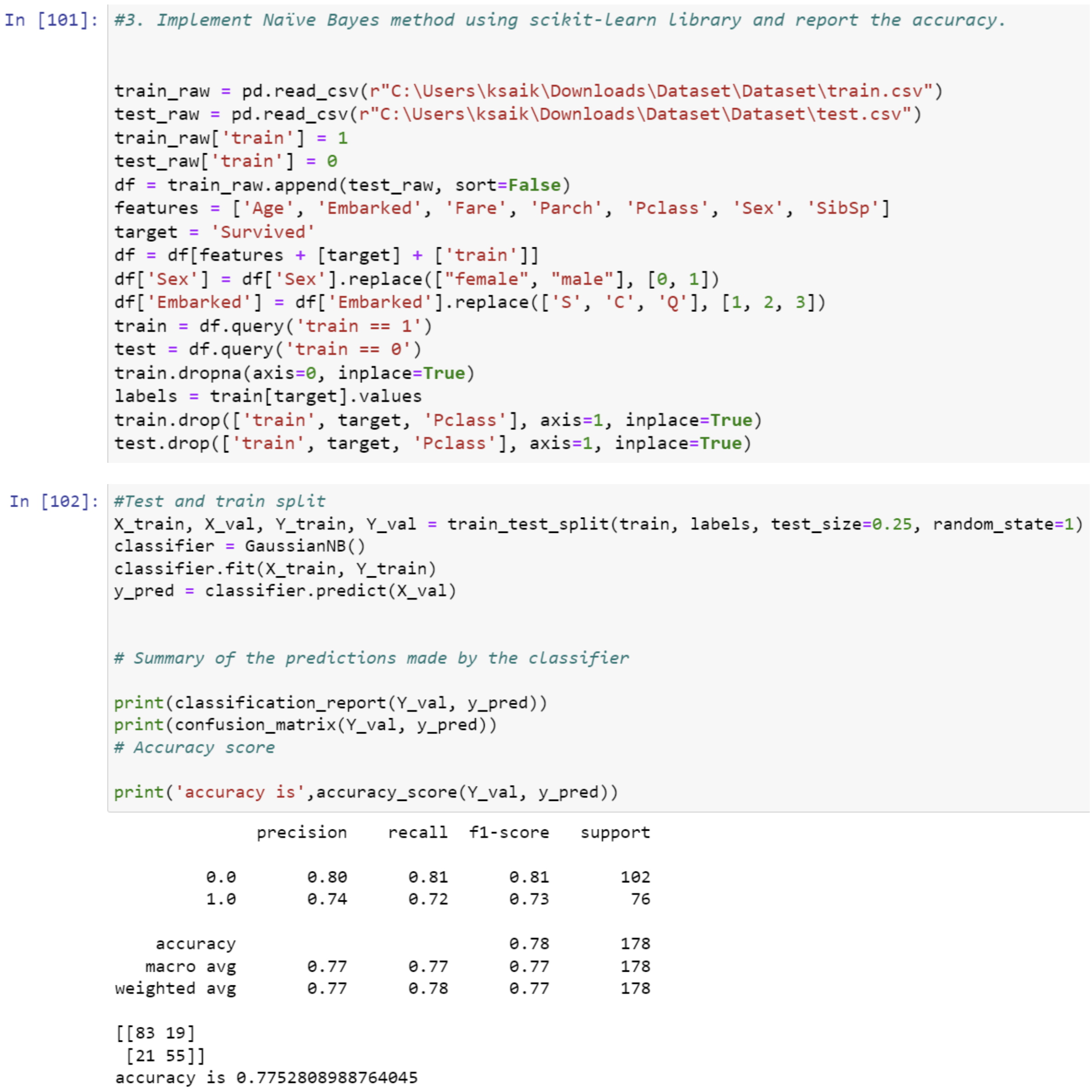




```
In [100]: df.corr().style.background_gradient()
Out[100]:
```

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare
PassengerId	1.000000	-0.005007	-0.035144	0.042939	0.036847	-0.057527	-0.001652	0.012658
Survived	-0.005007	1.000000	-0.338481	-0.543351	-0.077221	-0.035322	0.081629	0.257307
Pclass	-0.035144	-0.338481	1.000000	0.131900	-0.369226	0.083081	0.018443	-0.549500
Sex	0.042939	-0.543351	0.131900	1.000000	0.093254	-0.114631	-0.245489	-0.182333
Age	0.036847	-0.077221	-0.369226	0.093254	1.000000	-0.308247	-0.189119	0.096067
SibSp	-0.057527	-0.035322	0.083081	-0.114631	-0.308247	1.000000	0.414838	0.159651
Parch	-0.001652	0.081629	0.018443	-0.245489	-0.189119	0.414838	1.000000	0.216225
Fare	0.012658	0.257307	-0.549500	-0.182333	0.096067	0.159651	0.216225	1.000000

3. Implement Naïve Bayes method using scikit-learn library and report the accuracy.



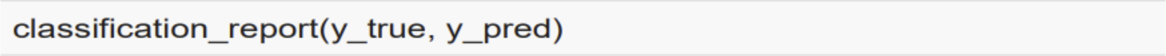
```
In [101]: #3. Implement Naïve Bayes method using scikit-learn library and report the accuracy.


          train_raw = pd.read_csv(r"C:\Users\ksaik\Downloads\Dataset\Dataset\train.csv")
          test_raw = pd.read_csv(r"C:\Users\ksaik\Downloads\Dataset\Dataset\test.csv")
          train_raw['train'] = 1
          test_raw['train'] = 0
          df = train_raw.append(test_raw, sort=False)
          features = ['Age', 'Embarked', 'Fare', 'Parch', 'Pclass', 'Sex', 'SibSp']
          target = 'Survived'
          df = df[features + [target] + ['train']]
          df['Sex'] = df['Sex'].replace(["female", "male"], [0, 1])
          df['Embarked'] = df['Embarked'].replace(['S', 'C', 'Q'], [1, 2, 3])
          train = df.query('train == 1')
          test = df.query('train == 0')
          train.dropna(axis=0, inplace=True)
          labels = train[target].values
          train.drop(['train', target, 'Pclass'], axis=1, inplace=True)
          test.drop(['train', target, 'Pclass'], axis=1, inplace=True)
```

```
In [102]: #Test and train split
          X_train, X_val, Y_train, Y_val = train_test_split(train, labels, test_size=0.25, random_state=1)
          classifier = GaussianNB()
          classifier.fit(X_train, Y_train)
          y_pred = classifier.predict(X_val)


          # Summary of the predictions made by the classifier

          print(classification_report(Y_val, y_pred))
          print(confusion_matrix(Y_val, y_pred))
          # Accuracy score

          print('accuracy is',accuracy_score(Y_val, y_pred))
```

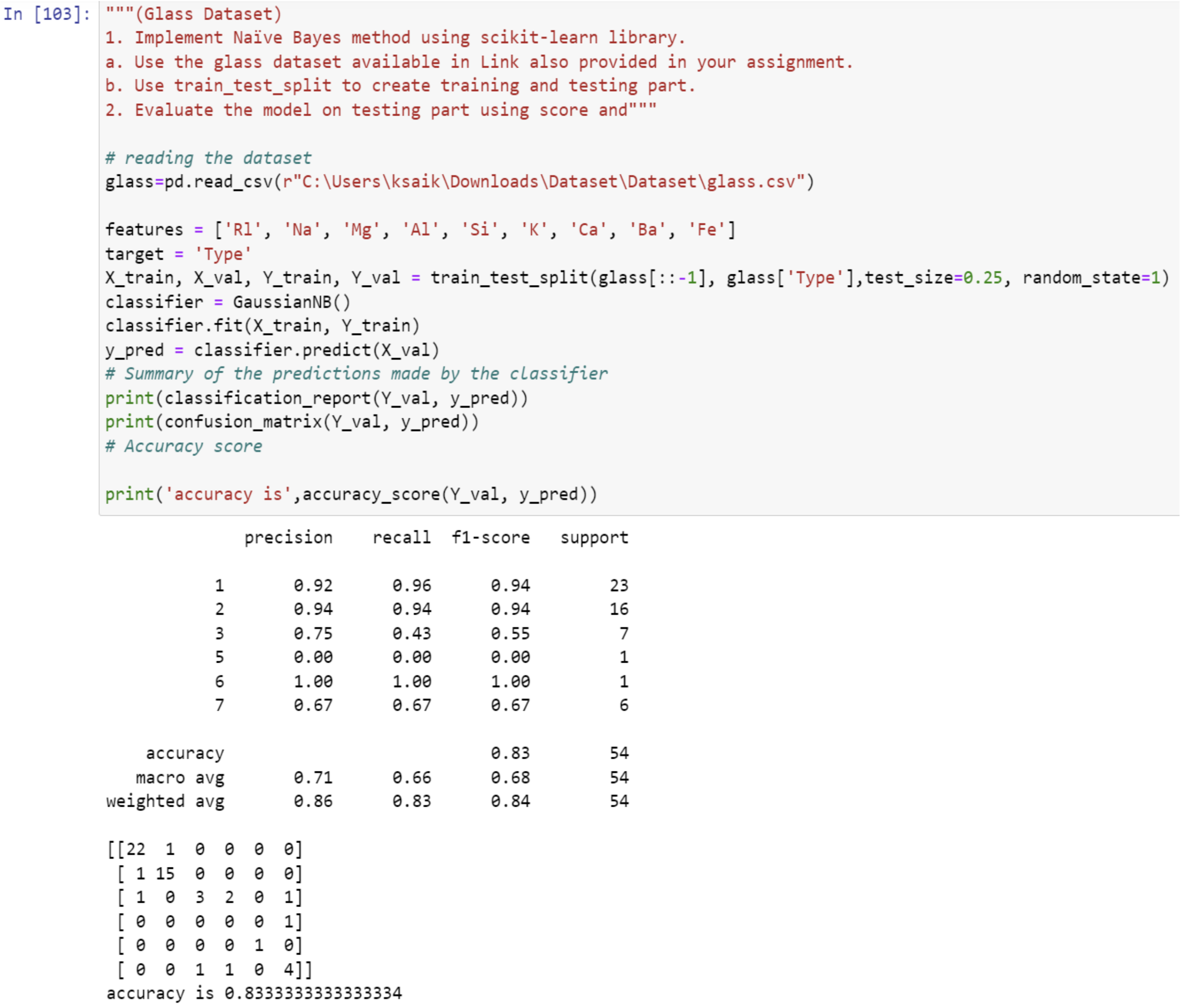
```
              precision    recall  f1-score   support

         0.0       0.80      0.81      0.81       102
         1.0       0.74      0.72      0.73        76

    accuracy                           0.78       178
   macro avg       0.77      0.77      0.77       178
weighted avg       0.77      0.78      0.77       178

[[83 19]
 [21 55]]
accuracy is 0.7752808988764045
```

2. **(Glass Dataset)**

1. Implement Naïve Bayes method using scikit-learn library.
    a. Use the glass dataset available in Link also provided in your assignment.
    b. Use **train_test_split** to create training and testing part.
2. Evaluate the model on testing part using score and



```
classification_report(y_true, y_pred)
```

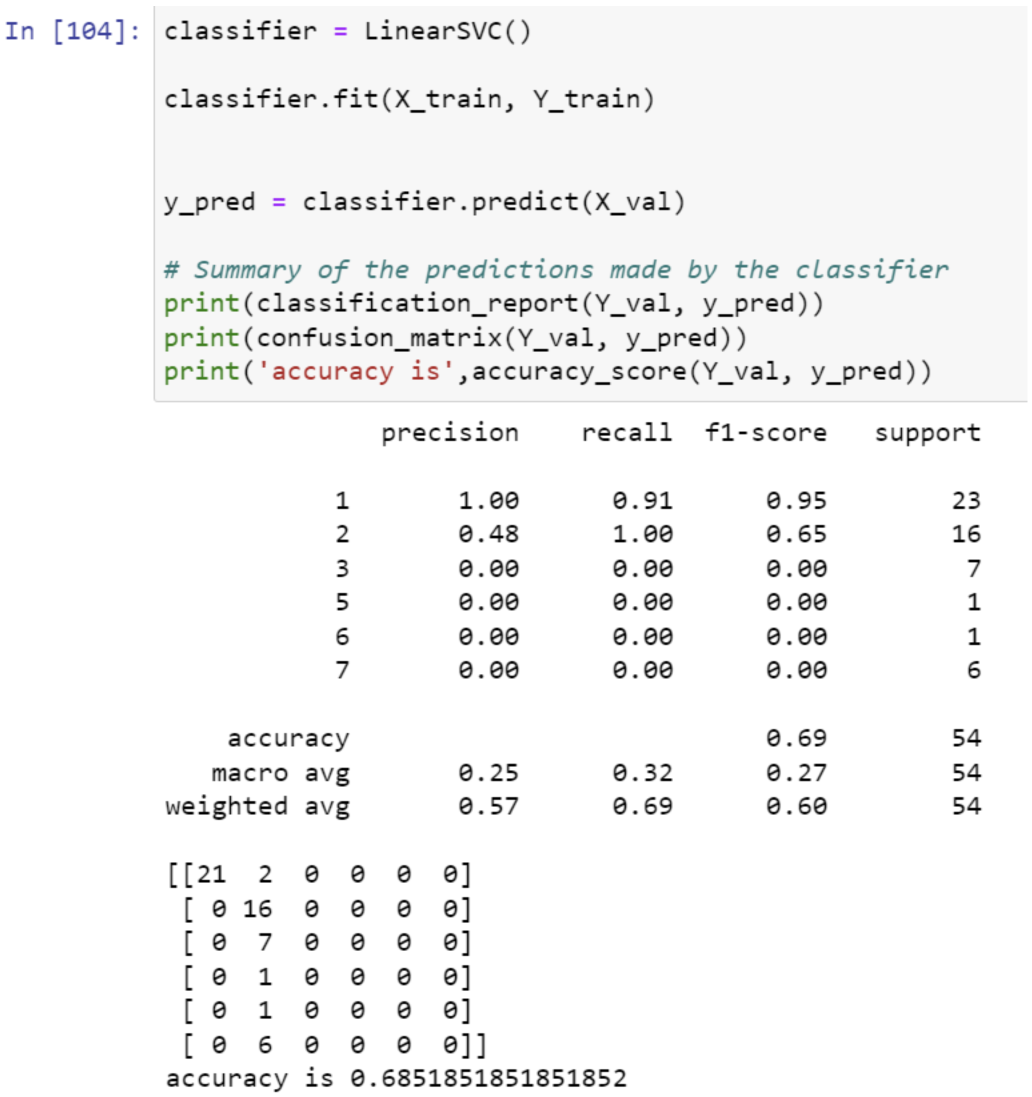


```
In [103]: """(Glass Dataset)
          1. Implement Naïve Bayes method using scikit-learn library.
          a. Use the glass dataset available in Link also provided in your assignment.
          b. Use train_test_split to create training and testing part.
          2. Evaluate the model on testing part using score and"""

          # reading the dataset
          glass=pd.read_csv(r"C:\Users\ksaik\Downloads\Dataset\Dataset\glass.csv")

          features = ['Rl', 'Na', 'Mg', 'Al', 'Si', 'K', 'Ca', 'Ba', 'Fe']
          target = 'Type'
          X_train, X_val, Y_train, Y_val = train_test_split(glass[::-1], glass['Type'],test_size=0.25, random_state=1)
          classifier = GaussianNB()
          classifier.fit(X_train, Y_train)
          y_pred = classifier.predict(X_val)
          # Summary of the predictions made by the classifier
          print(classification_report(Y_val, y_pred))
          print(confusion_matrix(Y_val, y_pred))
          # Accuracy score

          print('accuracy is',accuracy_score(Y_val, y_pred))
```

```
              precision    recall  f1-score   support

           1       0.92      0.96      0.94        23
           2       0.94      0.94      0.94        16
           3       0.75      0.43      0.55         7
           5       0.00      0.00      0.00         1
           6       1.00      1.00      1.00         1
           7       0.67      0.67      0.67         6

    accuracy                           0.83        54
   macro avg       0.71      0.66      0.68        54
weighted avg       0.86      0.83      0.84        54

[[22  1  0  0  0  0]
 [ 1 15  0  0  0  0]
 [ 1  0  3  2  0  1]
 [ 0  0  0  0  0  1]
 [ 0  0  0  0  1  0]
 [ 0  0  1  1  0  4]]
accuracy is 0.8333333333333334
```

1. Implement linear SVM method using scikit library
    a. Use the glass dataset available in Link also provided in your assignment.
    b. Use **train_test_split** to create training and testing part.
2. Evaluate the model on testing part using score and

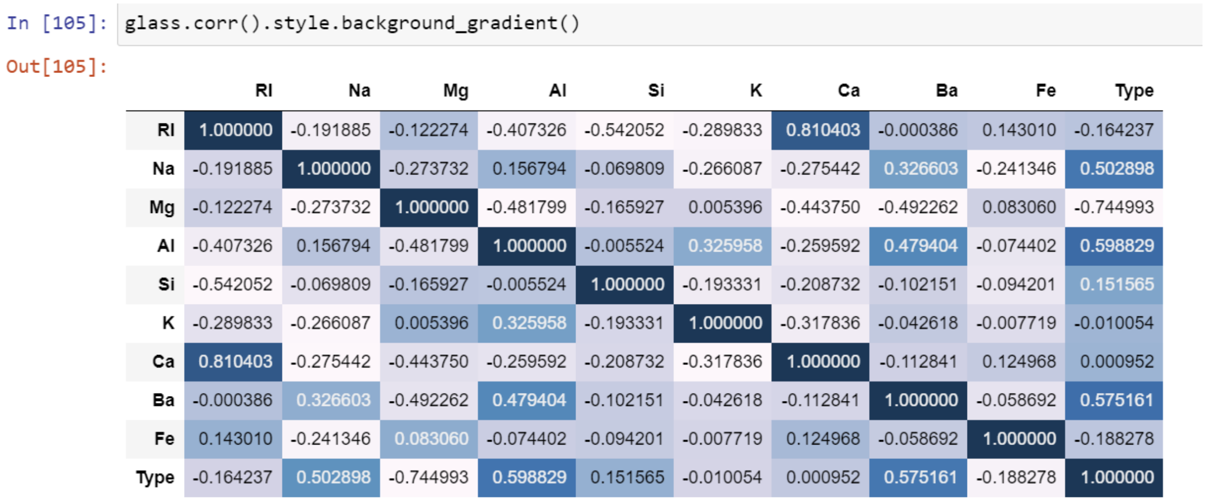
```
classification_report(y_true, y_pred)
```



```
In [104]: classifier = LinearSVC()

          classifier.fit(X_train, Y_train)


          y_pred = classifier.predict(X_val)

          # Summary of the predictions made by the classifier
          print(classification_report(Y_val, y_pred))
          print(confusion_matrix(Y_val, y_pred))
          print('accuracy is',accuracy_score(Y_val, y_pred))
```

```
              precision    recall  f1-score   support

           1       1.00      0.91      0.95        23
           2       0.48      1.00      0.65        16
           3       0.00      0.00      0.00         7
           5       0.00      0.00      0.00         1
           6       0.00      0.00      0.00         1
           7       0.00      0.00      0.00         6

    accuracy                           0.69        54
   macro avg       0.25      0.32      0.27        54
weighted avg       0.57      0.69      0.60        54

[[21  2  0  0  0  0]
 [ 0 16  0  0  0  0]
 [ 0  7  0  0  0  0]
 [ 0  1  0  0  0  0]
 [ 0  1  0  0  0  0]
 [ 0  6  0  0  0  0]]
accuracy is 0.6851851851851852
```

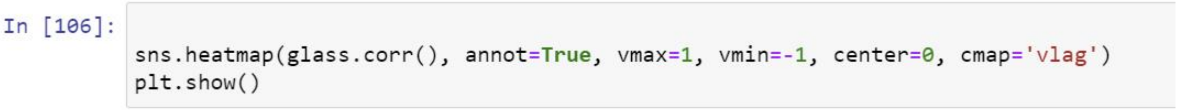
Do at least two visualizations to describe or show correlations in the Glass Dataset.



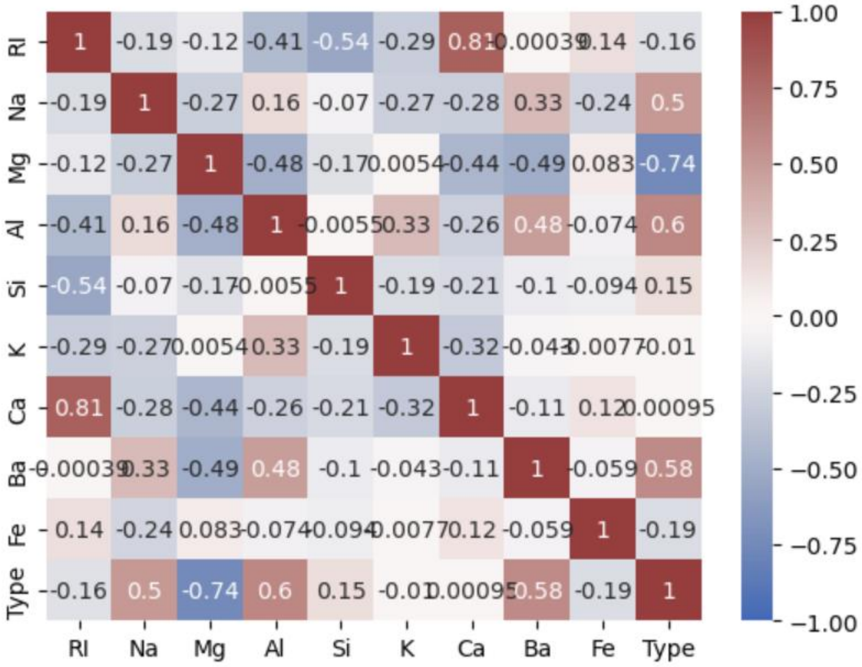
```
In [105]: glass.corr().style.background_gradient()
```

Out[105]:

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
RI	1.000000	-0.191885	-0.122274	-0.407326	-0.542052	-0.289833	0.810403	-0.000386	0.143010	-0.164237
Na	-0.191885	1.000000	-0.273732	0.156794	-0.069809	-0.266087	-0.275442	0.326603	-0.241346	0.502898
Mg	-0.122274	-0.273732	1.000000	-0.481799	-0.165927	0.005396	-0.443750	-0.492262	0.083060	-0.744993
Al	-0.407326	0.156794	-0.481799	1.000000	-0.005524	0.325958	-0.259592	0.479404	-0.074402	0.598829
Si	-0.542052	-0.069809	-0.165927	-0.005524	1.000000	-0.193331	-0.208732	-0.102151	-0.094201	0.151565
K	-0.289833	-0.266087	0.005396	0.325958	-0.193331	1.000000	-0.317836	-0.042618	-0.007719	-0.010054
Ca	0.810403	-0.275442	-0.443750	-0.259592	-0.208732	-0.317836	1.000000	-0.112841	0.124968	0.000952
Ba	-0.000386	0.326603	-0.492262	0.479404	-0.102151	-0.042618	-0.112841	1.000000	-0.058692	0.575161
Fe	0.143010	-0.241346	0.083060	-0.074402	-0.094201	-0.007719	0.124968	-0.058692	1.000000	-0.188278
Type	-0.164237	0.502898	-0.744993	0.598829	0.151565	-0.010054	0.000952	0.575161	-0.188278	1.000000



```
In [106]:  sns.heatmap(glass.corr(), annot=True, vmax=1, vmin=-1, center=0, cmap='vlag')
           plt.show()
```



Which algorithm you got better accuracy? Can you justify why?

We can numerically conclude that Naive bayes is better than SVM because there is less correlation in data and the accuracy is also higher