ИУ5-62Б Ковалев Сергей РК2

Импорт библиотек

In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from pandas.plotting import scatter_matrix
import warnings
warnings.filterwarnings('ignore')
sns.set(style="ticks")
%matplotlib inline
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
```

In [2]:

```
data = pd.read_csv('/Users/set27/Downloads/states_all.csv')
```

In [3]:

```
data.head()
```

Out[3]:

	PRIMARY_KEY	STATE	YEAR	ENROLL	TOTAL_REVENUE	FEDERAL_REVENUE	STATE_REVENUE	LOCAL_REVEN
0	1992_ALABAMA	ALABAMA	1992	NaN	2678885.0	304177.0	1659028.0	71568
1	1992_ALASKA	ALASKA	1992	NaN	1049591.0	106780.0	720711.0	22210
2	1992_ARIZONA	ARIZONA	1992	NaN	3258079.0	297888.0	1369815.0	159037
3	1992_ARKANSAS	ARKANSAS	1992	NaN	1711959.0	178571.0	958785.0	57460
4	1992_CALIFORNIA	CALIFORNIA	1992	NaN	26260025.0	2072470.0	16546514.0	764104

5 rows × 25 columns

In [4]:

```
data = data.fillna(1)
```

In [5]:

```
data.dtypes
```

Out[5]:

```
PRIMARY_KEY                      object
STATE                            object
YEAR                              int64
ENROLL                          float64
TOTAL_REVENUE                   float64
FEDERAL_REVENUE                 float64
STATE_REVENUE                   float64
LOCAL_REVENUE                   float64
TOTAL_EXPENDITURE               float64
INSTRUCTION_EXPENDITURE         float64
SUPPORT_SERVICES_EXPENDITURE    float64
OTHER_EXPENDITURE               float64
CAPITAL_OUTLAY_EXPENDITURE      float64
GRADES_PK_G                     float64
```

```
GRADES_KG_G                     float64
GRADES_4_G                      float64
GRADES_8_G                      float64
GRADES_12_G                     float64
GRADES_1_8_G                    float64
GRADES_9_12_G                   float64
GRADES_ALL_G                    float64
AVG_MATH_4_SCORE                float64
AVG_MATH_8_SCORE                float64
AVG_READING_4_SCORE             float64
AVG_READING_8_SCORE             float64
dtype: object
```

In [6]:

```
data.isnull().sum()
# проверим есть ли пропущенные значения
```

Out[6]:

```
PRIMARY_KEY                     0
STATE                           0
YEAR                            0
ENROLL                          0
TOTAL_REVENUE                   0
FEDERAL_REVENUE                 0
STATE_REVENUE                   0
LOCAL_REVENUE                   0
TOTAL_EXPENDITURE               0
INSTRUCTION_EXPENDITURE         0
SUPPORT_SERVICES_EXPENDITURE    0
OTHER_EXPENDITURE               0
CAPITAL_OUTLAY_EXPENDITURE      0
GRADES_PK_G                     0
GRADES_KG_G                     0
GRADES_4_G                      0
GRADES_8_G                      0
GRADES_12_G                     0
GRADES_1_8_G                    0
GRADES_9_12_G                   0
GRADES_ALL_G                    0
AVG_MATH_4_SCORE                0
AVG_MATH_8_SCORE                0
AVG_READING_4_SCORE             0
AVG_READING_8_SCORE             0
dtype: int64
```

In [7]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1715 entries, 0 to 1714
Data columns (total 25 columns):
 #   Column                        Non-Null Count  Dtype
---  ------                        --------------  -----
 0   PRIMARY_KEY                   1715 non-null   object
 1   STATE                         1715 non-null   object
 2   YEAR                          1715 non-null   int64
 3   ENROLL                        1715 non-null   float64
 4   TOTAL_REVENUE                 1715 non-null   float64
 5   FEDERAL_REVENUE               1715 non-null   float64
 6   STATE_REVENUE                 1715 non-null   float64
 7   LOCAL_REVENUE                 1715 non-null   float64
 8   TOTAL_EXPENDITURE             1715 non-null   float64
 9   INSTRUCTION_EXPENDITURE       1715 non-null   float64
 10  SUPPORT_SERVICES_EXPENDITURE  1715 non-null   float64
 11  OTHER_EXPENDITURE             1715 non-null   float64
 12  CAPITAL_OUTLAY_EXPENDITURE    1715 non-null   float64
 13  GRADES_PK_G                   1715 non-null   float64
 14  GRADES_KG_G                   1715 non-null   float64
 15  GRADES_4_G                    1715 non-null   float64
```

```
 16   GRADES_8_G                    1715 non-null   float64
 17   GRADES_12_G                   1715 non-null   float64
 18   GRADES_1_8_G                  1715 non-null   float64
 19   GRADES_9_12_G                 1715 non-null   float64
 20   GRADES_ALL_G                  1715 non-null   float64
 21   AVG_MATH_4_SCORE              1715 non-null   float64
 22   AVG_MATH_8_SCORE              1715 non-null   float64
 23   AVG_READING_4_SCORE           1715 non-null   float64
 24   AVG_READING_8_SCORE           1715 non-null   float64
dtypes: float64(22), int64(1), object(2)
memory usage: 335.1+ KB
```

In [8]:

```
data.head()
```

Out[8]:

	PRIMARY_KEY	STATE	YEAR	ENROLL	TOTAL_REVENUE	FEDERAL_REVENUE	STATE_REVENUE	LOCAL_REVEN
0	1992_ALABAMA	ALABAMA	1992	1.0	2678885.0	304177.0	1659028.0	71568
1	1992_ALASKA	ALASKA	1992	1.0	1049591.0	106780.0	720711.0	22210
2	1992_ARIZONA	ARIZONA	1992	1.0	3258079.0	297888.0	1369815.0	159037
3	1992_ARKANSAS	ARKANSAS	1992	1.0	1711959.0	178571.0	958785.0	57460
4	1992_CALIFORNIA	CALIFORNIA	1992	1.0	26260025.0	2072470.0	16546514.0	764104

5 rows × 25 columns

In [9]:

```
parts = np.split(data, [1,17,18], axis=1)
X = parts[0]
Y = parts[1]
G = parts[2]
print('Входные данные:\n\n', X.head(), '\n\nВыходные данные:\n\n', G.head())
```

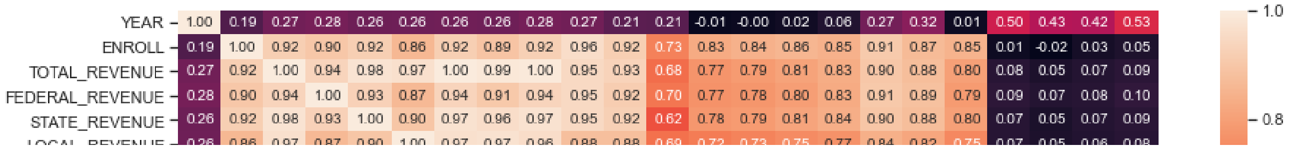
```
Входные данные:

         PRIMARY_KEY
0      1992_ALABAMA
1       1992_ALASKA
2      1992_ARIZONA
3     1992_ARKANSAS
4   1992_CALIFORNIA

Выходные данные:

    GRADES_12_G
0        41167
1         6714
2        37410
3        27651
4       270675
```

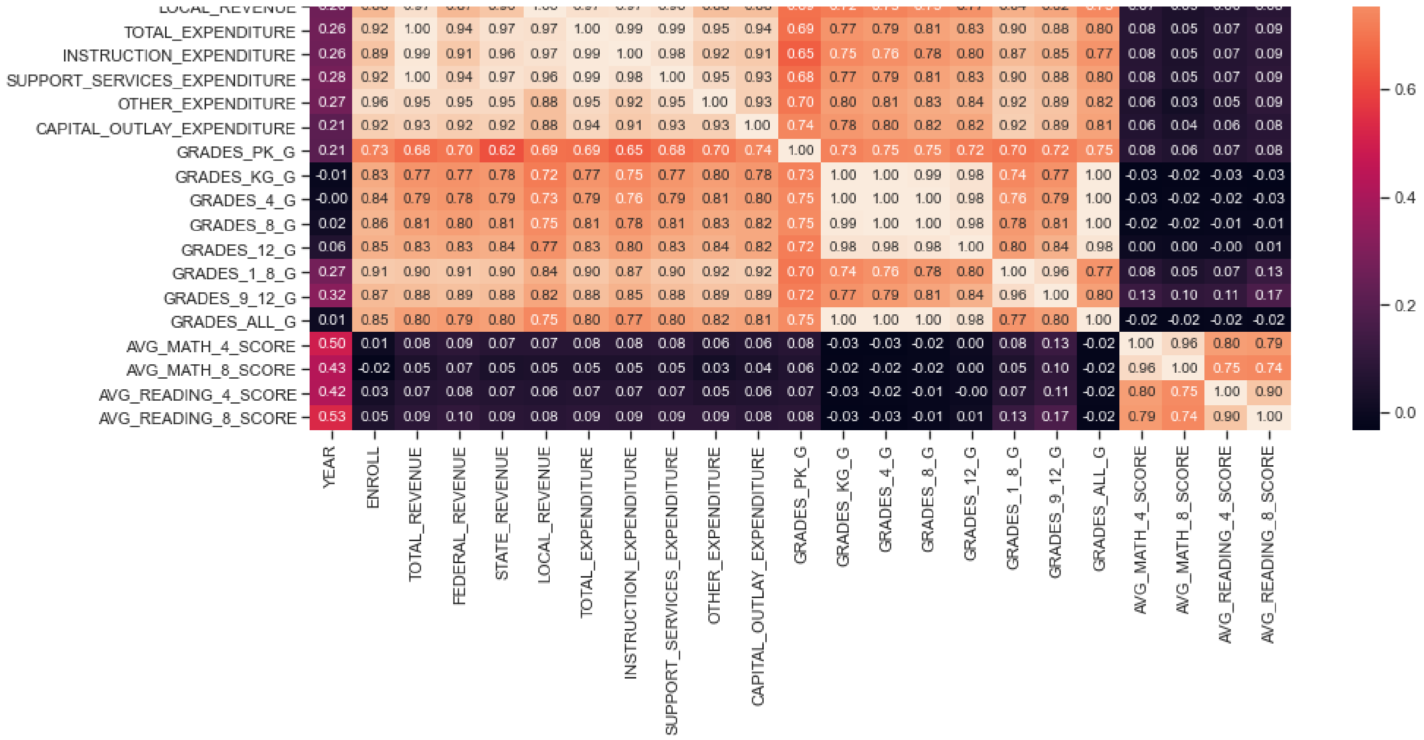
In [10]:

```
#Построим корреляционную матрицу
fig, ax = plt.subplots(figsize=(15,7))
sns.heatmap(data.corr(method='pearson'), ax=ax, annot=True, fmt='.2f')
```

Out[10]:

```
<AxesSubplot:>
```





In [23]:

```
X = data.drop(['PRIMARY_KEY','ENROLL','TOTAL_REVENUE','FEDERAL_REVENUE','AVG_MATH_4_SCORE','AVG_MATH_8_SCORE','AVG_READING_4_SCORE','AVG_READING_8_SCORE','STATE','STATE_REVENUE','LOCAL_REVENUE', 'TOTAL_EXPENDITURE', 'INSTRUCTION_EXPENDITURE','SUPPORT_SERVICES_EXPENDITURE','OTHER_EXPENDITURE','CAPITAL_OUTLAY_EXPENDITURE','GRADES_PK_G','GRADES_KG_G','GRADES_4_G','GRADES_8_G','GRADES_12_G','GRADES_1_8_G','GRADES_9_12_G','GRADES_ALL_G'], axis = 1)
Y = data.YEAR
print('Входные данные:\n\n', X.head(), '\n\nВыходные данные:\n\n', Y.head())
```

```
Входные данные:

    YEAR
0  1992
1  1992
2  1992
3  1992
4  1992

Выходные данные:

 0    1992
1    1992
2    1992
3    1992
4    1992
Name: YEAR, dtype: int64
```

In [24]:

```
X_train,  X_test,  Y_train,  Y_test = train_test_split(X,  Y, random_state = 0, test_size = 0.1)
print('Входные параметры обучающей выборки:\n\n',X_train.head(), \
      '\n\nВходные параметры тестовой выборки:\n\n', X_test.head(), \
      '\n\nВыходные параметры обучающей выборки:\n\n', Y_train.head(), \
      '\n\nВыходные параметры тестовой выборки:\n\n', Y_test.head())
```

```
Входные параметры обучающей выборки:

      YEAR
82    1993
1579  1989
1544  1989
1323  2017
249   1996
```

```
Входные параметры тестовой выборки:

       YEAR
1101  2013
6     1992
746   2006
1320  1989
473   2001

Выходные параметры обучающей выборки:

 82      1993
1579    1989
1544    1989
1323    2017
249     1996
Name: YEAR, dtype: int64

Выходные параметры тестовой выборки:

 1101    2013
6       1992
746     2006
1320    1989
473     2001
Name: YEAR, dtype: int64
```

In [25]:

```
from sklearn.svm import SVC , LinearSVC
from sklearn.datasets.samples_generator import make_blobs
from matplotlib import pyplot as plt
```

In [26]:

```
svc = SVC(kernel='linear')
svc.fit(X_train,Y_train)
```

Out[26]:

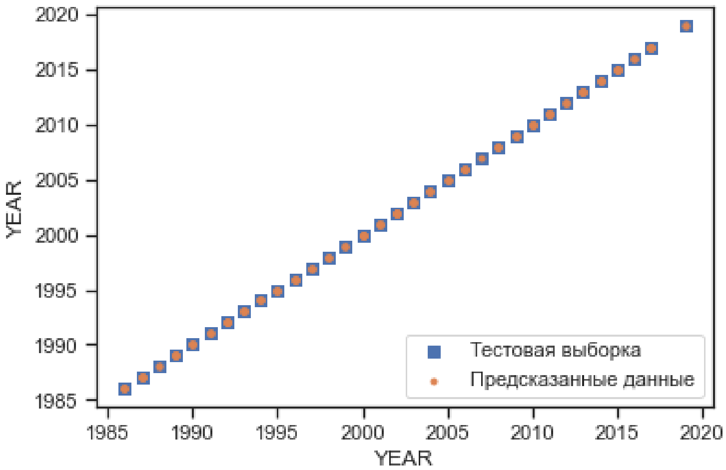
```
SVC(kernel='linear')
```

In [27]:

```
pred_y = svc.predict(X_test)
```

In [28]:

```
plt.scatter(X_test.YEAR, Y_test,    marker = 's', label = 'Тестовая выборка')
plt.scatter(X_test.YEAR, pred_y, marker = '.', label = 'Предсказанные данные')
plt.legend (loc = 'lower right')
plt.xlabel ('YEAR')
plt.ylabel ('YEAR')
plt.show()
```



In [29]:

```
from sklearn.ensemble import RandomForestRegressor
```

In [30]:

```
forest_1 = RandomForestRegressor(n_estimators=5, oob_score=True, random_state=10)
forest_1.fit(X, Y)
```

Out[30]:

```
RandomForestRegressor(n_estimators=5, oob_score=True, random_state=10)
```

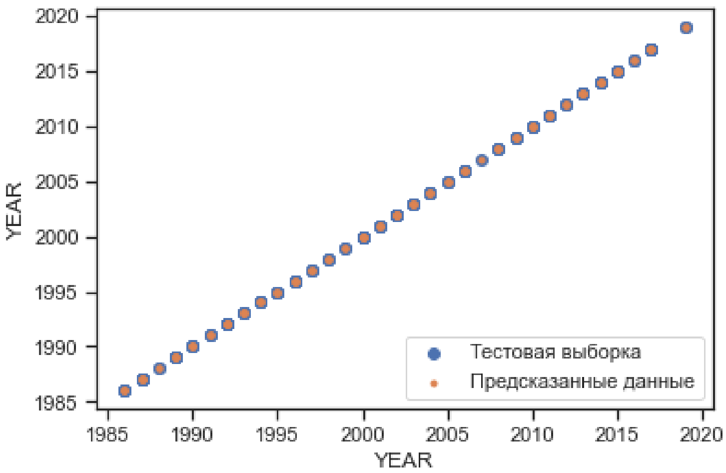
In [31]:

```
Y_predict = forest_1.predict(X_test)
print('Средняя абсолютная ошибка:',   mean_absolute_error(Y_test, Y_predict))
print('Средняя квадратичная ошибка:', mean_squared_error(Y_test, Y_predict))
print('Median absolute error:',       median_absolute_error(Y_test, Y_predict))
print('Коэффициент детерминации:',    r2_score(Y_test, Y_predict))
```

```
Средняя абсолютная ошибка: 0.0
Средняя квадратичная ошибка: 0.0
Median absolute error: 0.0
Коэффициент детерминации: 1.0
```

In [32]:

```
plt.scatter(X_test.YEAR, Y_test,    marker = 'o', label = 'Тестовая выборка')
plt.scatter(X_test.YEAR, Y_predict, marker = '.', label = 'Предсказанные данные')
plt.legend(loc = 'lower right')
plt.xlabel('YEAR')
plt.ylabel('YEAR')
plt.show()
```



In [ ]: