Ввод [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Ввод [2]:

```
data = pd.read_excel('default_of_credit_card_clients.xls')
data= data[1:]
print(data)
```

```
          X1 X2 X3 X4  X5  X6  X7  X8  X9 X10  ...    X15    X16    X17  \
1      20000  2  2  1  24   2   2  -1  -1  -2  ...      0      0      0
2     120000  2  2  2  26  -1   2   0   0   0  ...   3272   3455   3261
3      90000  2  2  2  34   0   0   0   0   0  ...  14331  14948  15549
4      50000  2  2  1  37   0   0   0   0   0  ...  28314  28959  29547
5      50000  1  2  1  57  -1   0  -1   0   0  ...  20940  19146  19131
...      ... .. .. ..  ..  ..  ..  ..  ..  ..  ...    ...    ...    ...
29996  220000  1  3  1  39   0   0   0   0   0  ...  88004  31237  15980
29997  150000  1  3  2  43  -1  -1  -1  -1   0  ...   8979   5190      0
29998   30000  1  2  2  37   4   3   2  -1   0  ...  20878  20582  19357
29999   80000  1  3  1  41   1  -1   0   0   0  ...  52774  11855  48944
30000   50000  1  2  1  46   0   0   0   0   0  ...  36535  32428  15313

         X18    X19    X20   X21    X22   X23  Y
1          0    689      0     0      0     0  1
2          0   1000   1000  1000      0  2000  1
3       1518   1500   1000  1000   1000  5000  0
4       2000   2019   1200  1100   1069  1000  0
5       2000  36681  10000  9000    689   679  0
...      ...    ...    ...   ...    ...   ... ..
29996   8500  20000   5003  3047   5000  1000  0
29997   1837   3526   8998   129      0     0  0
29998      0      0  22000  4200   2000  3100  1
29999  85900   3409   1178  1926  52964  1804  1
30000   2078   1800   1430  1000   1000  1000  1

[30000 rows x 24 columns]
```

Ввод [3]:

```
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
scaler.fit(data.drop('Y', axis=1))
scaled_features = scaler.transform(data.drop('Y', axis=1))
scaled_data = pd.DataFrame(scaled_features, columns = data.drop('Y', axis=1).columns)
```

Ввод [4]:

```
#Разделение датасета на обучающие и тестовые данные
from sklearn.model_selection import train_test_split
x = scaled_data
y = data['Y']
x_training_data, x_test_data, y_training_data, y_test_data = train_test_split(x, y, test_si
print(x_training_data)
print("-------------------------------------------------")
print(y_training_data)
print("-------------------------------------------------")
print(x_test_data)
print("-------------------------------------------------")
print(y_test_data)
```

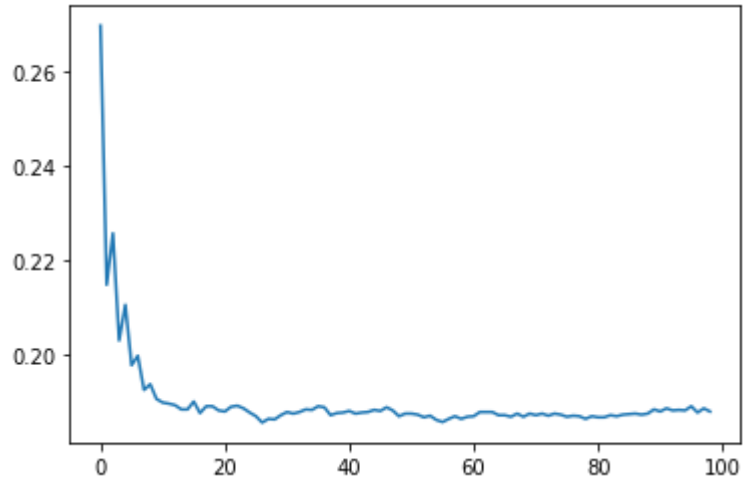
```
1
25258 -0.638686  0.204578 -0.220706 -0.249319 -0.254698 -0.259417 -0.09143
8
15392 -0.306059 -0.235077 -0.169795 -0.149528 -0.244230 -0.264915 -0.23617
4

[21000 rows x 23 columns]
-------------------------------------------------
19097    0
16621    0
21574    1
7652     0
10267    0
        ..
18385    0
7951     0
16894    0
25259    0
15393    1
Name: Y, Length: 21000, dtype: object
```

Ввод [5]:

```
#Выбор оптимального значения для K с помощью метода «Локтя»
from sklearn.neighbors import KNeighborsClassifier
error_rates = []
y_training_data = y_training_data.astype('int')
for i in np.arange(1, 100):
    new_model = KNeighborsClassifier(n_neighbors = i)
    new_model.fit(x_training_data, y_training_data)
    new_predictions = new_model.predict(x_test_data)
    error_rates.append(np.mean(new_predictions != y_test_data))
val, idx = min((val, idx) for (idx, val) in enumerate(error_rates))
plt.plot(error_rates)
print("K = ",idx)
print("Error = ",error_rates[idx])
```

```
K =  26
Error =  0.18577777777777776
```



Ввод [6]:

```
#Обучение модели K-ближайших соседей
model = KNeighborsClassifier(n_neighbors = idx)
model.fit(x_training_data, y_training_data)
```

Out[6]:

```
KNeighborsClassifier(n_neighbors=26)
```

Ввод [7]:

```
#Делаем предсказания с помощью алгоритма K-ближайших соседей
predictions = model.predict(x_test_data)
```

Ввод [8]:

```
#Оценка точности нашей модели
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
y_test_data = y_test_data.astype('int')

print(classification_report(y_test_data, predictions))
```

```
              precision    recall  f1-score   support

           0       0.83      0.96      0.89      7024
           1       0.66      0.30      0.41      1976

    accuracy                           0.81      9000
   macro avg       0.75      0.63      0.65      9000
weighted avg       0.79      0.81      0.78      9000
```

Ввод [9]:

```
#Генерируем матрицу ошибок
error_matrix = confusion_matrix(y_test_data, predictions)
print(error_matrix)
print()
print("Percentage of errors = " + str(round(1-error_matrix[1,1]/np.sum(error_matrix,axis=1)
```

```
[[6723  301]
 [1383  593]]

Percentage of errors = 0.7
```

Ввод [ ]:

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