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Вариант 11

In [1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.impute import SimpleImputer
from sklearn.impute import MissingIndicator
from sklearn.impute import KNNImputer
from sklearn.preprocessing import StandardScaler
from sklearn.pipeline import Pipeline
from sklearn.model_selection import GridSearchCV
from sklearn.experimental import enable_iterative_imputer
from sklearn.impute import IterativeImputer
from IPython.display import Image
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style="ticks")
```

Задача №11

Для набора данных проведите устранение пропусков для одного (произвольного) категориального признака с использованием метода заполнения отдельной категорией для пропущенных значений.

In [2]:

```
data = pd.read_csv('downloads/Data.csv')
```

In [3]:

```
data
```

Out[3]:

	Country	League	Club	Player Names	Matches_Played	Substitution	Mins	Goals	xG	xG Per Avg Match	Sh
0	Spain	La Liga	(BET)	Juanmi Callejon	19	16	1849	11	6.62	0.34	
1	Spain	La Liga	(BAR)	Antoine Griezmann	36	0	3129	16	11.86	0.36	
2	Spain	La Liga	(ATL)	Luis Suarez	34	1	2940	28	23.21	0.75	1
3	Spain	La Liga	NaN	Ruben Castro	32	3	2842	13	14.06	0.47	
4	Spain	La Liga	(VAL)	Kevin Gameiro	21	10	1745	13	10.65	0.58	
...	...	...	...	...	...	...	...	...	...	...	
655	Netherlands	Eredivisie	(UTR)	Gyrano Kerk	24	0	2155	10	7.49	0.33	

	Country	League	Club	Player Names	Matches_Played	Substitution	Mins	Goals	xG	xG Per Avg Match	Sh
656	Netherlands	Eredivisie	(AJA)	Quincy Promes	18	2	1573	12	9.77	0.59	
657	Netherlands	Eredivisie	(PSV)	Denzel Dumfries	25	0	2363	7	5.72	0.23	
658	Netherlands	Eredivisie	None	Cyriel Dessers	26	0	2461	15	14.51	0.56	
659	Netherlands	Eredivisie	(PSV)	Cody Gakpo	14	11	1557	7	4.43	0.27	

660 rows × 15 columns

In [4]:

```
data.dtypes
```

Out[4]:

```
Country                      object
League                       object
Club                         object
Player Names                 object
Matches_Played                int64
Substitution                  int64
Mins                          int64
Goals                         int64
xG                          float64
xG Per Avg Match            float64
Shots                         int64
OnTarget                      int64
Shots Per Avg Match         float64
On Target Per Avg Match     float64
Year                          int64
dtype: object
```

In [5]:

```
data.isnull().sum()
```

Out[5]:

```
Country                    0
League                     0
Club                       6
Player Names               0
Matches_Played             0
Substitution               0
Mins                       0
Goals                      0
xG                         0
xG Per Avg Match           0
Shots                      0
OnTarget                   0
Shots Per Avg Match        0
On Target Per Avg Match    0
Year                       0
dtype: int64
```

In [6]:

```
def impute_column(dataset, column, strategy_param, fill_value_param=None):

    temp_data = dataset[[column]].values
    size = temp_data.shape[0]

    indicator = MissingIndicator()
    mask_missing_values_only = indicator.fit_transform(temp_data)

    imputer = SimpleImputer(strategy=strategy_param,
                            fill_value=fill_value_param)
    all_data = imputer.fit_transform(temp_data)

    missed_data = temp_data[mask_missing_values_only]
    filled_data = all_data[mask_missing_values_only]

    return all_data.reshape((size,))

Node_data=data['Club']
Club_name=impute_column(data, 'Club', 'constant', fill_value_param='No_data')
data['Club']=Club_name
data.isnull().sum()
```

Out[6]:

```
Country                     0
League                      0
Club                        0
Player Names                0
Matches_Played              0
Substitution                0
Mins                        0
Goals                       0
xG                          0
xG Per Avg Match            0
Shots                       0
OnTarget                    0
Shots Per Avg Match         0
On Target Per Avg Match     0
Year                        0
dtype: int64
```

In [7]:

```
print("Количество устраненных пропусков: ", data['Club'].value_counts()['No_data'])
```

```
Количество устраненных пропусков:  6
```

In [8]:

```
data[data.Club == 'No_data']
```

Out[8]:

	Country	League	Club	Player Names	Matches_Played	Substitution	Mins	Goals	xG	xG Per Avg Match	Shots
3	Spain	La Liga	No_data	Ruben Castro	32	3	2842	13	14.06	0.47	117
13	Spain	La Liga	No_data	Gerard Moreno	37	0	3361	13	8.49	0.24	82
15	Spain	La Liga	No_data	Wissam Ben Yedder	20	11	1735	11	7.85	0.43	44
18	Spain	La Liga	No_data	Cedric Bakambu	17	9	1633	10	8.08	0.47	50
23	Italy	Serie A	No_data	Nikola Kalinic	26	6	2648	15	15.05	0.54	90
30	Italy	Serie A	No_data	Diego Falcinelli	35	1	3308	13	11.49	0.33	99

Задача №31

Для набора данных проведите процедуру отбора признаков (feature selection). Используйте метод обертывания (wrapper method), прямой алгоритм (sequential forward selection).

In [9]:

```
data_2 = pd.read_csv('downloads/heart.csv')
```

In [10]:

```
data_2.head()
```

Out[10]:

	age	anaemia	creatinine_phosphokinase	diabetes	ejection_fraction	high_blood_pressure	platelets	se
0	75.0	0	582	0	20	1	265000.00	
1	55.0	0	7861	0	38	0	263358.03	
2	65.0	0	146	0	20	0	162000.00	
3	50.0	1	111	0	20	0	210000.00	
4	65.0	1	160	1	20	0	327000.00	

In [11]:

```
X=data_2.drop(['event'], axis=1)
y=data_2['event']
```

In [12]:

```
from mlxtend.feature_selection import SequentialFeatureSelector as SFS
from sklearn.neighbors import KNeighborsClassifier

knn = KNeighborsClassifier(n_neighbors=3)
sfs1 = SFS(knn,
           k_features=4,
           forward=True,
           floating=False,
           verbose=0,
           scoring='accuracy',
           cv=4)

sfs1 = sfs1.fit(X, y)
```

In [13]:

```
sfs1.subsets_
```

Out[13]:

```
{1: {'feature_idx': (7,),
  'cv_scores': array([0.62666667, 0.70666667, 0.68      , 0.72972973]),
  'avg_score': 0.6857657657657659,
  'feature_names': ('serum_creatinine',)},
 2: {'feature_idx': (7, 9),
  'cv_scores': array([0.70666667, 0.73333333, 0.73333333, 0.74324324]),
  'avg_score': 0.7291441441441442,
  'feature_names': ('serum_creatinine', 'sex')},
 3: {'feature_idx': (7, 9, 10),
  'cv_scores': array([0.69333333, 0.76      , 0.72      , 0.63513514]),
  'avg_score': 0.7021171171171171,
  'feature_names': ('serum_creatinine', 'sex', 'smoking')},
 4: {'feature_idx': (5, 7, 9, 10),
  'cv_scores': array([0.69333333, 0.69333333, 0.73333333, 0.75675676]),
  'avg_score': 0.7191891891891893,
  'feature_names': ('high_blood_pressure',
   'serum_creatinine',
   'sex',
   'smoking')}}
```

In [14]:

```
print("Признаки: ", str(sfs1.k_feature_names_)[1:-1])
```

```
Признаки:  'high_blood_pressure', 'serum_creatinine', 'sex', 'smoking'
```

In [15]:

```
print("Оценка: ", sfs1.k_score_)
```

```
Оценка:  0.7191891891891893
```

In [16]:

```
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from mlxtend.feature_selection import SequentialFeatureSelector as SFS
import mlxtend

knn1 = KNeighborsClassifier()

sfs1 = SFS(estimator=knn1,
           k_features=4,
           forward=True,
           floating=False,
           scoring='accuracy',
           cv=4)

pipe = Pipeline([('sfs', sfs1),
                 ('knn1', knn1)])

param_grid = {
    'sfs__k_features': [1, 2, 3, 4],
    'sfs__estimator__n_neighbors': [2, 3, 4]
  }

gs = GridSearchCV(estimator=pipe,
                  param_grid=param_grid,
                  scoring='accuracy',
                  n_jobs=1,
                  cv=4,
                  refit=False)

# run gridearch
gs = gs.fit(X, y)
```

In [17]:

```
for i in range(len(gs.cv_results_['params'])):
    print(gs.cv_results_['params'][i], 'test acc.:', gs.cv_results_['mean_test_score'][i])
```

```
{'sfs__estimator__n_neighbors': 2, 'sfs__k_features': 1} test acc.: 0.7027027027027027
{'sfs__estimator__n_neighbors': 2, 'sfs__k_features': 2} test acc.: 0.6922522522522523
{'sfs__estimator__n_neighbors': 2, 'sfs__k_features': 3} test acc.: 0.7022522522522523
{'sfs__estimator__n_neighbors': 2, 'sfs__k_features': 4} test acc.: 0.6822522522522523
{'sfs__estimator__n_neighbors': 3, 'sfs__k_features': 1} test acc.: 0.7027027027027027
{'sfs__estimator__n_neighbors': 3, 'sfs__k_features': 2} test acc.: 0.6922522522522523
{'sfs__estimator__n_neighbors': 3, 'sfs__k_features': 3} test acc.: 0.7022522522522523
{'sfs__estimator__n_neighbors': 3, 'sfs__k_features': 4} test acc.: 0.6822522522522523
{'sfs__estimator__n_neighbors': 4, 'sfs__k_features': 1} test acc.: 0.7027027027027027
{'sfs__estimator__n_neighbors': 4, 'sfs__k_features': 2} test acc.: 0.6922522522522523
{'sfs__estimator__n_neighbors': 4, 'sfs__k_features': 3} test acc.: 0.7022522522522523
{'sfs__estimator__n_neighbors': 4, 'sfs__k_features': 4} test acc.: 0.6822522522522523
```

In [18]:

```
print("Best params", gs.best_params_)
```

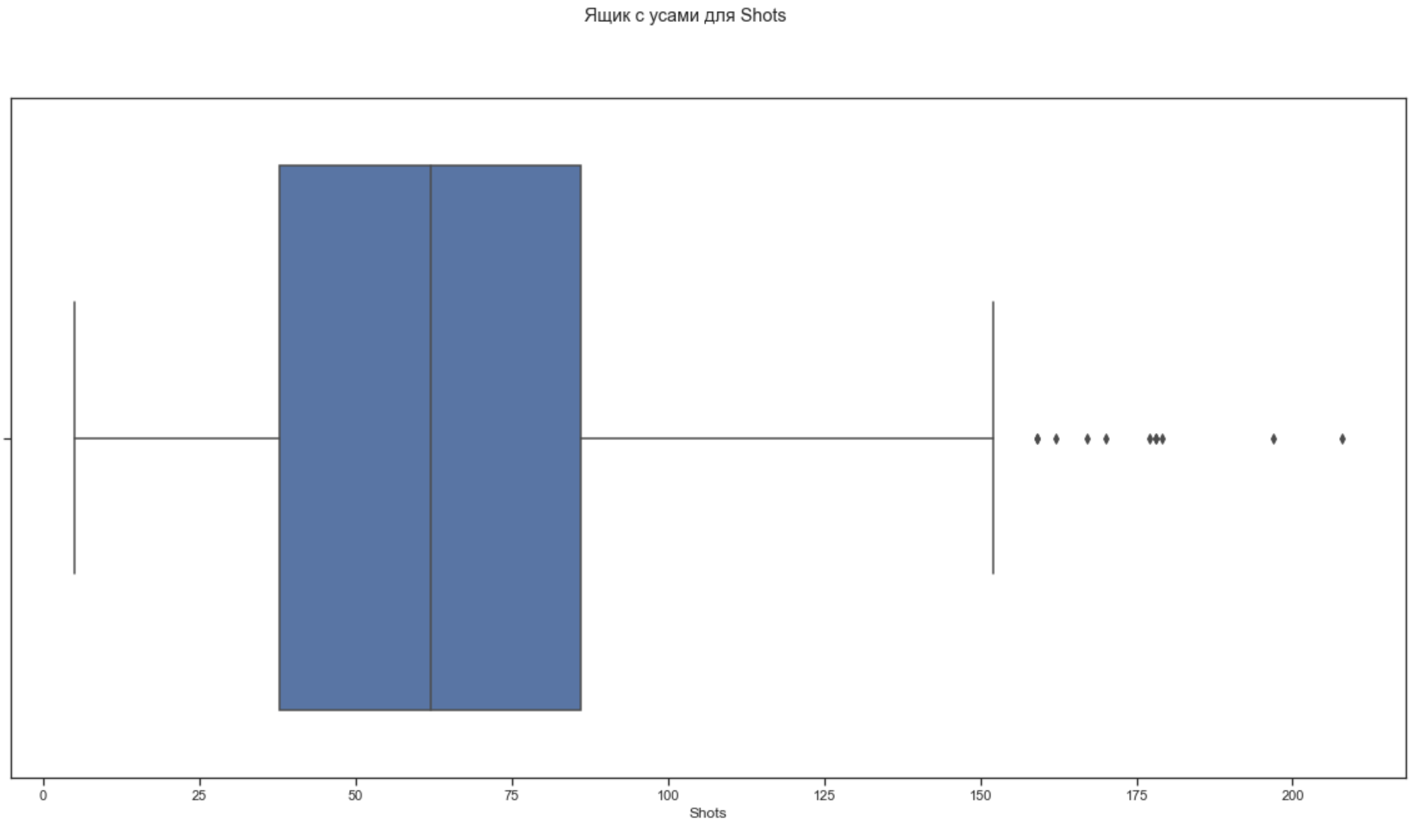
```
Best params {'sfs__estimator__n_neighbors': 2, 'sfs__k_features': 1}
```

Дополнительные требования по группам:

Для студентов групп ИУ5-23М, ИУ5И-23М - для произвольной колонки данных построить график "Ящик с усами (boxplot)".

In [19]:

```
fig, ax = plt.subplots(figsize=(20,10))
sns.boxplot(x=data['Shots'])
fig.suptitle('Ящик с усами для Shots')
plt.show()
```



Ящик с усами для Shots